

ISSN-0973-9122 (Print) • ISSN-0973-9130 (Electronic)

Volume 8

Number 2

July-December 2014



Indian Journal of Forensic Medicine & Toxicology

Website: www.ijfmt.com

Official Organ of Indian Association of Medico-Legal Experts (Regd.)

Indian Journal of Forensic Medicine & Toxicology

EDITOR

Prof. R K Sharma

Dean (R&D), Saraswathi Institute of Medical Sciences, Hapur, UP, India
Formerly at All India Institute of Medical Sciences, New Delhi
E-mail: editor.ijfnt@gmail.com

INTERNATIONAL EDITORIAL ADVISORY BOARD

1. **Dr Nuwadatta Subedi** (*In Charge*) Dept of Forensic Med and Toxicology College of Medical Sciences, Bharatpur, Nepal
2. **Dr. Birendra Kumar Mandal** (*In charge*) Forensic medicine and Toxicology, Chitwan Medical College, Bharatpur, Nepal
3. **Dr. Sarathchandra Kodikara** (*Senior Lecturer*) Forensic Medicine, Department of Forensic Medicine, Faculty of Medicine, University of Peradeniya, Sri Lanka
4. **Prof. Elisabetta Bertol** (*Full Professor*) Forensic Toxicology at the University of Florence, Italy
5. **Babak Mostafazadeh** (*Associate Professor*) Department of Forensic Medicine & Toxicology, Shahid Beheshti University of Medical Sciences, Tehran-Iran
6. **Dr. Mokhtar Ahmed Alhrani** (*Specialist*) Forensic Medicine & Clinical Toxicology, Director of Forensic Medicine Unit, Attorney General's Office, Sana'a, Yemen
7. **Dr. Rahul Pathak** (*Lecturer*) Forensic Science, Dept of Life Sciences Anglia Ruskin University, Cambridge, United Kingdom
8. **Dr. Hareesh** (Professor & Head) Forensic Medicine, Ayder Referral Hospital, College of Health Sciences, Mekelle University, Mekelle Ethiopia East Africa

SCIENTIFIC COMMITTEE

1. **Pradeep Bokariya** (*Assistant Professor*) Anatomy Dept. Mahatma Gandhi Institute of Medical Sciences, Wardha, Maharashtra
2. **Dr Anil Rahule** (Associate Professor) Dept of Anatomy, Govt medical college Nagpur
3. **Dr Yadaiah Alugonda** (Assistant Professor) Forensic Medicine, MNR Medical college, Hyderabad
4. **Dr Vandana Mudda (Awati)** (*Associate Prof*) Dept of FMT, M.R. Medical College, Gulbarga, Karnataka,
5. **Dr. Lav Kesharwani** (*Asst. Prof.*) School of Forensic Science, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad U.P.
6. **Dr. Nishat Ahmed Sheikh** (*Associate Professor*) Forensic Medicine, KIMS Narketpally, Andhra Pradesh
7. **Dr K.Srinivasulu** (*Associate Professor*) Dept of Forensic Medicine & Toxicology, Mediti Institute of Medical sciences, Ghanpur, MEDCHAL Ranga Reddy. Dist.AP_501401.
8. **Dr. Mukesh Sharma** (Senior Scientific Officer) Physics Division, State Forensic Science Laboratory, Jaipur, Rajasthan
9. **Dr Amarantha Donna Ropmay** (Associate Professor) NEIGRIHMS, Shillong
10. **Dr Basappa S. Hugar** (Associate Professor) Forensic Medicine, M.S. Ramaiah Medical College, Bangalore
11. **Dr. Anu Sharma** (*Associate Prof*) Dept of Anatomy, DMCH, Ludhiana (PB)

"Indian Journal of Forensic Medicine & Toxicology" is peer reviewed six monthly journal. It deals with Forensic Medicine, Forensic Science, Toxicology, DNA fingerprinting, sexual medicine and environment medicine. It has been assigned International standard serial No. p-0973-9122 and e-0973-9130. The Journal has been assigned RNI No. DELENG/2008/21789.

The journal is indexed with Index Copernicus (Poland) and is covered by EMBASE (Excerpta Medica Database). The journal is also abstracted in Chemical Abstracts (CAS) database (USA). The journal is also covered by EBSCO (USA) database.

The Journal is now part of UGC, DST and CSIR Consortia. It is now official publication of Indian Association of Medico-Legal Experts (Regd.).

NATIONAL EDITORIAL ADVISORY BOARD

1. **Prof. Shashidhar.C.Mestri** (*Professor*) Forensic Medicine & Toxicology, Karpaga Vinayaga Institute of Medical Sciences, Palayanoor Kanchipuram District, Tamil Nadu
2. **Dr. Madhuri Gawande** (*Professor*) Department of Oral Pathology and Microbiology, Sharad Pawar Dental College, Sawangi, Wardha.
3. **Dr.T.K.K. Naidu** (*Prof & Head*) Dept of Forensic Medicine, Prathima Institute of Medical Sciences, Karimnagar, A.P.
4. **Dr. Shalini Gupta** (*Head*) Faculty of Dental Sciences, King George Medical University, Lucknow, Uttar Pradesh
5. **Dr. Pratik Patel** (Professor & Head) Forensic Medicine Dept, Smt NHL Mun Med College, Ahmedabad
6. **Professor Devinder Singh** Department of Zoology & Environmental Sciences, Punjabi University, Patiala
7. **Dr. Pankaj Datta** (*Principal & Head*) Department of prosthodontics, Inderprasth Dental college & Hospital, Ghaziabad
8. **Dr. Mahindra Nagar** (Head) Department of Anatomy, University College of Medical Science & Guru Teg Bahadur Hospital, Delhi
9. **Dr. D Harish** (Professor & Head) Dept. Forensic Medicine & Toxicology, Government Medical College & Hospital, Sector 32, Chandigarh
10. **Dr. Dayanand G Gannur** (*Professor*) Department of Forensic Medicine & Toxicology, Shri B M Patil Medical College, Hospital & Research centre, Bijapur-586101, Karnataka
11. **Dr. Alok Kumar** (*Additional Professor & Head*) Department of Forensic Medicine & Toxicology, UP Rural Institute of Medical Sciences and Research, Saifai, Etawah. -206130 (U.P.), India.
12. **Prof. SK Dhattarwal**, Forensic Medicine, PGIMS, Rohtak, Haryana
13. **Prof. N K Aggrawal** (Head) Forensic Medicine, UCMS, Delhi
14. **Dr. Virender Kumar Chhoker** (Professor) Forensic Medicine and Toxicology, Santosh Medical College, Ghaziabad, UP.

Print-ISSN:0973-9122 Electronic - ISSN: 0973-9130 Frequency: Six Monthly

© All Rights reserved The views and opinions expressed are of the authors and not of the Indian Journal of Forensic Medicine & Toxicology. Indian Journal of Forensic Medicine & Toxicology does not guarantee directly or indirectly the quality or efficacy of any products or service featured in the advertisement in the journal, which are purely commercial.

Website: www.ijfnt.com

Editor

Dr. R.K. Sharma

Institute of Medico-legal Publications

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Printed, Published and owned by

Dr. R.K. Sharma

Institute of Medico-legal Publications

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Design & Printed at

M/s Vineeta Graphics, Mobile: 9990005742, 9990005734

Published at

Institute of Medico-legal Publications

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001



Indian Journal of Forensic Medicine & Toxicology

www.ijfmt.com

Contents

Volume 08 Number 02

July-December 2014

1. A Retrospective Study of Pregnancy Related Deaths 01
Shrikant Shinge
2. Significance of Maintaining Dental Records 04
Sanchana Balakrishnan, Nithya Jagannathan MDS
3. Stature Estimation from Length of Fingers in Gujarati Population 08
Senthil Kumaran M, Binaya Kumar Bastia, Lavlesh Kumar, Sweta H Patel, Keyur K Nimavat
4. Forensic Entomology Solves the Mysteries 12
Dattatray Ghodake, Datta Pawale, T V Sathe
5. Autopsy Study of Unnatural Deaths among Young People of 13-21 Years 16
Age Group Conducted at Kims Hospital, Bengaluru
C Ramesh, Hanumantha, Ananda K, Devidas Tondare
6. Analysis of Tissue Samples from Unknown to Known 21
V Dekal, J Magendran, N Srinivasa Ragavan
7. Desperate Need of Modernized Mortuaries in Hospitals of India 25
Shilekh Mittal
8. Estimation of Stature from Middle Finger Length-in Salem Region 30
S Sasi Kumar, Pavanchand Shetty, Shankar
9. Thermal Burn: An Epidemiological Retrospective Study 34
S K Pandey, Neha Chaurasia, Awdhesh Kumar
10. Fusion of Epiphyses of Ischial Tuberosity in Relation with Age: A Cross Sectional Study 38
Anita Verma, Kanan Shah
11. Role of DNA in Forensic Identification 43
Karthavya Sampath, Nithya Jagannathan
12. Morphometric Analysis of Foramen Magnum for Sex Determination in Karnataka 48
Kazi, S A K, Aadamali A Nadaf, Pramod B Gai
13. Analysis of Fatal Railway Accidents in District Hospital, South India: A Retrospective Study 52
Chandru K, Rajendra Kumar R, Rudramurthy S
14. An Epidemiological Study of Fatal Firearm Cases in Varanasi, UP 55
Kaulaskar Shashikant V, S K Pandey, Pravin N Yerpude, Manoj Pathak, Keerti S Jogdand
15. Sexual Dimorphism of Cranial Sutures in Maharashtra and North-Karnataka Region 59
Makandar U K, Kaushal Vishuddha M, Rajendra R, Sharieff J H
16. Post Mortem and the Risk of HIV Infection 63
Mukesh Kumar Bansal, SK Naik, Poonam Gupta, Yashoda Rani, BL Sherwal
17. Fetal Head Circumference: An Important Criterion for Gestational Age Estimation 68
*Sachin Sudarshan Patil, Ravindra Baliram Deokar, Jyoti Rahul Sul,
Sandeep Shivaji Gosavi, Varsha Pratik Mahajan*

II

18. A Study on Pattern of Injuries due to Railway Accidents Occuring at Khammam Region - Andhra Pradesh 72
Roop Kumar KM, Udaypal Singh, Satya Sai Panda, Shaikh Khaja
19. Pattern of Railway Fatalities in Western Vidarbha Region of India 77
SN Hussaini, A A Mukherjee, PA Wankhede, AS Rahule, SV Tambe, MSM Bashir
20. A Study on Estimation of Stature from Foot Measurements 81
Kazi S A K, Aadamali A Nadaf, Vijayachandra, B G Shalawadid
21. A Study of Ligature Mark in Deaths due to Hanging in Warangal Area, Andhra Pradesh 85
Bharathi Rama Rao, V Chand Basha, K Sudhakar Reddy
22. A Five Year Retrospective Study of Victims of Sexual Offences in Jaipur Region 89
Yadav A, Meena R L, Pathak D, Kothari N S
23. A Study of Different Position of Mastoid Foramen Related of Skull Bone 94
Dimple S Patel, Rohit C Zariwala, Bharat D Trivedi
24. Postmortem Autolytic Changes in Oral Mucosa: Histological Review 97
Charan Gowda BK, C V Mohan, Hemavathi
25. A Socio-Demographic Profile of Fatal Burn Deaths in Jaipur City, India 101
Punia R K, Yadav A, Meena D K
26. Troponin: the Valuable Assay in Post Mortem Investigation of Ischemic Heart Disease 107
Anita Verma, Shaista Saiyad, Pratik Patel
27. An Insight into Additional Factors in Drug Abuse 112
Seema S Sutay, Nishat Ahmed Sheikh
28. Hidden Facts of Peri-Operative Deaths in ASA-Class I and ASA- Class II Patients - A Cross-Sectional Study 117
N Vijayakumari, K Meiyazhagan
29. Clinical Pattern and Outcome in Patients of Organophosphorus Poisonings 121
in the Rural Area around Talegaon - Dabhade
Maya Pai Dhungat, Pradip Pai Dhungat, Dilip P Bhoge
30. Age Related Changes in Human Kidneys- An Autopsy Study 126
S R Jagannatha, Mouna Subbaramaiah
31. Morbidity and Mortality among the RTA Casualties Attending in a Tertiary Care Hospital, 130
Belgaum - A Retrospective Study
Bimlesh Kumar Sah, Ashwini Narasannavar, M D Mallapur, Sanjay Kumar Yadav
32. The Suicidal Cowdung Powders of Kongunadu 134
Tarun K George, Anugrah Chrispal, Ramya I, Joe Flemming, Pradeep Kumar, Sneha Anna Joy
33. Juvenile Delinquency: Retribution / Reform?=Futuristic Vision vis a vis Changing Scenario 137
Shrikant Asawa, Sandeep Bhowate, Pardeep Singh
34. Study of Ossification of Carotido-Clenoid Ligament and Interclenoid Ligament in 143
Skulls of Central India and its Clinical Implications
Rashmi Deopujari, Ashutosh S Mangalgiri, Dibya Kishore Satpathi, Lata S Khanzode
35. Haematemesis and Malaena - Rare Presentations of Methotrexate Toxicity - A Case Report 146
Aundhakar S C, Bhalla G B, Mhaskar D M, Mane M B, Panpaliya N, Mahajan S K
36. Psychopathology and other Contributing Stressful Factors in Female Offenders: An Exploratory Study 149
Pallavi Joshi, Sanjay Kukreja, Avinash Desousa, Nilesh Shah, Amresh Shrivastava
37. Stature and Percutaneous Tibial Length - A Correlational and Comparative Study in Sex of Gujarat 156
Dimple S Patel, Rohit C Zariwala, Bharat D Trivedi

38. Study of Origin of Left Vertebral Artery from the Arch of Aorta in Central India and its Clinical Relevance	161
<i>Ashutosh S Mangalgiri, Akash Deep Suri, Dibya Kishore Satpathi, Lata S Khanzode</i>	
39. An Analytical Study of 818 Poisoning Cases Autopsied at Osmania	165
<i>Medical College, Hyderabad, Andhra Pradesh</i>	
<i>Sanjay Punuri, Seetharamaiah Mynedi, VP Kumar Sriperumbuduru</i>	
40. Myositis due to Consumption of Swarmer Termites: A Case Report	169
<i>Agrawal A, Venkatrathamma P N, Srinivas S V</i>	
41. Histopathological Spectrum in Lung Autopsies- A 50 Case Study	172
<i>Kanwardeep Kaur Tiwana, Sarita Nibhoria, Manvi Gupta, Ashish Yadav</i>	
42. A Topographic Study of Wormian (Sutural) Bones and their Clinical Significance	176
<i>in the Region of Parietal Bone in Human Skulls of Central India</i>	
<i>Dibya Kishore Satpathi, Ashutosh S Mangalgiri</i>	
43. Comparative Study of Incidence of Inca Bones in North and South Indian Human Crania	180
<i>Makandar U K, Kaushal Vishudda M, Rajendra R, Patil B G</i>	
44. Non Parasitic Liver Cyst-Incidental Diagnosis Made on Autopsy	185
<i>Kanwardeep Kaur Tiwana, Sarita Nibhoria, Preeti Padma, Varinder Nibhoria</i>	
45. Spontaneous Rupture of Abdominal Aorta due to Penetrating Atheromatous Ulcer:	187
<i>A Rare Cause of Sudden Death in a Young Individual</i>	
<i>Pradeep K Saralaya, Y P Girish Chandra, Clement Wilfred D, Amoolya Bhat</i>	
46. Elastofibroma Dorsi: A Rare Soft Tissue Tumor Detected Incidentally on Autopsy	192
<i>Vardendra Kulkarni, Seema Bijjaragi</i>	
47. Neurological Manifestation's of Lead Toxicity in a Battery Worker-A Case Report	196
<i>Varma Sanjay, Gupta G B, Malhotra Yogendra, Khare R L, Singh C, Agrawal Shweta, Mandavi Sanjay</i>	
48. Fatal Case of Hexaconazole Poisoning: A Rare Case Report	201
<i>Tanmay Sardar, Saswata Biswas, Aniruddha Das, Nirmalya Chakrabarti,</i>	
<i>Partha Pratim Mukhopadhyay, Subodh Bhattacharyya</i>	
49. A Rare Case of Fatal Cardiotoxicity and Methemoglobinemia Following Nitrobenzene Poisoning	204
<i>B J Kiran, P N Venkatarathnamma, S V Srinivas, K Sabari Girish</i>	
50. A Medicolegal Study to Evaluate Relationship between Fingerprint Pattern and Abo Blood Groups	208
<i>Md Ziya Ahmad, R N Karmakar</i>	
51. Estimation of Stature & Sexual Dimorphism from Dimensions of Palm in Living and in Cadavers	212
<i>More Raghunath S, R J Patil, G V Kesari, B N Umarji</i>	
52. A Study of Ossification of Capitate, Hamate, Triquetral & Lunate in Forensic Age Estimation	218
<i>Ajay Balachandran, Moumitha Kartha, Anooj Krishna, Thomas Jerry, Prathilash K, Prem T N,</i>	
<i>Libu G K, Krishnan B, Liza John</i>	
53. Correlative Study of Gall Bladder with Liver in South Indian Cadavers	225
<i>Rajendra R, Makandar Uk, Tejaswi H L, Ajay N</i>	
54. Death due to Consumption of Calcium Hydroxide or "Chooona" Presumed to be a Slimming	230
<i>Agent: An Unusual Case Report</i>	
<i>Mohit Chauhan, Monisha Pradhan, Jatin Bodwal, C Beherea</i>	
55. Abuse of Sections of IPC'S 304 (B) and 498 (A) - A Case Report	234
<i>R Ravikumar</i>	

A Retrospective Study of Pregnancy Related Deaths

Shrikant Shinge

Assistant Professor, Dept. of Forensic Medicine, Govt. Medical College, Miraj, Dist.- Sangli, Maharashtra

ABSTRACT

The death of a woman in childbirth is a tragedy, an unacceptable and wasteful event that carries with a huge burden of grief and pain. It is recognized as a social indicator, and there is a large gap between the maternal mortality rate in developed countries and that in developing nations. The lifetime risk of dying from pregnancy related complication in developed country is 1 in 11 compared to 1 in 5000 in developing countries. Information provided by medical autopsies has played an important role in increasing the accuracy of cause-of-death reports and improving clinical practice in the developed world. We carried out this study to understand the magnitude of maternal mortality in this region and also to know the cause of death and to find out preventive factor. We found that most of the women were from age group 21 - 25 years (45.45%) with mean age of 23.72 years. All the females were of primipara except one who delivered in second para. Hemorrhage remained the main cause of death followed by septicemia.

Keywords: *Pregnancy, Maternal Deaths, Hemorrhage, Septicemia*

INTRODUCTION

The death of a woman in childbirth is a tragedy, an unacceptable and wasteful event that carries with a huge burden of grief and pain. Pregnancy is not a disease and pregnancy related morbidity and mortality are preventable¹. According to the World Health Organization (WHO), 55% of maternal deaths occur in Asia, 40% occur in Africa, and only 1% occurs in developed countries². With 16% world's population India accounts for over 20% of maternal deaths. The lifetime risk of dying from pregnancy related complication in developed country is 1 in 11 compared to 1 in 5000 in developing countries³. One of the Millennium development goals (MDG) set by WHO was to reduce maternal mortality ratio by three quarter between 1990 and 2015, and achieving universal access to reproductive health by 2015. But an important challenge is that a majority of countries still lack a

complete civil registration system with good attribution of cause of death, making it challenging to assess accurately the extent of progress towards MDG⁴.

Maintenance of data on maternal deaths is crucial to the implementation of maternal health programs in the country⁵. Information provided by medical autopsies has played an important role in increasing the accuracy of cause-of-death reports and improving clinical practice in the developed world⁶. We carried out this study to understand the magnitude of maternal mortality in this region and also to know the cause of death and to find out preventive factor.

MATERIAL & METHOD

We carried out the retrospective review of all the medico-legal cases referred to Govt. Medical College, Miraj, Dist – Sangli (Maharashtra) during the period of January 2011 to December 2012. All the cases of death of a woman while pregnant or within 42 days of pregnancy irrespective of duration and site of pregnancy from any cause related to or aggravated by pregnancy or its management were included in the study. These cases were reviewed with respect to maternal demographic profile, autopsy and histopathological findings. Performa for study was

Corresponding author:

Shrikant Shinge

Block No 3. Bulding No- 2, Residential campus,
Govt. Medical College, Miraj, Dist.- Sangli,
Maharashtra, Pin - 416410
Phone No - +919860151299
Email id - drshri.2001@gmail.com

prepared and all collected data were put into the master-chart, which was prepared and then feed into the computer in Excel worksheet and then analyzed.

RESULTS

During January 2011 to December 2012 total 11 pregnancy associated deaths were recorded in this institute. Their age ranged from 17 years to 35 years and most of the women were from age group 21 – 25 years (45.45%) with mean age of 23.72 years. (Table no 1) All the females were of primipara except one who delivered as second para. Considering the pregnancy outcome 5 were undelivered and brought dead to casualty while in 4 cases baby were live born and in one cases stillbirth was recorded. The cases intrauterine fetal age varied from 24 to 28 weeks. Hemorrhage remained the main cause of death followed by septicemia. (Table no 2) One maternal death was recorded due to indirect cause who suffered from lung abscess associated with liver cirrhosis. One patient died due intra-cerebral hemorrhage which cannot be counted as direct or indirect cause of death.

Table No. 1 Age wise distribution

Sr. No	Age	No of cases	Percentage
1	15 – 20	04	36.37
2	21 – 25	05	45.45
3	26 – 30	1	09.09
4	31 – 35	1	09.09
5	More than 35	0	00

Table No. 2 Distribution of cases according to cause of death

Sr. No	Cause of death	No of cases	Percentage
1	Post partum hemorrhage	04	36.37
2	Septicemia	02	18.18
3	Disseminated intravascular coagulation	02	18.18
4	Pulmonary thromboembolism	01	09.09
5	Lung abscess associated with liver cirrhosis	01	09.09
6	Other	01	09.09

DISCUSSION

Death during pregnancy is dependent upon the general socioeconomic status, nutrition level and the level of maternal healthcare in the community. It is recognized as a social indicator, and there is a large

gap between the maternal mortality rate in developed countries and that in developing nations⁷.

As per ICD 10 (international classification of disease) Pregnancy-related death is that which occurred during pregnancy, or within 1 year after delivery and resulting from pregnancy-specific complications². The causes can be classified as direct and indirect. Direct maternal deaths are those resulting from obstetric complications of the pregnancy, delivery or their management. Indirect maternal deaths includes conditions present before or developed during pregnancy but aggravated by physiological effects of pregnancy and strain of labour³.

In the present study 21-25 years age group was the sufferer of this tragedy which is similar to studies conducted by other authors in developed countries^{1, 6, 8, 9, and 10}. All the women who died during pregnancy were married while one female was unmarried and of 17 years old who died due to septicemia of unskillful abortion. Among all the pregnancy related deaths, primiparas contributed to the majority of maternal deaths. In primiparas the major cause of death was hemorrhage followed by sepsis. DIC is a consumption coagulopathy and is a key contributor to primary postpartum hemorrhage⁸ other causes included rupture horn of bicornuate uterus.

Limitation: Main limitation of a retrospective study is incompleteness of data due to incomplete recordings of case notes. Using death certificate as sole source suffers from drawback because many times cause of death is not mentioned, especially if death incurred medico-legal autopsy. Often only cardio-respiratory arrest was furnished as a cause of death.

ACKNOWLEDGEMENT

I gratefully acknowledge to Dr. M. B. Shrigiriwar, Prof & head, Dept of FMT, VNGMC, Yavatmal for his valuable support and constant encouragement. I am also thankful to the Dr. V. D. Sonar, Assistant professor and Dr. R.V. Bardale, Associate Professor, Dept of FMT, GMC, Miraj, for their help and support. I express sincere gratitude to the authors & writers of various textbook and journals whose references have been cited.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Not required

REFERENCES

1. Herpassa Garomssa, AD Dwiwedi; Maternal mortality in Ambo hospital a five year retrospective review; Ethiopian journal of reproductive health; May 2008; 2(1); p 2-13
2. Linda A Goodrum; Maternal Mortality – strategies in prevention and care; Hospital physician; January 2001; p 44-51
3. D C Dutta; Textbook of obstetrics oncluding prenatalogy and contraception; New central book agency; Kolkata; 6th edition; 2006; p – 599 to 602
4. Trends in maternal mortality 1990 to 2010; WHO library cataloguing in publication, WHO document production services, Geneva, Switzerland, 2012, p 3
5. Chrisitan C Ibeh, Patricia U. Okpala; Maternal deaths where do they occur? A survey of health facilities in Abia state, south east Nigeria; Journal of nursing education and practice; 2013; vol 3 (3), p 139 -146
6. Clara Menendez, Cloafe Romagosa, Mamudo R Ismail et al; An Autopsy Study of Maternal Mortality in Mozambique: The Contribution of Infectious Diseases; PLoS Med. 2008 February; 5(2): e44
7. T S Panchbhai, P D Patil, D R Shah, A S Joshi; An autopsy study of maternal mortality – A tertiary healthcare perspective; journal of postgraduate medicine; 2009; vol 55 (1); p 8-11
8. R V Bardale, P G Dixit; Pregnancy –related deaths a three year retrospective study; Journal of Indian academy of forensic medicine; vol 32 (1); p 15 – 18
9. Shinagawa S, Katagiri S, Noro S, Nishihira M; An autopsy study of 306 cases of maternal deaths in Japan; Nihon sanko fujinka gakkai zashi; February 1983; Vol 35(2); p 194-200.
10. Wandira, Richard; Autopsy study of maternal deaths in Mulago hospital; June 2007; Dessertation submitted to the Mekerere University, Kampala

Significance of Maintaining Dental Records

Sanchana Balakrishnan¹, Nithya Jagannathan MDS²

¹BDS Student, ²Senior Lecturer, Department of Oral Pathology, Saveetha Dental College, Saveetha University, No 162, Poonamalle High Road, Vellapanchavadi, Chennai, India

ABSTRACT

Dental record is essential in forensic analysis as it serves as a major tool in providing information for antemortem source. The dental patient record provides a history of care delivered to the patient, the results of examination and diagnostic tests, imaging studies, a plan for addressing conditions that warrant treatment and other information that assists those who provide care to the patient. It is also a legal record that documents professional care provided to the patient. A thorough knowledge of dental records is essential for the practicing dentist, as it not only has forensic application, but also a legal implication with respect to insurance and consumerism. As the dental remains are usually the last to get destroyed among the various body parts after death and hence it has a great importance in identification of a person. So a proper maintenance of dental records is essential so that forensic odontologist can compare the antemortem and postmortem records of the suspect and arrive at a conclusion. They may also be useful for personal identification in cases of mass disasters and decomposed unidentified bodies. This article enumerates on the methods of collecting dental records and their documentation and their implication in medicolegal issues.

Keywords: Records, Personal Identification, Recovery, Identification

INTRODUCTION

Forensic dentistry or forensic odontology is the application of dental knowledge to those criminal and civil laws that are enforced by police agencies in a criminal justice system. Forensic dentists assist investigative agencies to identify recovered human remains in addition to the identification of whole or fragmented bodies. Identification is done by the comparison of antemortem and postmortem dental records and using the unique features visible on dental radiographs¹. A dental record is the detailed document

of the history of illness, physical examination, diagnosis, treatment and management of a patient. Dental records serve as an information source for dentists and the patients, in medico-legal, administrative financial function within general practice for quality assurance and audit.

Every practicing dentist has a legal duty as in keeping some sort of record of each patient for whom they are providing dental care². The ability of a dental practitioner to produce and maintain accurate dental records is essential for good quality patient and follow-up. With increasing awareness among the general public of legal issues surrounding healthcare, in forensic purposes and with the worrying rise in malpractice of insurance claim cases, a thorough knowledge of dental records issues is essential for any practitioner³. Dental records can be used for teaching and also for research purposes. Record maintenance is legally mandatory in the American and European

Corresponding author:

Nithya Jagannathan

Department of Oral Pathology,
Saveetha Dental College, Saveetha university,
No 162, Poonamalle High road, Vellapanchavadi,
Chennai, India - 600077

Mail id: dr.nithya@ymail.com

Ph no : 9884754910

countries⁴, but the rules are not clear in India and there is ignorance regarding the same among dentists in our country. The review aims to create awareness about the maintenance of dental records and its importance in forensics or medico-legal cases.

General Principles To Be Applied In Completing Patients Records

Dentists should take reasonable steps to ensure that the information in dental records is accurate, complete and up to date. Clinically relevant, accurate, contemporaneous records are essential to provide dental care and for forensic purposes. Records must be sufficiently comprehensible in each entry so that another practitioner, relying on the record can undertake the patient's ongoing care. Entries should be made in chronological order. Dental records must be understandable by third parties, particularly other health care providers. Records should be legible and abbreviations standard ones. Dental records must be able to be retrieved when required. All comments must be provided based on the facts, do not include emotional language or make defamatory statements. Dentists should protect the privacy and confidentiality of dental records and comply with all relevant privacy laws⁵.

Contents and Standards For Record Keeping

Patient details

Sufficient information to identify and communicate with the patient should be recorded including, identifying details of the patient (including full name, sex, date of birth and address, including email and telephone number) and current medical history of the patient, including any adverse drug reactions⁴.

Substitute decision maker

If the patient is a child or under the care of a legal guardian or substitute decision maker, the dental record should contain the name, address and contact details of the parent, guardian or substitute decision maker and the relationship of the substitute decision maker to the patient^{4,5}.

Practitioner details

It is essential to clearly identify the name and professional role of the practitioner providing the services and making the record⁴.

Consents and restrictions

Constrictions and restrictions include record of consents provided by the patient. If a written consent is provided, the signed consent form and if written consent is not provided, then a description of the treatment as explained to the patient and the consents provided by the patient, including consent to treatment, privacy consents and financial consent are documented. The patient is then advised on the treatment options, the relevant material risks and benefits of those patients pre and post-treatment instructions and likely outcomes. Documentation of any treatment advice that is denied by the patient, any comments or complains by patients about treatment provided and if the patient has made a direction to care, such as a restriction on blood transfusions are also essential⁵.

Clinical details

For every appointment a clear documentation describing, the date of visit the identifying details of the practitioner providing the treatment. Information about the type of examination conducted, the presenting complaint, relevant history, clinical findings and observations, diagnosis, treatment plans and alternatives are recorded. An informed consent of the patient, client or consumer, all procedures conducted, instrument batch (tracking) control identification, where relevant, a medicine/drug prescribed, administered or supplied or any other therapeutic agent used (name, quantity, dose instructions), details of advice provided, unusual sequelae of treatment, significant events or adverse events, radiographs and other relevant diagnostic data, digital radiographs must be readily transferable and available in high definition digital, other digital information include CAD-CAM restoration files, instructions to and communications with laboratories, other details, all referrals to and from other practitioners, any relevant communications with or about the patient, client or

consumer, details of anyone contributing or the dental record, estimates or quotations of fees records should also indicate when the patient failed to attend and provide for adequate follow up⁶.

Importance of Maintaining Dental Records

Protecting health information and diligent and complete record keeping is extremely important for many reasons

Care of the patient: Patient records document the course of treatment and may provide data that can be used in evaluating the quality of care that has been provided to the patient⁷.

Means of communication: Records also provide a communication between the treating dentist and any other doctor who will care for the patient. Complete and accurate records provide enough information to allow another provider who has no prior knowledge of the patient to know the patient's dental experience^{6,7}.

Defence allegations of malpractice: Besides, the dental record may be in a court of law to establish the diagnostic information that was obtained and the treatment that was rendered to the patient⁷.

Identification of a dead or missing person: Another way the dental record may be used is to help provide information to appropriate legal authorities that will aid in the identification of dead or missing person. The most common element of forensic dentistry that a general practitioner is likely to encounter is to supply antemortem records to forensic odontologists⁷.

Forensic Uses of Patient Records

As mentioned above the most common element in forensic dentistry that a general practitioner is likely to encounter is to supply antemortem records to aid in personal identification. Forensic dentists are frequently called upon to identify the remains of individuals who cannot be identified visually. This encompasses a large number of situations such as burnt, grossly decomposed or mutilated remains. The identification is normally carried out by the comparison of antemortem and postmortem records⁸.

The identification of the deceased individuals is an essential element in the process of death certification and is a crucial component in the investigation of homicides or suspicious death. The police officers in-

charge of the case will normally call upon the dentist to provide details of dental records. When a request for records is received the entire record is useful, including such items as laboratory prescriptions and study models. Many documented cases have used the unique pattern of the palatal rugae recorded on an orthodontic study model to identify young individuals with no dental restorations⁹.

CONCLUSION

Thus maintenance of dental record is very essential for a good dental practitioner for helping in medico legal cases and in the identification of a person in any mass fatality disorders etc . An awareness must be created among the dentists for documenting good patient record an fits maintenance is very essential. To achieve positive changes in maintaining the standard of keeping records, proper education is to be given among the undergraduates and postgraduates¹⁰.

ACKNOWLEDGEMENT

The authors thank the Department of Oral Pathology, Saveetha University for the technical assistance and guidance in preparation of the manuscript.

Declaration of Interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Source of Funding: The paper is a review paper and requires no source of funding.

Ethical Clearance: The article does not involve with patients/ animals and is a review paper. Hence it is not relevant.

REFERENCES

1. Verma K , Joshi B, Joshi CH, Rejz Paul MP. Bite marks as physical evidence fro the crime scene - An overview. *Open Acc Scient Reports*. 2013; 2:605
2. Charangowda BK. Dental records: An overview *J.Forensic Dent.Sci* 2010; 2:5-10
3. Lawney M. For the record understanding patient record keeping. *NY state Dent.J.* 1998;64:34-43
4. American Academy of Pediatric Dentistry. Clinical guideline on record keeping. *Pediatr Dent* 2004;26:134-9

5. Drafted taking into considerations "guidelines on dental records" Dental Board of Australia Version 25 September 2012
6. Madhusudan A, Swati S, Gayathri R, Nisheeth S. Dental Records: Are we ready for the forensic needs? *J Forensic Dent Sci.* 2011; 3(2): 52–57. Maintaining dental records: Are we ready for forensic needs? Maintaining dental records: Are we ready for forensic needs? Maintaining dental records: Are we ready for forensic needs?
7. Platt M, Yewe-Dyer M. How accurate is your charting? *Dent. Update.* 1995;22;37
8. American Board of Forensic Odontology. Body identification guidelines. *J Am Dent Assoc.* 1994;125:1244-54
9. Bormann H, Dahlbom U, Loyola E, Rene N. Quality evaluation of 10 years patient records in forensic odontology. *Int J Legal Med.* 1995;108:100-4
10. Pessian F, Beckett HA. Record keeping by undergraduate dental students : A clinical audit. *Br. Dent J .* 2004;197:703-5.

Stature Estimation from Length of Fingers in Gujarati Population

Senthil Kumaran M¹, Binaya Kumar Bastia², Lavlesh Kumar², Sweta H Patel³, Keyur K Nimavat⁴

¹Senior Resident, ²Professor, ³Junior Resident, Department of Forensic Medicine, SBKS Medical Institute & Research Centre, Vadodara, Gujarat, India, ⁴Junior Resident, Department of Forensic Medicine, B.J. Medical College, Ahmedabad, Gujarat, India

ABSTRACT

Background: Anthropometric characteristics have direct relationship with sex, shape and form of an individual. These are closely linked with each other in estimating height of an individual from available data, which form the basis of forensic anthropology.

Aim and Objective: To derive a regression equation to estimate the height of an individual using finger lengths in Gujarati population.

Material and Method: A cross-sectional study was conducted among two hundred Gujarati students in the age group of 20-24 years. Standing height of the individual and finger lengths of ten digits were measured to derive a regression formula using SPSS software version 17.

Results: Stature estimation from finger lengths using different regression equation was obtained. The length of left middle finger was specific for males and left index finger for females.

Conclusion: This study will be helpful for forensic experts, anthropologists, anatomists in estimating the stature of an individual from fragmentary remnants.

Keywords: Anthropometry, Stature, Finger Length, Regression Equation, Gujarati Population

INTRODUCTION

Establishing the identity of an individual has always been a necessity due to natural disasters like earthquakes, tsunamis, cyclones, floods and man-made disasters like terror attacks, wars, plane crashes etc. It is often required in medico-legal practice and the problem mainly arises when the body is recovered in decomposed, mutilated or skeletonized state. Sometimes, fragments of soft tissues are found

disposed off in rubbish dumps, ditches or open etc., and this material is brought to forensic experts for anthropological evaluation. Stature is an important parameter for identification of an individual and has a notable importance in forensic anthropology in narrowing down the pool of possible victim matches in cases of identification from dismembered remains.¹ So there exists a need to estimate stature from various body parts in different population groups.

Trotter and Glesser formulae are used most frequently in many parts of the world for stature estimation from long bone lengths, however there are expressed concerns regarding the use of population specific formulae.² Krogman and Iscan has stressed upon that regression formula for stature estimation should be population specific.³

Corresponding author:

Senthil Kumaran M

Senior Resident

Department of Forensic Medicine, JIPMER,
Puducherry, INDIA

Contact no : +91 8940355577

Email: msenthil_doct@yahoo.com

There are various ways to estimate stature from bones but the easiest and most reliable method is by regression analysis.⁴ Many studies are available to estimate height of an individual using various bone lengths but literature regarding estimation of stature using finger length are very limited.⁵⁻⁸ The diversity of Indian population provides an unique opportunity to study the morphogenetic variations. The aim of this study is to derive different regression equations to calculate the height of an individual using percutaneous measurement of finger lengths of all the ten digits.

MATERIAL AND METHOD

This cross-sectional study was conducted at a tertiary care teaching hospital, Vadodara, Gujarat. Study population consisted of 200 healthy medical students (100 males and 100 females) from different parts of the Gujarat in the age group of 20 to 24 years. Those with congenital or acquired skeletal abnormality were excluded. The procedure and aim of the study were explained in a group and an informed written consent was taken from each participant prior to taking measurements. Measurements were made at a fixed time of each day to avoid diurnal variation and by the same person to avoid personal errors in methodology.

An anthropometer was used to measure height. Height was measured from crown to heel on standing erect in anatomical position with bare foot against a wall. The feet were kept parallel to each other with heels, buttocks and back touching the wall. The head

was kept in the eye-ear-eye plane and then height was measured to the nearest 0.1 cm.

A sliding caliper was used to measure the finger length. The subject was asked to place the hand on a flat table, with palms facing downwards. The proximal point (phallogion) was noted by palpating the joint space between head of metacarpal and base of proximal phalange. Then sliding caliper was used to measure the distance between phallogion and the distal most point of the finger (dactylion). Same procedure was repeated for all the digits respectively.

The data were entered in MS Excel 2007 and analysed using SPSS version 17 for windows. Independent linear regression equations to calculate the height were obtained for individual finger for both males and females. P value for <0.05 was considered statistically significant.

RESULTS AND OBSERVATION

Linear regression analysis was done by using finger lengths as independent variables and height as dependant variable. For males the derived regression equations were significant for all the ten digits, and most specific for left middle finger ($p < 0.001$; $r^2 = 0.138$) followed by right ring ($p < 0.001$; $r^2 = 0.123$) and left ring fingers ($p < 0.001$; $r^2 = 0.121$). (Table-1) Similarly, in females it was significant for all the digits, being most specific for left index finger ($p < 0.001$; $r^2 = 0.170$) followed by left middle ($p < 0.001$; $r^2 = 0.139$) and left ring finger ($p < 0.001$; $r^2 = 0.133$). (Table-2)

Table 1 Results obtained for male subjects

Finger	Regression equation for height	Percentage explained (r^2)	p value
Right Thumb (RT)	$150.275 + 3.792 \times (RT)$	0.068	0.002
Right Index (RI)	$139.319 + 3.728 \times (RI)$	0.087	0.001
Right Middle (RM)	$132.914 + 4.076 \times (RM)$	0.117	<0.001
Right Ring (RR)	$132.699 + 4.397 \times (RR)$	0.123	<0.001
Right Little (RL)	$145.195 + 3.658 \times (RL)$	0.072	0.002
Left Thumb (LT)	$152.016 + 3.499 \times (LT)$	0.058	0.007
Left Index (LI)	$137.267 + 3.960 \times (LI)$	0.100	<0.001
Left Middle (LM)	$128.084 + 4.604 \times (LM)$	0.138	<0.001
Left Ring (LR)	$132.637 + 4.398 \times (LR)$	0.121	<0.001
Left Little (LL)	$143.076 + 3.955 \times (LL)$	0.081	0.001

Table 2 Results obtained for female subjects

Finger	Regression equation for height	Percentage explained (r ²)	p value
Right Thumb (RT)	138.450+3.608x(RT)	0.046	0.016
Right Index (RI)	121.631+4.442x(RI)	0.095	<0.001
Right Middle (RM)	115.596+4.760x(RM)	0.121	<0.001
Right Ring (RR)	117.164+4.995x(RR)	0.119	<0.001
Right Little (RL)	126.567+4.649x(RL)	0.082	0.001
Left Thumb (LT)	135.439+4.191x(LT)	0.071	0.003
Left Index (LI)	111.653+5.712x(LI)	0.170	<0.001
Left Middle (LM)	108.056+5.635x(LM)	0.139	<0.001
Left Ring (LR)	116.550+5.055x(LR)	0.133	<0.001
Left Little (LL)	120.931+5.514x(LL)	0.121	<0.001

DISCUSSION

The regression formula devised by Trotter and Glessler is still used throughout the world to estimate the height of an individual from long bones. However, it is specific to Europeans, Africans, Mongolians and Americans, and not reliable for Asians.⁹ It was constantly stressed that all these equations should be population specific. Literature reveals that proportions of the length of fingers vary according to sexes and that females had longer second digits than fourth digits, while males had longer four digits than second digits.¹⁰ In Nigeria, a study was conducted to estimate height using 2D and 4D finger length on both hands; the result showed that height could be predicted from the lengths of right and left 2D and 4D significantly ($P < 0.001$).⁶

To estimate the height from finger lengths in both the genders among Gujarati population we derived different linear regression equations from individual fingers. We found that in both the sexes, all the ten fingers are statistically significant (p value < 0.05) and with high degree of correlation. Therefore any of the finger length can be used to calculate the height of an individual. The best among them is left middle finger ($r^2=0.138$) for males and left index finger ($r^2=0.170$) for females.

A study done in Karnataka, India showed that middle finger length bears a significant relation to stature and could be an important tool for stature estimation.⁷ Another study from the same geographical population showed that in case of males left thumb and in females right thumb was more significant compared to other fingers.⁸ However in our study, we observed that for estimation of stature, left middle

finger is most suitable for males and left index finger for females.

CONCLUSION

The results show that there is strong positive correlation between stature and finger length in Gujarati population. We also found that estimating stature from fragmentary remains like any of the available fingers using this method is reliable and accurate for forensic anthropological evaluation.

REFERENCES

1. Mant Keith A. Identification of the living and dead. In: Taylor's Principles and Practice of Medical Jurisprudence. 13th ed. New Delhi: B.I. Churchill Livingstone Pvt. Ltd; 1995. p. 156-82.
2. Trotter M, Glessler G. Estimation of stature from long bones of American Whites and Negroes. *Am J Phys Anthropol* 1952; 10(4):463-514.
3. Krogman WM, Iscan MY. The Human Skeleton in Forensic Medicine. 2nd ed. Springfield: Charles C Thomas; 1986. p. 302-51.
4. Jantz LM, Jantz RL. Secular changes in long bone length and proportion in the United States, 1800-1970. *Am J Phys Anthropol* 1999; 110(1):57-67.
5. Krishnan K, Kanchan T, Asha N. Estimation of stature from index and ring finger length in a North Indian adolescent population. *J Forensic Leg Med* 2012; 19(5):285-90.
6. Barnabas D, Samuel SA, Alexander BA, Samuel AO. Estimation of height and weight from the lengths of second and fourth digits in Nigerians. *The Internet Journal of Forensic Science*. 3(2) [Internet]. [cited 2012 Dec 21].

7. Rastogi P, Kanchan T, Menezes RG, Yoganarasimha K. Middle finger length-a predictor of stature in the Indian population. *Med Sci Law* 2009; 49(2):123-6.
8. Verghese AJ, Balraj BM, Pramod KGN. A study of estimation of stature from length of fingers in Mysore. *Indian Journal of Forensic Medicine and Toxicology* 2010; 4(2):12-4.
9. Trotter M, Gleser GC. A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death. *Am J Phys Anthropol* 1958; 16(1):79-123.
10. Manning JT, Barley L, Walton J. The 2nd:4th digit ratio, sexual dimorphism, population differences and reproductive success: Evidence for sexually antagonistic genes?. *Evol Hum Behav* 2000; 21(3):163-183.

Forensic Entomology Solves the Mysteries

Dattatray Ghodake¹, Datta Pawale², T V Sathe³

¹Assistant Professor, ²Professor and Head, Dept. of Forensic Medicine, RCSM, Govt. Medical College & CPR Hospital, Kolhapur, ³Professor, Dept. of Zoology, Shivaji University, Kolhapur

ABSTRACT

Insects have important role in forensic science for solving problems related to murder and mysteries. Forensic Entomology is the use of the insects and other arthropods that feed on decaying remains to aid legal investigations. Therefore in the present paper history of Forensic Entomology, why insects are used in Forensic Science, major groups of insects associated with cadavers, insect life cycle and medico legal aspects, role of autopsy surgeon and challenges in Forensic Entomology were discussed.

Keywords: Forensic Entomology, Insect, Autopsy

INTRODUCTION

Insects have important role in forensic science for solving problems related to murder and mysteries. Forensic Entomology is the use of the insects and other arthropods that feed on decaying remains to aid legal investigations. They provide important information on time since death, the road used by the culprit, the region or place of death etc. However, early historical account of forensic insects is almost non-existent. Review of literature indicates that very little attention is paid in India on forensic insects and medicolegal aspects. Hence the present work will add great relevance to the field of medico-legal forensic entomology.¹

History

In the 13th century, a death investigator named Sung T'zu wrote the first book "The Washing Away of Wrongs" about forensic entomology. In which he tells of a murder in a Chinese village in which the victim was repeatedly slashed with a sickle. The magistrate

ordered all the men in the village to assemble with their sickles, and in the heat, the flies were attracted to one sickle, because of the blood residue and small tissue fragments clinging to it. They determined that he was indeed the murderer. After confrontation, the owner of the sickle confessed to the crime.

In 1850 the application of entomology to forensic science happened when Dr Bergeret d' Arboris determined the date of death of a child.² Later Europeans used insects in forensic cases (Meganin 1887).³ In late 19th century Glaister & Brash in 1937 in Britain in the notorious Buxton case determined time since death from the appearance of maggots. In past Aruntjunov (1963), Leclercq (1969), Nuorteva (1947, 1977), Friedrich (2003), Amendt et al (2004), Williams & Villet (2006), Sukontason et al. (2007), Sathe (2011), etc worked on forensic insects. Later the evidences of Forensic insects have been used commonly in Europe throughout the 20th century. In western country today Forensic Entomology used quite extensively and commonly in homicide investigations.⁴

Why are insects used in Forensic Science?

A cadaver is a very rich but short-lived resource. In most seasons and environments, insects colonize a dead body almost immediately after death. There is tremendous competition among organisms, especially in the early stages of decomposition. Insect colonization of a corpse occurs in a series of stages. Different groups are adapted to different

Corresponding author:

Dattatray G Ghodake

Assistant Professor

Dept. of Forensic Medicine, RCSM, Govt. Medical College & CPR Hospital, Kolhapur-416002 Maharashtra State (India)

Phone No. 09867850167

Email: drdatta_07@yahoo.co.in

decomposition stages of a corpse. Thus, there is a fairly predictable sequence of colonization. Their rate of development and species dynamics over time can be used to accurately determine time since death. Entomological evidences after 72 hours are the most accurately determine the elapsed time since death.⁴

Major groups of insects associated with cadavers

Flies (Diptera): Blowflies, House Flies, Cheese Skippers, Flesh Flies.

Blowflies: Blowflies are an attractive blue-green, metallic colored, leading to the common English names, blue-bottles and green-bottles. They also come in a non-metallic, brown form, but all blowflies usually relatively large flies. Blowflies can pick up faint traces of the odor of decay from up to 20 km away and lay their eggs in a suitable corpse. Blow flies are one of the first insects to arrive at a cadaver – they prefer fresh and moist flesh. A particularly maggots efficiently exploit semi-liquid material of dead body.

House Flies: Adult flies are most common at corpses in the early stages of decomposition when the corpse is moist. The larvae are usually dung feeders. The most common house flies found in India are *Musca domestica* and *Musca nebulosa*.

Cheese Skipper: Cheese flies are attracted to the cheesy odors which come from a corpse during the later stages of decomposition, particularly when the body is undergoing butyric fermentation. They are also common pests of cheeses and hams.⁴

Beetles (Coleoptera): Carrion Beetles, Histerid beetles, Rove Beetles, Hide Beetles, Ham beetles, Scarab Beetles

Carrion Beetle: The beetle arrives first at a corpse soon after the body begins to putrefy. The beetles have chewing mouthparts and can manage solid foods of dead body. Several beetle types make their living out of corpses. Some of these species lay their eggs in the corpse, and the emerging larvae, which share their parent's powerful jaws, also feed on fly larvae. There are over 200 species in this family, but the ones that eat dead flesh are those that belong to the subfamily Necrophorinae.

Histerid beetles: They are among the first beetles to arrive at carrion. They generally hide under a corpse

during the daylight, and only become active at night when they enter the maggot-infested part of the corpse to capture and devour maggots. The adults feed on both the larvae and pupae of all species of blowfly. The adults lay their eggs in the corpse, and the larvae feed on blowfly pupae when they emerge.

Rove Beetles: They eat the fauna residing on and in a corpse. Adults are early visitors to a corpse and they feed on larvae and eggs of all species of fly, including predatory fly larvae. They lay their eggs in the corpse, and the emerging larvae are also predator.

Hide Beetles: They are late-arriving species tend to be specialist scavengers which feed on tougher parts like skin and tendons as the body dries out. The dominant late stage scavengers include the larvae of hide beetles.

Ham beetles: They are elongate beetles that often have a metallic sheen or are colored red or yellow. Both the larvae and the adults are predatory, feeding on other insects. The Ham beetle is also common in the later stages of decomposition of a corpse. The larvae feed on dried fat and pupate inside the empty pupal cases of flies.

Scarab Beetles: Like the ham beetle, scarab beetles arrive when the body is completely dry.⁴

Insect life cycle and medico legal aspects

Flies and beetles have four (Egg, Larva, Pupa and Adult) distinct life stages and are associated with specific stages of cadaver decomposition.

Adult flies lay eggs on the cadaver especially at wound areas or around the openings in the body such as the nose, eyes, ears, anus, etc. Eggs hatch into larva (maggot) in 12-24 hours. Larva grows and molt into various stages. 1st stage measures about 5 mm long and lasts for 1.8 days, 2nd stage measures 10 mm long and lasts for 2.5 days and 3rd stage lasts for 4-5 days and measures about 14-16 mm. long. While 4th stage larva measures about 17 mm and develop into pupa and descend down in soil for further development. After 8 days Adult fly emerge from pupal case.

Beetles lay eggs either singly or in clusters on cadaver decomposition. Larvae feed voraciously on cadaver or fly larvae. All beetle larvae go through several instars. In many species the larvae simply

increase in size with each successive instar as more food is consumed. Beetle larvae pupate, and from this pupa emerges a fully formed, sexually mature adult beetle, or imago. Adults have an extremely variable lifespan, from weeks to years, depending on the species.⁹

Applications of forensic Entomology

Insect developmental stages tells more regarding

1. Post mortem interval
2. Place of death
3. Whether the body was moved after death
4. Presence and position of wound sites
5. Detection of toxins or drugs through analysis of insect larvae
6. Association of suspects with the death scene
7. Length of time of abuse or neglect in living victims.^{1,2,4,6}

Role of autopsy surgeon

For autopsy examination of decomposed body, autopsy surgeon should collect the necessary samples of maggots and related other samples. Insects can be collected from corpse or their surrounding in three groups namely maggots, insects from soil and other insects

1. **Maggots:** Maggots are immersed and killed in very hot (almost boiling) water and transferred to preservative (solution of acetic alcohol that is 3 parts 70% alcohol and 1 part glacial acetic acid). Killing of maggots in hot water over immediate immersion in preservative have advantages. Rearing of maggots can be done on some meat or liver and reared to adult stage. All containers carrying live specimen must be perforated for gaseous exchange.
2. **Soil insects:** The soil samples should be collected in specimen bags from which insects can later be extracted in the laboratory. Soil should not be compacted.

3. **Other insects:** Other insects are collected by insect net for comparison.^{4,9}

Challenges in Forensic Entomology

1. **Temperature:** Temperature affect rate of maggot development in different species. Hence, need temperature data to get a precise idea of insect development. Flies lay eggs at a particular temperature and in the dark also.
2. **Variations in larval development:** Insects from the same species but different localities develop at different rate.
3. **Season:** Forensic entomology is only valuable during certain times of the year, when insects are present.
4. **Exclusion of Insects:** Freezing, burying or wrapping a body can prevent insects from colonizing it.
5. **Myiasis:** Invasion of living tissues by maggots will create uncertainty in estimation of time since death.^{4,9}

Acknowledgment: Nil

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Nil

REFERENCES

1. Sathe T.V, Sathe Asawari, Sathe NT. Diversity of dipterous forensic insect from western Maharashtra, India. *Int J Pharm Bio Sci* 2013;4(2):173-89.
2. Bergeret M. Infanticide, momification ducadaver. *Decouverte du cadaver dum enfant nouveau-ne dans une dheminee ou il setait mopal l'mifie. Determination de l'epoque de la naissance par la prescence et pal l'etude de leurs metamorphoses.* 1855.
3. Megnin J.P. *La faune des cadues: application de l'entomologie a la medicine legale.* Masson et Ganthiers-Villars, Paris. 1894:214.

4. Dorothy E. Gennard. Forensic Entomology- An introduction. John Wiley & Sons Ltd 2007:1-199.
5. Arutjunov, A.M. Sud Med Ekspert. 1963;6:51-52.
6. Nuorteva P. Age determination of a blood stain in a decaying shirt by entomological means. Forensic Sci 1974;3:89-94
7. Nuorteva P. Sarcosaprophagous insect as forensic indicators. In forensic Medicine, ed. C.G. Tedeschi, W.G. Eckert, and L.G. Tedeschi. 1977:1072-1095.
8. Sathe T.V, M.R. Awate. Crickets and household pests. Daya Publishing House. 2009:1-179.
9. Leclercq M. entomological parasitology. The relation between entomology and the medical sciences. Oxford, pergamon. 1969:159.
10. Amendt J. Roman Krettek and R. Zehuer. Forensic Entomology. Natuewissenschaften. 2004;91:5165.
11. Sukontason et al. forensic entomology cases in Thailand: a review of cases from 2000 to 2006. Parasitol. Res. 2007;101:1417-1423.

Autopsy Study of Unnatural Deaths among Young People of 13-21 Years Age Group Conducted at KIMS Hospital, Bengaluru

C Ramesh¹, Hanumantha², Ananda K³, Devidas Tondare⁴

¹Assistant Professor, Department of Forensic Medicine, Kempegowda Institute of Medical Sciences (KIMS) Bengaluru,

²Assistant Professor, Department of Forensic Medicine, ESIC PGIMSR & Medical College, K K Nagar,

Chennai,³Professor and Head, Department of Forensic Medicine, Kempegowda Institute of Medical Sciences (KIMS)

Bengaluru, ⁴Associate Professor, Department of Community Medicine, ESIC PGIMSR & Medical College,

K K Nagar, Chennai

ABSTRACT

Unnatural deaths are the leading killer of today's younger generation, as the patterns have changed from infections towards social etiologies during the last decades. This particular section of the society is very much vulnerable due to tough competition in every field. There is limited data on young people mortality particularly from developing countries, which is much needed for designing schemes directing towards healthy development and preventing unnatural deaths. Descriptive study of unnatural deaths of young people of the age group 13-21 years was conducted for 2 years from June 2009 to May 2011. Total 114 (14.2%) cases of unnatural deaths were autopsied of this age group. 20 (17.5%) were in the age group of 13-15 years, 33 (30%) 16-18 years and 61(53.5%) 19-21 years. 55 (48.2%) were males and 59 (51.8%) were females. Maximum victims were from social class III i.e., 51 cases. 91(79.8%) were intentional and 23 (20.2%) were unintentional. Hanging is preferred method used to commit suicide with 68 (76.4%) out of 89 suicidal cases, followed by 10 (11.2%) of poisoning, 7 (7.9%) of burns and 4 (4.5%) of fall from height. Major cause for suicide was Insanity /Mental illness 28 cases (31.5%), 25 (28.1%) were due to family problems. Out of 23 unintentional deaths 18 (78.3%) were due to road traffic accidents. Majority deaths occurred among the age group of 18 to 21 yrs as this age group is facing more psychological stress related problems. Female outnumbered male due to lack of support from family and society. Road traffic accidents are major cause for unintentional deaths among young males.

Keywords: Unnatural Deaths, Young People, Suicide, Road Traffic Accidents

INTRODUCTION

A significant number of young people die each year due to unnatural causes. Unnatural deaths are the leading killer of today's young generation¹, as the patterns have changed from infections towards social etiologies during the last decades. The unnatural

deaths may be due to unintentional or intentional injuries. Unintentional injuries are mainly accidents and homicides. Intentional injuries are mainly suicides. Road traffic accidents and poisoning are a major problem all over the world. The last quarter of the century has seen tremendous advances in the fields of agriculture, industrial technologies and medical pharmacology. These advances have been paralleled with remarkable changes in the trends of acute poisoning in developing countries, including India². The burn fatalities are not just related with accidents but also become a social calamity in India³. The prevailing system of dowry, is a product of emerging capitalist ethos - the offshoot of an unequal society, a

Corresponding author:

Hanumantha

Assistant Professor,

Department of Forensic Medicine, ESIC PGIMSR & Medical College, K K Nagar, Chennai-78

Cell no.9489885901

e-mail:ananthappu@yahoo.com

result of rampant consumerism, aided and abetted by the black market economy. Its increasing incidence is symbolic of continuing erosion and devaluation of women's status in independent India.⁴ The other means of unnatural deaths - include hanging, drowning, jumping from height, etc for suicidal purposes. This is so because methods used by individuals bent on self-destruction depend upon the availability of the lethal instruments.⁵ Snake bites, electrocution, anaphylactic deaths, etc categorized under "others" constitute a substantial number of unnatural deaths in this part of the world because of the lack of infrastructural facilities for timely management of such patients. Undiagnosed and sudden deaths are registered to be under suspicious circumstances and inquest proceedings initiated by the police, only to find on postmortem examination, that in most of such cases a disease process was responsible for the death. Crime rate in a community is directly linked with the rate of poverty and illiteracy.⁶ India is passing through a major socio-demographic, epidemiological, and technological and media transition. In the past two decades, India has witnessed rapid urbanization, motorization, industrialization and migration of people resulting from socioeconomic growth and development. Many cultural and socio-economic factors of a country are usually related to the causation of unnatural deaths. The aim of this study is to investigate young deaths due to unnatural cause in the city of Bangalore. Unintentional injury and suicides are leading causes of death among youngsters and reducing this is an important health priority as the people of this age are characterized by hope, drive and ambition. This particular section of the society is very much needed for the building the nation in future. There is limited data on young people mortality particularly from developing countries with unreliable death registration systems. This calls for the use of other sources of data to ascertain cause of teenager and adolescent mortality. Police investigation records provide a valuable source of information on the events leading up to the death of an individual, and analysis of these records along with postmortem analysis may help us understanding of the causal pathway, elucidate potential areas for intervention and socio-political system to investigate and develop preventive measures.

AIMS AND OBJECTIVES

1. To study the incidence of unnatural deaths in age group 13 to 21 years.
2. To assess the type of unnatural death, age, sex, diurnal variations and socioeconomic status among these victims.

METHODOLOGY SOURCE OF DATA

Department of Forensic Medicine, KIMS Hospital and Research Centre, Bengaluru is a post graduate Institute which conducts autopsies of sudden, suspicious, unnatural deaths which occur in and around south Bangalore. The present study is a descriptive study of unnatural death cases which was autopsied at KIMS hospital, Bengaluru for a period of 2 years from June 2009 to May 2011 which form the material of the study.

METHOD OF COLLECTION OF DATA

All unnatural death cases of the age group 13 to 21 years autopsied at Kempegowda Institute of Medical Sciences and Research Centre, Bengaluru were included in the study.

Relevant autopsy findings related to each of these cases were taken for analysis. Further the details of clinical data of the victim including the investigations and procedure done, survival period, time and cause of death were ascertained from hospital records. Information pertaining to the time and manner of death was sought from the police personnel investigating the case. Some of the particulars like reasons for the death were also obtained from relatives, friends and others. The various epidemiological factors involved such as age, sex, socioeconomic status and others were noted down. These were then correlated with the post-mortem findings to conclude the analysis of each case.

Inclusion Criteria

All autopsied cases of unnatural deaths in the age group of 13 to 21 years.

Exclusion Criteria

- Decomposed dead bodies of the age group 13 to 21 years.
- Unknown dead bodies where exact age is not clearly established.

RESULTS AND DISCUSSION**Table 1: Incidence Unnatural Deaths**

Incidence	No.	Percent
Natural Deaths	114	12.4
Unnatural Deaths	804	87.6
Total*	918	100.0

*Postmortems Conducted During Study Period

During two years of study period 918 cases were autopsied out of which 804 (87.6%) cases were unnatural deaths and only 114 (12.4%) cases were natural deaths.

As per the National Crime Records Bureau (NCRB) report of 2001 total 2,710,019 accidental deaths, 108,506 suicidal deaths and 44,394 violence-related deaths were reported in India.⁷ During the year 2009 in Bangalore 2466 people died due to unintentional injuries and 2314 people died due to intentional injuries.⁸

Table 2: Incidence Of Unnatural Deaths Of Age Group 13-21 Years

Incidence	No.	Percent
Unnatural Deaths among Young	114	14.2
Total	804	100.0

Out of 804 unnatural deaths 114 (14.2%) cases were from the age group of 13-21 years which were autopsied at above centre in study period. This shows significant numbers of young people are becoming victim of unnatural death.

Table 3: Distribution Of Victims According Age And Sex

Age (yrs)	Male		Female		Total	
	No.	Percentage	No.	Percentage	No.	Percentage
13-15	7	12.7	13	22.0	20	17.5
16-18	11	20.0	22	37.3	33	30.0
19-21	37	67.3	24	40.7	61	53.5
Total	55	100.0	59	100.0	114	100.0

Table shows the distribution of victims according to age and sex. In this most common affected age group is 19 to 21 years (53.5%) cases and females outnumbered males. Out 114 cases 59 (51.8%) are females and 55 (48.2%) are males.

Table 4: Socio Economic Status (B. G. Prasad Classification)

Social Class	No. of cases	Percentage
I	12	10%
II	21	18%
III	51	45%
IV	20	18%
V	10	9%
Total	114	100

Majority of the victims 51 (45%) were from social class III. Socioeconomic classification gives the background of victim which is important in day to day struggle of life.

Table 5: Methods Employed To Commit Suicide

Method	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
Hanging	28	82.4	40	72.7	68	76.4
Poisoning	3	8.8	7	12.7	10	11.2
Burns	1	2.9	6	10.9	7	7.9
Jumping from height	2	5.9	2	3.6	4	4.5
Total	34	100.0	55	100.0	89	100.0

Suicide is most common in unnatural deaths and most common method used to commit suicides is by hanging, in this study majority of participants 68 (76.4%) used this method by readily available ligature material. According to various studies method of suicide is dictated by what is convenient and readily available, though the acceptance of various suicide methods can change over time.⁹

Table 6: Causes For Suicide

Causes for suicide	No.	Percent
Love affair	9	10.1
Failure in examination	9	10.1
Insanity/ Mental illness/ Depression	28	31.5
Family problems	25	28.1
Illness	14	15.7
Intentional excessive consumption of drugs	1	1.1
Dowry related	3	3.4
Total	89	100.0

Most common cause for committing suicide was insanity/mental illness with 28 (31.5%) cases was reported with this cause. Next cause is family problems.

The suicide rate among teenage and pre-teen children ages 10 to 14 was 1.3/100,000 or 272 deaths among 20,910,440 children in this age group. Four out of five teenage people who try to kill themselves gave clear signals of their intent.¹⁰ While females attempt suicide more often than males, at a rate of 4:1, males “succeed” more often, at the same rate.¹¹

According to NCRB the student suicides are increased by 26% in the last 5 years (from 2006 to 2010).¹²

Since the origin of the mankind in this world, poisoning always remained associated with it; though it was mostly accidental in nature in the earlier times.¹³ In spite of advanced medical treatment and awareness, the fatal outcome from exposure (inhalation, skin contacts and ingestion) to the chemicals of agricultural and domestic use is increasing day by day.¹⁴ Easy availability, extensive use and low cost of the chemicals, all make the population more vulnerable for suicidal poisoning.¹⁵

Poisoning is one of the preferred means of committing suicide among males and females in India.¹⁶ The relatively high ratio of teenage poisoning

deaths to hospital admissions and the recent increases in teenage death rates from suicide³ underscore the importance of identifying causal factors and developing preventive measures that will reduce not only the morbidity from poisoning but the fatal outcomes for several hundred teenagers each year.¹⁷ The commonly used poisons to commit suicide in India are Organophosphorus compounds, Opium, Barbiturates, Oleander, Oxalic acid, Copper sulphate, Combination of two or more. These poisons are considered as ideal suicidal poisons because it is easily available, cheap, either tasteless or agreeable taste, can easily be consumed with food, drinks, highly toxic and will be certain in action, and will cause painless death.¹⁸ Cluster suicides occur in the young and are often initiated by direct communication. As it is possible that Internet-based social sites may facilitate this phenomenon, investigations should include an evaluation of the victim’s Internet access given the potential risk of similar actions by peers.¹⁹ The method of suicide is dictated by what is convenient and readily available, though the acceptance of various suicide methods can change over time.⁹ Drowning remains a significant public health concern, as it is a major cause of disability and death, particularly in children.²⁰

Table 7: Types Of Unintentional Deaths

Unintentional Deaths	No.	Percentage
Road Traffic Accidents	18	78.3
Electric Shock	2	8.7
Drowning	3	13
Total	23	100

Out of 23 cases of unintentional deaths 18 (78.3%) cases are due to road traffic accidents. RTA is important cause of unnatural deaths particularly in country like India where traffic rules, road conditions and vehicle conditions are responsible directly or indirectly. Apart from this at personal level high risk behavior like speeding, drug abuse, inadequate training and disregard for traffic rule also contribute for unnatural deaths.

CONCLUSION

From this study it can be concluded that unnatural death trend is increasing and that to in the younger age group, which is draining major economic power by losing productive population. These deaths can be prevented if proper measures are taken at every level and it can be advised to come up with new national level health scheme to curb unnatural deaths.

Acknowledgement: Authors are thankful to Department of Forensic Medicine KIMS Bengaluru, relatives of victims and Bengaluru Police.

Conflict of Interest: Nil

Ethical Clearance: Cleared by Ethical Committee of Institution.

Source of Funding: Self (no external funding)

REFERENCES

1. Blum RW, Nelson-Mmari K: The health of young people in a global context. *J Adolesc. Health* 2004, 35(5):402-418.
2. Singh D, Jit I. Changing Trends of acute Poisoning in Chandigarh Zone. *Am J Forensic Med. Pathol.* 1999; 20 (2): 203-210.
3. Sharma BR, Naik RS, Anjankar AJ. Epidemiology of burnt females. *The Antiseptic* 1991; 88(11): 570-572.
4. Sharma BR, Harish D, Sharma V et al. Kitchen Accidents Vis-à-vis Dowry deaths. *Burns* 2002; 28 (3): 250 - 253.
5. Avis SP, Archibald JF. Asphyxial Suicide by Propane inhalation & plastic Bag suffocation. *Journal of Forensic Sciences JFSCA* 1994; 39 (1): 253-256.
6. Aryappan A and Jayadev CJ. *Society in India*; Social Science Publication; 1985.
7. National Crime Records Bureau.
8. *Injury and Violence in India: Facts and figures*; NIMHANS: 2011.
9. Shaw. Suicide in children and adolescents: A 10-Year retrospective review; *American Journal of Forensic Medicine & Pathology*; 2005 Vol.26 issue 4: pp 309-315.
10. http://www.add-adhd-help-center.com/depression/adolescent_suicide.htm.
11. Peters, Lori J. *Teenage Suicide: Identification, Intervention and Prevention. Highlights: An ERIC/CAPS Fact Sheet*; 1985.
12. *Forensic Pathology: Bernard Knight, 2nd Ed.* 1996; pg 231.
13. Gorea RK, Dalal JS, Gargi J, Rai H. Pattern of Poisoning in Punjab. *J Punjab Acad. Forensic Med Toxicol.* 2001; 1: 6-8.
14. Gupta BD and Vaghela PC. Profile of Fatal Poisoning in and around Jamnagar. *Journal of Indian Academy of Forensic Medicine.* 2005; 27(3): 145-148.
15. Unnikrishnan B, Singh B and Rajeev A. Trends of Acute Poisoning in South Karnataka. *Kathmandu Univ Med J.* 2005 Apr-Jun; 3(2):149-54.
16. Kanchan T, Meneze RG. "Suicidal poisoning in Southern India: Gender differences": *Journal of Forensic and Legal Medicine*, Volume 16, Issue 6, August 2009, Pg 365.
17. Baker SP, O'Neill B, Karpf RS: *The Injury Fact Book.* Lexington, MA: Lexington Books, 1984.
18. Karmakar. *Text book of Forensic Medicine and Toxicology*, 2010; pg 234.
19. Meel BL. A study on the incidence of suicide by hanging in the sub-region of Transkei: *Journal of Clinical Forensic Medicine* (2003); Volume: 10, Issue: 3, Pages: 153-157.
20. Wirthwin DP, Barnard JJ, Prahlow JA; Suicide by drawing; 20- year review. *Journal of Forensic Science* 2012 Jan; 47 (1): 131-6.

Analysis of Tissue Samples from Unknown to Known

V Dekal¹, J Magendran¹, N Srinivasa Ragavan²

¹Associate Professor, ²Professor, Department of Forensic Medicine, Saveetha medical College, Thandalam, Chennai, India

ABSTRACT

Death due to poisoning accounts to a large number of fatalities throughout the world and India.

Irrespective of the mode of exposure of a poison, the confirmation of the cause of death is always by subjecting the viscera and blood for chemical analysis. The methods of analysis will be selected on the view of Drugs involved, Resources available and Standard of proof acceptable by the prosecution. Each laboratory would have formulated a protocol for the analysis of tissue specimens, based on the incidences of poisonings in the region. The forensic science laboratory of Bangalore has got a scheme for detection of poisons based on various studies.

When certain compounds are suggested by the history or clinical findings, simple tests like colour tests may be performed. However, in the absence of clinical or other evidences to indicate the poisons involved a defined series of tests is needed. In the analysis of an unknown poison, various steps are involved and tests are performed sequentially. The importance of better communication between the analytical toxicologist, clinician, autopsy surgeon is emphasized in this paper as well.

Keywords: Analytical Toxicology, Unknown Poison, Detection Methods, Procedures Involved

INTRODUCTION

Death due to poisoning accounts to a large number of fatalities throughout the world and India is not an exception to it. Cases of acute pesticide poisoning (APP) account for significant morbidity and mortality worldwide, especially in developing countries.^{1,2} The percentage of deaths due to poisoning would be much higher in India, compared to the global average. According to WHO (1999)³ more than three million poisoning cases with 251,881 deaths occur worldwide annually, of which, 99% of fatal poisonings occur in developing countries, particularly among agricultural workers. Poisoning in children is usually accidental and suicide by poisons is more common in people of age above 15 years⁴.

Irrespective of the mode of exposure of a poison (accidental / occupational, suicidal or homicidal) many toxic substances do not leave any specific postmortem findings. The confirmation of the cause of death is always by subjecting the viscera and blood for chemical analysis. Almost all the cases of death due to poisoning are medico-legal cases and the proof of death due to a particular poison is accepted by the law enforcing agencies only by a positive chemical analysis report.

There are various methods available in the analysis of poisons and drugs with varying sensitivity and specificity. The particular method applied on a sample will be chosen based on many criteria. Owing to the large number of poisons available in medicolegal practice, the methods of analysis will be selected on the view of Drugs involved, Resources available and Standard of proof acceptable by the prosecution.

In this practice, more complicated and highly sensitive techniques have limited application owing to availability of resources, high cost and non-availability of technical expertise and hence are restricted to only those toxins where the routine

Corresponding author:

V Dekal

Assistant Professor

Department of Forensic medicine

Saveetha Medical College, Thandalam,

Chennai, India

Tel: +91-9940376579 (M)

E. mail - drdekal@gmail.com

methods fail to detect a poison or when the quantity of the poison is very low in the organic material making identification difficult.

Each laboratory would have formulated a protocol for the analysis of tissue specimens, based on the incidences of poisonings in the region. The forensic science laboratory of Bangalore has got a scheme for detection of poisons based on various studies.

The objectives of this paper are

1. To highlight the basic steps involved in unknown poisons detection for medical officers
2. To discuss importance of the clinical findings and postmortem findings in screening procedures of unknown poison samples.
3. Precautions to be taken by the doctors while forwarding the samples to forensic science laboratory.

MATERIALS & METHOD

The study was carried out in the central forensic science laboratory, Bangalore from January to April 2006. The steps involved in the processing and determination of any unknown poisons are discussed & monitored. There was a detailed interaction between the analytical toxicologists & various staffs done. Standard methods involved in the qualitative and quantitative analysis of different group of poisons were studied.

Procedure of analysis

In the analysis of a poison, the following details are essential in selecting a particular a group of tests.

1. History
2. Information furnished by the police and relatives
3. Postmortem findings
4. Nature of the poisons available in a particular area, and
5. Access of the person to the poison.

The basic steps involved in the poison detection from the given sample are

1. Extraction of the active principle
2. Stripling or purification of the toxic substances and its metabolites

3. Identification or rapid screening
4. Confirmation of the identity
5. Quantitative assay

When certain compounds are suggested by the history or clinical findings, simple tests like colour tests may be performed. However, in the absence of clinical or other evidences to indicate the poisons involved a defined series of tests is needed.

Generally unknown Poisons are gases, volatile compound, drug, metals, pesticide or anion. Hence, three entirely different analytical techniques are performed⁵

1. Color test
2. Chromatography
3. Spectroscopy

Extraction of the active principle

A simple direct solvent extraction scheme is generally employed to eliminate endogenous substances which might reduce the efficacy of the system.

Isolation and purification of poison

This process is vital to purify the toxic substance from other metabolites. For the purpose of chemical analysis poison are grouped, according to the methods used for the isolation of a group substance from the tissues.

Table 1. Isolation methods for different poison groups

Group	Isolation method
Noxious gases	Diffusion and distillation
Volatile poisons (organic/inorganic)	Stem distillation from ether in an acidic or basic medium
Non volatile metallic poisons	Dry ashing process (450 degree C),Wet digestion process
Non volatile organic poisons	Solvent extraction under ether
Toxic anions	Dialysis
Miscellaneous	Special extraction techniques likelon exchange columns,Freeze drying andContinuous extraction with a polar solvent

Identification or rapid screening

Screening tests are carried out presumptively to identify the poison or the group to which it belongs to. These tests usually have more sensitivity. A broad spectrum screening capable of diagnosing or

eliminating most of the poisons in a group usually requires a combination of three or more different analytical techniques.

In the process of rapid screening, first group tests are done to find out which group of substances the poison belong to, followed by specific tests.

Group tests

Volatile compounds, drugs, metals and pesticides.

Specific tests

Gases, anions and miscellaneous poisons. For screening a “general unknown” poison, intuitive considerations or “guess work” nearly always predominate.

It is common to commence with drug screen (confined to soluble drugs) if the onset of symptoms was less than one hour. If no information regarding the poison is available, then samples are tested for gases and volatiles first. If the patient dies after several days of hospitalization then metallic poisons, poisons having cumulative effect and some fat soluble substances can only be detected. If severe vomiting and diarrhea were present, then heavy metals are tested first. Many a times, factors such as age, occupation and the place of incident are the guiding tools for the analytical toxicologist to decide the first choice of testing. Some poisons are so common to such an extent that they should always be tested or ruled out in the first place. Example (alcohol)

Procedure of Detection of a plant poison

Extraction is carried out in automated solvent extractor (DIONEX) using chloroform as solvent at room temperature, 1500 psi solvent pressure.

Clean up procedure

To remove the fat the extract is passed through a column containing Florisil / silica gel and anhydrous sodium sulfate. Extracts evaporated to dryness under vacuum and minimal volume of methanol added. The confirmation is done by colour tests and UV spectrometry.

Many of these common poisons can be checked by rapid analytical probing tests before a full screen method is adopted.

Procedures adopted for confirmation of identity and estimation

Colour tests are indispensable in the initial stages of analysis. The merit of doing colour tests is that it can be applied to a sample directly without any need for isolation and purification.

Rapid screening tests (color tests) are done to identify the individual poison, which can be confirmed by specific tests such as UV Spectrometry, Gas chromatography and Mass spectrometry.

Table 2. Screening and confirmatory tests for different poisons groups

Poisons	Tests
Volatile compounds	Screening tests: Colour test Confirmatory tests: UV Spectrometry GC, MS, and GC-MS
Non volatile organic compounds	Screening: TLC Confirmatory: HPTLC, HPLC
Non volatile metallic compounds	Confirmatory: EDXRF [Energy Dispersive X-ray Fluorescence] ICP [Inductive Coupled Plasma Spectrometry]
Drug and pesticides	Confirmatory: Mass spectrometry GC or HPLC

DISCUSSION

It is not practically possible to test for every poison, due to limitations like time, work load, man power and size of the specimen. The information furnished by the police and the relatives and the Post Mortem findings are the only guide lines that helps the toxicologist to start their proceedings in search of a poison.

The toxicologists mainly rely on Clinical & PM findings as they are scientifically acceptable and can stand the test of judicial scrutiny.

As the list of poisons and drugs is vast and ever increasing, in any circumstance it is not possible to test for each and every poison, especially when the nature of the poison is unknown. In current scenario, there is a wide communication deficit between the forensics experts and the analytical toxicologists. Hence for effective management and handling of cases of unknown poison it is always preferable to have periodical and regular interaction between the various stakeholders like the clinicians, autopsy surgeons and the analytical toxicologist.

No specific post mortem findings could be elicited in many of the common poisons but it could give a clue to the group of poison to which the toxic substance belongs to. Hence, the medical officer conducting the post mortem examination must in all circumstances express his idea / opinion regarding the possible

poison which is suspected to be involved in that particular case, which will definitely help the toxicologist to test for that toxic substance first.

CONCLUSION

To conclude, I wish to highlight yet another aspect in the sample storage and forwarding of tissue samples by the medical officers for chemical analysis. During the period of time when I was with the analytical toxicologists at CFSL, Bangalore to study and understand their design protocol of testing a sample of unknown poison, they requested me to express their views in sending samples for analysis.

- 1) Any particulate matter present in the stomach during autopsy should be isolated and sent to the FSL separately labeled "stomach contents" without preservatives. Toxicologists by their knowledge may easily suspect or exclude a particular poison and proceed with the analysis.
- 2) Preserve water soluble compounds in alcohol.
- 3) Try to collect or arrange to send the stomach wash contents to FSL, especially if the patient dies after prolonged hospitalization.
- 4) Quantization is done only on blood and hence preservation of blood is very important (sufficient sample with appropriate preservative in right quantity)
- 5) The post mortem doctor should make an attempt to identify the nature of the poison on the basis of postmortem findings as observed by him and it should always be mentioned in the PM report.

Ethical Clearance: Nil, as the study does not involve any human participation.

ACKNOWLEDGEMENT

- My sincere thanks to the Director, Central Forensic Science laboratory, Bangalore &
- Dr. Anandha, Professor, Kempagowda Institute Of Medical Sciences, Bangalore

Conflict of Interest: Nil

Source of Funding: Nil

REFERENCES

1. Kishi M, Ladou J. International pesticide use. *Int J Occup Environ Health* 2001; 7: 259-65.
2. Jeyaratnam J. Acute pesticide poisoning: a major global health problem. *World Health Stat Q* 1990; 43: 139-44.
3. World Health Organisation. Guidelines for poison control. *Bulletin* 1999; Geneva, World Health Org.
4. Taft C et al. Childhood unintentional injury worldwide: meeting the challenge. Washington, DC, Safekids Worldwide, 2002 (<http://www.safekids.org/pdf/WWStudy-Ltr.pdf>, accessed 6 April 2008).
5. Basic analytical toxicology. RJ Flanagan - 1995 Geneva, World Health Org.

Desperate Need of Modernized Mortuaries in Hospitals of India

Shilekh Mittal

Assistant Professor, Department of Forensic Medicine, GGS Medical College, Faridkot

ABSTRACT

In majority of the Mortuaries there are no proper rooms for basic necessities and staff. Some of the mortuaries have attained the status of historical monument, which have no caretaker and present a deserted look. At many places, the mortuaries are in the dirtiest corner and neglected part of the hospital. Facilities for autopsy like dissection table, instruments, and water supply, lighting and sterilization facilities are lacking at many places and if present, are in worst and rusted condition, in spite of the guidelines of Medical Council of India and judiciary. In this paper, some problems are highlighted and their planned solutions for modernized mortuaries are discussed.

Keywords: Modernized Mortuaries, Hospitals, Judiciary, Police

INTRODUCTION

Presently, mortuaries dispel the sense of dislike, fear and hatred prevailing in majority of the so-called postmortem buildings in major part of the country. The mortuary is the most neglected, ignored place in all hospitals including medical colleges and is generally located in a far-off isolated corner of the hospital with Stone Age facilities for body preservation and autopsy. From the overall expenditure of any hospital, a very minute share is spent on the autopsy facility; it being considered an unnecessary evil & the overall environment in a mortuary is depressing and gloomy. This situation is further compounded by administrative apathy towards medico-legal work as a whole. Working in a mortuary is extremely stressful experience, which is made worse in India due to the large number of people dying sudden violent deaths and the pitiable conditions of mortuaries throughout the country. New concepts regarding mortuaries include the need for a total change in the way the dead bodies are being managed as well as changed working conditions for the staff working in mortuaries. Facilities for safe custody of dead bodies before and after post-mortem are to be provided accordingly. The concept of health of the population from "womb to tomb" in the community health care clearly indicates that, a doctor's duty is not only caring for the living but also in helping to arrange for the disposal of those patients who die, to keep unclaimed bodies until

disposal or identification by relatives, police and other people. To receive dead bodies brought to the hospital for medico legal post-mortem work and store in the mortuary pending further disposal and for teaching the undergraduates as well as post-graduates.

The services provided by a Forensic facility, i.e. comprehensive morgue and postmortem comprising: - Specimen handling area, Administrative functions (documentation of incoming or outgoing bodies report preparation), preparation and temporary storage of cadavers. Determining the cause of death, by performing post mortem examination on the dead body. The demonstration of post mortem findings in cases of clinical interest, for teaching or forensic purposes, mobile radiography, photography, family/polic viewing and/or identification of the body.

Recommendations as Per Various Govt. Organizations and Judiciary

According to Bureau of Police Research & Development sub-committee report 1975, no teaching hospital should have more than 500 autopsies in a year, otherwise teaching activities suffer. In criminal case no. 214 DB of 1997, Justice Amar Dutt & Justice Kiran Anand Lall (Punjab and Haryana High Court) on 23.10.2005 have passed orders for ways and means to facilitate better conduction of post-mortems plus medico legal work. The division Bench has observed

that orders be served to the States of Punjab and Haryana and Union Territory of Chandigarh. The court has also observed, "It may be appropriate if the concerned state communicates the steps taken by it to the sister States so that they do not lag behind."

The Sub-Committee Report (Bureau of Police Research and Development of 1975) laid down the staffing pattern and this has been accepted in principle by the government.

(A) For initial 100 autopsies per year

- Specialists: Two (as one specialist is likely to be busy in other important work, teaching work, in court attendance, or if he falls sick, it is necessary to have two specialists).
- Post mortem technician: One.
- Post Mortem Assistant: One.
- Clerk/Steno: One.
- Chowkidar: One.
- Peon: One
- Sweeper/Morgue attendants: [4] (Three sweepers for shift duty round the clock and one as a reliever).

(B) For every additional 100 autopsies per year, following additional staff is required

- Specialist: One.
- Post mortem assistant: One.
- Technician: One (for teaching institutions).
- Technical assistant: (300-500 Autopsies/yr): One, (>500 autopsies / yr): Two.
- Photographer: One.
- Dark Room Attendant: One (on big centers, personnel for photographic work)

The Sub-Committee noted that in teaching institutions, teaching staff prescribed by the Medical Council of India should not be counted while assessing the total number of staff required as they will be busy in discharging their administrative, teaching and research guidance work.

Minimum Facilities Needed Arrangements for receiving the dead bodies from the hospital or from outside, with separate arrangements for keeping

decomposed and infectious bodies (known HIV/ hepatitis death cases) etc. Arrangements for performing autopsies, handing over the dead bodies after postmortem examination to the relatives/ undertakers through police, postmortem viewing gallery for the students /IO /nominees as per court orders etc. Other basic essential requirements like offices and related rooms should have basic facilities like furniture, telephone and other infrastructures.

The design of the teaching mortuary was prepared keeping in view the intake of students in medical college, workload, condition of the various bodies being brought for postmortem examination and to have workable atmosphere as to cleanliness & breathing with fresh air and natural light to be available in each room of the mortuary. It should have adequate parking space. It should be preferably centrally air conditioned.

The mortuary should be located in a separate building near the pathology laboratory on the ground floor, easily accessible from the wards, accident and emergency departments and operation theatres, in an area with ample natural light through windows; the windows of the principal rooms should preferably be on the northern side. It should be located in one wing of the hospital near the main road, preferably away from major traffic junctions. It must have a separate entrance and exist for relatives.

Proposed Plan For A Mortuary Complex at Tertiary Level Hospitals

1. Veranda should be in front of the faculty office, autopsy surgeon room in which these should open and working windows for the reception room on both sides.
2. Faculty office with an attached toilet.
3. Autopsy surgeon's room (size 14x20 sq. ft.): where the Autopsy surgeon /medical officer can discuss details of the case with police and relatives and write reports peacefully without any disturbance.
4. Computer Room & Office (12x10 sq. ft): with furniture, computer, printer cum scanner, photography instruments.
5. Stores-1 (12x10 sq. ft) for clean gowns, aprons, rubber gloves, gumboots, towels etc.
6. Reception and waiting area (Size 240 sq. ft.). It should be easily approachable and due care should

be taken to shield it from OPD/ward block. This area should be gently illuminated, warm and have comfortable chairs. It should be pleasantly and soberly furnished and decorated with plants and pictures, which would create a pleasant atmosphere, as the last impression of the relatives receiving the deceased is one of quiet dignity in death. This area can also be used as prayer area where relatives and friends of all religion may like to offer prayer. A lavatory also must be provided. Waiting hall for attendants, police with provisions for a central platform.

7. Investigating officer /Police Room (10x10 sq. ft.) for the police personnel accompanying the body who has to watch and take care of the dead bodies in the mortuary complex. Veranda/shade for trolley etc.
8. Class IV Rooms (8x10 sq. ft.); it has lockers etc. and used as changing place for them. Toilet for staff. Walled enclosure with gate.
9. Pre autopsy room (16x20sq. ft) the number of bodies to be accommodated will be taken as three percent of the hospital beds. Body racks should be refrigerated, with a temperature maintained between 4-6.5°C. Body in the mortuary should be kept with complete identity
10. A/c plant room, where more than twelve bodies are to be stored, a separate plant room 25-30 sq. ft. may be required, immediately adjacent to the body storeroom. Access for maintenance should be arranged externally so that unnecessary entrants are stopped.
11. Post Autopsy Room (14x18 sq. ft.): should have a central platform (4x8 sq. ft.) for handing over the body to the investigating officer who subsequently handover the body to the relatives for final disposal after completion of the post-mortem examination.
12. Teaching autopsy room of the size should be at least 400 Sq. Meters or more. This room, like an operation theatre must be kept clean to protect the doctors & staff from bacterial contamination. It should have at least two mortuary tables of stainless steel with arrangements for free drainage of a constant flow of water (hot and natural) from top to bottom. A proper vent and duct system for exit of foul smelling gases and entry of fresh air. Room should have mortuary work station. There should have big windows up to the level of roof with glasses facing the east, south and west, so that the maximum sun light may remain in the rooms. Fluorescent lighting/good concentrated lighting over tables with at least one having tilting mechanism.
13. There should be large charts depicting weights and measurements of viscera, bones etc. for quick reference. There should be X-ray view boxes for seeing x-ray film etc. Portable x-ray machine should be available. Built in cupboards for keeping instruments and equipments. Water-impervious floors sloping to a drain. Laminated walls so that the whole room can be easily washed. Suitably covered junctions between the walls and floors. Two sinks for clean and dirty work separately. Writing desk and chairs, shelves for jars (and tanks under) for disposing the specimens immediate.
14. Trolleys for shifting dead bodies and sufficient furniture. Testing table, accommodating scales, gas, and light with blackboard on behind wall, fans if the room is not air conditioned. The viewing gallery for the students shall be constructed around the autopsy tables depending upon their strength in teaching autopsy rooms. Staired benches at the sides of the room for observers to visualize and avoid interference. The doors should be fly proof.
15. Laboratory Facilities: - Biochemistry and Microbiology laboratories should be present inside the mortuary complex preferably near the teaching autopsy room. Tests for infectious diseases should be must before every autopsy. Chemical examination laboratory for quick examination of blood, viscera and urine is very useful.
16. Space for open mortuary /maceration tanks/open research lab; (with roof covered with net) for the decomposed bodies and other ancillary work. This space should be all around both the teaching autopsy rooms so that public cannot have an access to the ongoing postmortem.
17. Instrument Room (8x10 sq. ft.): instrument cleaning room to be provided for the thorough cleansing of all numbered instruments / equipments in the autopsy room.
18. Viscera Preparation Room (12x10 sq. ft.) where the technician / mortuary attendant can do the assigned job under the supervision of the medical officer.

19. Stores-II (12x10 sq. ft.) for reserve stocks and chemical solutions for preserving the viscera and packing materials etc.

20. Officer's toilet; (8x12 sq. Ft.) One separate male and female W.C. lavatory, basin and a shower cubical are needed.

21. Doctors changing room: there must be two changing rooms (12x10 sq. ft. each) having bath with shower for autopsy surgeons and with lockers for male and female officers.

22. Green belt: this is required to make mortuary complex eco-friendly.

Corridors & Verandas' all around: these will help not only in free movement of the functioning officials in the premises of mortuary, but also in cases of emergency of handling of mass disaster cases and will provide more space for decomposed gases to spread and exit.

23. Main Gate; preferably it should be sliding type.

24. Open space for parking for vehicles bringing and carrying the dead bodies.

25. Miscellaneous Requirements

a) Floors: should be hard and durable, moisture resistant and can be easily cleaned. Floor ducts and trenches should be avoided. The junctions between the walls and floors should be suitably covered.

b) Walls: the walls of the mortuary should be thick, durable and permanent. The walls should be fitted with pale blue color tiles up to the ceiling so that natural colors of the dead body can be appreciate as in day light.

c) All doors in the mortuary complex should be wide sliding type and fly proof.

d) Windows: the mortuary should have sufficient natural light. The windows should be preferably on the east, south and west sides, whenever possible for receiving maximum sunlight. They should have glass. Windows slits should be at least 5 ft. above the floor and go up to near the ceiling.

e) Corridors: the corridors of the mortuary limit should be wide to allow passage of trolleys. (Not less than 8 ft.)

f) Air conditioning: the entire complex should be air

conditioned with a separate system for the autopsy rooms to prevent foul air permeating the rest of the area. No air should be re-circulated in the mortuary in order to ensure a clean air environment.

g) Proper disposal of waste: the mortuary complex should have all the arrangements for disposal of different types of waste products. Cleanliness and sanitation in and around the mortuary should be maintained properly.

h) Measurements of the space may be adjusted depending upon the requirements and workload. The mortuary complex must have different sign boards like "No Admission", "Prohibited Area" etc.

i) The light fitting should be designed to avoid glare, and should be easy to clean and maintain. In the mortuary either tungsten or florescent lighting can be used. Switches in wet area should be hose proof. Special lighting should be provided in the post-mortem room to ensure adequate illumination of post-mortem tables and dissection tables. The height of the room should be optimum preferably twenty feet.

j) Hot and cold water supply: hot and cold water be required in the sinks, wash-basins and showers. The post-mortem tables should be fitted with individual /water hoses. Water suction pumps should not be used. Floor service ducts should be avoided. All the taps in the mortuary complex should be of elbow operated type particularly in the working area.

k) Safety: the complex should be fitted with emergency lighting, fire sprinklers and smoke/thermal detector in all rooms. A fire alarm system with blue /red beacon light with hooter should be installed. Fire exit routes should be clearly identifiable, well illuminated and earmarked with bold red arrows.

l) Refrigeration: the temperature of cold rooms is to be maintained between 4°C to 6.5°C, thermostat control will be required for each cold chamber. Facilities should be provided to enable the chambers which are not in use to be switched off.

The design of the ventilation system should provide air movement which is generally from clean to less clean areas. To satisfy exhaust needs, replacement air from the outside is necessary. Number of air changes

may be reduced when the room is unoccupied if provisions are made to ensure that the number of air changes indicated is re-established any time the space is being utilized. Adjustments shall include provisions so that the direction of air movement shall remain the same when the number of air changes is reduced. Air from areas with contamination and/or odour problems shall be exhausted to the outside and not recirculated to other areas.

Conclusion and Future Advancements: Safety and security are integral components of a forensic facility. Defining public areas from secure zones to ensure the secure custody of sensitive items such as case files, evidence, and human remains is critical. The concept of a modern and ideal mortuary will protect the occupants against diseases emanating from filthy and unhealthy environment and the mortuary contents against destruction from decay of unrepaired and neglected mortuary buildings. Tele-medicine facilities can be envisaged in the modern mortuary complex using large training areas and various meeting rooms with video conferencing capability

CT, MRI, and digital x-ray technology should be an integral component available to the mortuary staff – to limit invasive procedures for operational or religious reasons. An ideal mortuary will undoubtedly contribute to the advancement and evolution of forensic science and medicine, strengthening the relationship between service, teaching, and research. The public safety network and criminal justice system will benefit tremendously and will now be supported by a forensic facility built to match the level of excellence required.

Acknowledgement: Nil

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Nil

REFERENCES

1. Singh S, Sinha US, Kapoor AK, Verma SK, Singh D, Sharma S; Planning And Designing Of Modern Mortuary Complex In Tertiary Care; IJFMT 4(1) 2006
2. Sirohiwal BL, Paliwal PK, Sharma L, Chawala H Design and Layout of Mortuary Complex for a Medical College and Peripheral Hospitals. (2011) J Forensic Res 2:102e. (cited 2012 August 30): 1(1): (4 Screen). doi:10.4172/2157-7145.1000102e.
3. Mittal S, Yadav M, Singh H, Sharma G, Chawala R; Current Scenario of Forensic Medicine in India; JIAFM, 2007 29 (2). p. 59-60.
4. Hon'ble J. Amar Dutt & J. Kiran Anand Lall (Punjab and Haryana High Court): Judgment delivered in Criminal Law, No. 214-DB of 1997 dt. 23.10.2005).
5. The Committee on Plan Projects. Report on General Hospitals, 1964.
6. Jinesh P. S Modern Mortuary: 20/06/2012 (cited 2012 August 29): 1(1): (4 Screen). <http://www.authorstream.com/Presentation/dreamydews-1451189-modern-mortuary>

Estimation of Stature from Middle Finger Length-in Salem Region

S Sasi Kumar¹, Pavanchand Shetty², Shankar³

¹Assistant professor, Department of Forensic Medicine, Vinayaka Mission Kirupanda Variyar Medical College, Salem, Tamil Nadu, India, ²Assistant Professor, Department of Forensic Medicine, Kasturba Medical College, Manipal, ³Associate Professor, Department of Community Medicine, Vinayaka Mission Kirupanda Variyar Medical College, Salem, Tamil Nadu, India

ABSTRACT

Estimation of stature is considered to be important in those cases like only fragmented and mutilated remains of unknown person are recovered. Many previous studies have been done to estimate the stature using length of different long bones. The present study is an effort to establish correlation between middle finger length and stature. The study was conducted on students from the Vinayaka Mission Kirupanda Variyar Medical College aged between 16-22 years. Standing height and Middle finger length of 150 subjects were measured. Measurements were analysed statistically to establish relationship between Middle finger lengths with stature. Correlation coefficient between stature and middle finger length found to be positive. Regression equation was derived from using this formula $Y = \pi \delta y / \delta x (x - \bar{x}) - \bar{Y}$. We derived the formula for middle finger length for male as $Y = 3.70X + 135.39$ and for female as $Y = 4.33X + 129.26$. Y stands for standing height and x for middle finger length. By putting value of x in different situations stature are calculated and compared with corresponding real standing height.

Keywords: Middle Finger Length, Stature, Regression Equation

INTRODUCTION

One of the most important criteria for establishing identification is stature. Increasing frequency of mass disasters like plane crashes, earthquakes, genocide etc, has created problems in the determination of stature and identification of victims when only fragmented or dismembered humane remains are available for investigation. Those cases forensic expert has no option but to use other method of reconstruction if part of the body is available i.e mathematical method which is workable even part of the body parts are available.^{1,2,3} Most of the workers used intact long bones like femur, tibia, humerus and radius for

estimation of stature which is natural heights of a person in upright position and various formula, regression equations are devised for various groups^{4,5,6}. In the world various regression equation and multiplication factors are developed to estimate the stature using different body parts like length of hand, foot length, arm span and head length.

The present is an effort to establish correlation between middle finger length and stature. This will help the autopsy surgeon to determine the stature in mutilated bodies when the hand is intact most other parts are damaged.

MATERIALS AND METHOD

150 healthy Students of Vinyaka Mission Kirupanda Variyar Medical College aged between 16—22 years were selected for this study. Height was measured without wearing shoes, from vertex to floor using caliber. Middle finger length was measured from tip of middle finger to most proximal flexion of skin

Corresponding author:

S Sasi Kumar

Assistant Professor,

Dept of Forensic Medicine, Vinayaka Mission Kirupanda Variyar Medical College, Salem, Tamil Nadu, India

E mail; sasikumarfm@gmail.com

Contact no; 91-8220496604

crease. These measurements were compiled on master chart and also on excel. Dietary habits, Caste, Religion and Socio economic status were not considered. Students having fractured forearm and arm, growth disorder, deformities were excluded from the study. We derived mean, standard deviation of standing height and middle finger length. From which Correlation coefficient with standing height was calculated.⁷

Regression equation was derived from middle finger length for estimation of stature separately for male and female using this formula $Y = r \frac{\delta y}{\delta x} (x - \bar{x}) + \bar{y}$

r : correlation coefficient between middle finger length and height

Y is standing height (stature)

\bar{y} mean of standing height

X middle finger length

\bar{x} mean of middle finger length

δy standard deviation of standing height

δx standard deviation of middle finger length

RESULTS

Standing height of the males varied from 190 cm to 150 cm with standard deviation (S.D) of 9.08 and mean value of 167.06 cm. For females it varied from 179 cm to 144 cm with standard deviation of 9.46 and mean value of 166.06 cm. (Table no 1).

Table no 1. Stature of study group

Height	Male	Female
Maximum	190	179
Minimum	150	144
S.D	9.08	9.46
Mean	167.06	166.06

Middle finger length

The length of middle finger varied from 12.5 cm to 6.5 cm with mean value of 8.56 cm, standard deviation 1.076 and correlation coefficient with standing height 0.44. The length of middle finger for females varied from 9.5 cm to 6.5 cm with mean value of 8.50 cm, standard deviation 1.09 and correlation coefficient with standing height 0.50. (Table no. 2)

Table No 2. Middle finger length for females and males

Middle finger length	Male	Female
Maximum	12.5	9.5
Minimum	6.5	6.5
Mean	8.56	8.50
S.D	1.076	1.09
Correlation coefficient for stature	0.44	0.50

Regression equation was derived from middle finger length for estimation of stature separately for male and female using this formula $Y = r \frac{\delta y}{\delta x} (x - \bar{x}) + \bar{y}$.

Middle finger

For male: $Y = 0.44 * 9.08 / 1.076 (X - 8.56) + 167.06$
 $Y = 3.70X + 135.39$

For Female: $Y = 0.50 * 9.46 / 1.09 (X - 8.50) + 166.06$
 $Y = 4.33X + 129.26$

For males regression equation for stature from middle finger length is $3.70X + 135.39$ and for females $4.33X + 129.26$. Here X is middle finger length. By putting X value the stature can be calculated and it can be compared with corresponding real standing height.

Table No.3: Regression Equations and variations in calculated stature

Middle finger length	Subject	Regression equation	Length of middle finger	Standing height	Calculated stature	Variation in cm
	Male	3.70X+135.39	Max 12.5 cm	190 cm	181 cm	-9
			Min 6.5 cm	150 cm	159.4 cm	9.4
	Female	4.33X+129.26	Max 9.5	179 cm	170.39 cm	-9.39
			Min 6.5	144 cm	157.40 cm	13.40

DISCUSSION

Studies have been conducted in the recent past on height determination from length of hand, feet, upper extremity and facial measurement in the recent past. The present study documents relationship between middle finger length and stature. The present study shows the correlation coefficient for male is 0.44 and for female is 0.50 which is significant. Correlation coefficient between stature and middle finger length found to be statistically significant and positive indicating strong relationship between two parameters. Prateek rastogi (8) also reported statically significant correlation between middle finger length and stature and significant differences in mean stature of both males and females in north and south Indian population. Mean height for male is 167.06 cm and for females mean height is 166.06 cm. Mean middle finger length for male is 8.56 cm and for female is 8.50 cm. Mean height for male is higher as compared to females which is similar to Thakur (1985)⁹, Sharma (2001)¹⁰. Regression equation for stature estimation was formulated using middle finger lengths and checked for their accuracy by comparing the estimated stature and the actual stature. The results indicate that middle

finger length provides an accurate and reliable means in reconstructing the stature of an unknown individual.

Regression equation for stature estimation was formulated using middle finger length for male

$$Y = 0.44 * 9.08 / 1.076 (X - 8.56) - 167.06$$

$$Y = 3.70X + 135.39$$

For Female regression equation is: $Y = 0.50x 9.46 / 1.09 (X - 8.50) - 166.06$

$$Y = 4.33X + 129.26$$

Vergheese AJ et al ¹¹ found significant correlation between middle finger length of both the hands and stature in males and females and recommended that those equations should be used for estimation stature in Mysore and surrounding region of the Karnataka. Tyagi AK et al ¹² also found significant correlation between finger length and stature and they also suggested use of regression equation for stature estimation. Rahule et al¹⁴ also found good correlation and statistically highly significant correlation coefficient between right middle finger length and stature in the tribal district of Andhra Pradesh.

Table No. 4. Regression equation for various regions:

Authors	Region	Sex	middle finger	Regression Equation
Present Study	Tamil Nadu	Male	Right	S=3.70X RMFL+135.39
		Female	Right	S=4.33X RMFL+129.26
Rahule AS	Andhra Pradesh	Male	Right	S=120.74 +0.457 X RMFL
		Females	Right	S=93.56 + 0.636 X RMFL
Vergheese AJ	Mysore	Male	Right	S=120.20+4.95XRMFL
	Karnataka		Left	S=117.11+5.27XLMFL
		Female	Right	S=117.55+4.26XRMFL
			Left	S=115.77+4.43XLMFL
Sivkumar AH	Karnataka	Male	Right	S=152.02+1.47XRMFL
		Female	Right	S=120.20+4.95XRMFL

CONCLUSION

Mean height for male is higher as compared to females. Mean middle finger length for male is higher than males. There is positive correlation between stature and middle finger length. Simple linear regression equation derived can be used for estimation

of height. This study would be useful for anthropologist and Forensic Medicine experts.

Acknowledgement: Nil

Ethical Clearance Taken From: Institutional Ethical committee of Vinayaka Mission Kirupanada Variyar Medical College

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

1. Jasuja OP and Singh G. Estimation of stature from hand and phalange length. *J Ind Asso Forensic Med.* 2004; 26(3):100-106
2. Shahnaz C, Harbans S, Neena G. Estimation of stature from combined length of forearm and hand in Jammu region of India. *International Journal of basic and Applied Sciences.* 2014;3(1):8-10
3. Vij K , *Forensic Medicine and Toxicology*, 4 th edition, Elsevier India Private Ltd. 2008: 64
4. Trotter M & Gleser GC. Estimation of stature from long bones of America whites and nigros. *Am J Phys Anthropol.* 1952; 10:463-514
5. Pan N. Lengths of long bones and their proportions to body height in Hindus. *J Ana* 1924; 58: 374-378
6. Siddiqui MA H & Shah MA. Estimation of stature from long bones of Punjabis. *Indian J Med Res* 1944; 31:105-108
7. Kumar Amit, Srivastava A.K. Verma A.K. Estimation of stature by Percutaneous measurements of Distal half of upper limb. *Journal of Indian Academy of Forensic Medicine.* 2010; 32 (4): 325-328
8. Prateek rastogi, Tanuj Kanchan, Ritesh G menses and Yoganarasimha- middle ginger length – a predictor of stature in Indian population. *Journal of medicine and science and law.*2009; 49 (2): 126-129
9. Thakur SD and Rai KS. Determination of Stature from hand measurements. *Medicine, Science and Law* 1987:78: 25-28
10. Sharma pk and Kapoor AK. Estimation stature from finger tip length and finger tip length among criminals. *Recent advances in forensic biology (edited)—Kamla-Raj publication; 2007:117-127*
11. Verghese AJ. Balraj BM. Pramod Kumar GN.A study of estimation of stature from length of fingers in Mysore. *Indian Journal of Forensic Medicine Toxicology* 2010:4 (2):12-13
12. Tyagi AK. Kohli A. Verma SK. Aggarwal BBL. Correlation between stature and fingers length. *International Journal of Medical Toxicology and Legal Medicine.* 1999:1(2):20-22
13. Shivkumar AH. Raju GM. Prediction of stature by right middle finger length of males among south Indian population. *Journal of Pharmaceutical and scientific Innovation* 2013; 2(1):31-33
14. Rahule AS et al. A Study of Correlation between Middle Finger Length and Height in a Tribal District Population of India. *J Cont Med A Dent* Sept-Dec 2013;1(1):8-12

Thermal Burn: An Epidemiological Retrospective Study

S K Pandey¹, Neha Chaurasia², Awdhesh Kumar³

¹Assistant Professor, ²Senior Research Fellow, ³Junior Resident, Forensic Medicine, Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

ABSTRACT

The present retrospective study has been conducted in Varanasi area, cases brought to the Department of Forensic Medicine, IMS, BHU, Varanasi for the period of two years i.e. 2009 and 2010. Of the total unnatural deaths reported during the study period deaths due to burn injuries were 17.98 % and 17.07% respectively, showing the more or less steady trend. Burn deaths are usually associated with female and Dowry where female dies in her in-laws house within 7 years of her marriage. Female burn deaths dominated over male in the ratio of 1:4. Most of the deceased were from the married group (73.19%) followed by unmarried (23.55%). Predominant age group found to be 21-30 years (45.13%) followed by age group 11-20 and 31-40 years showing almost same rate around 20% reflecting that young adults were more involved in such type of deaths. As regards to place of death only 9.72% died on the spot or on the way to Hospital while 90.28% died in Hospital reflecting the prompt and proper health care services. Whatever the manner of death Female burn deaths are investigated by magistrate as per provision of 176 Cr.P.C. and case registered under 304B IPC (Dowry Death) and Medico legal postmortem examination conducted by panel of Two Doctors, whereas male burn deaths are investigated by police as per provisions of 174 Cr.P.C. as routine case and medico-legal postmortem examination conducted by single doctor.

Keywords: Dowry Death; Female Burn; Magistrate; Cr.P.C

INTRODUCTION

Fire was perhaps man's first double-edged sword, evidenced throughout history, it has served as well as destroyed mankind¹. Burning or burn injuries are caused due to contact with dry heat. Thus burning may occur due to contact with hot metal or any other hot solid or it may be caused due to contact with flame. The effect of contact very extremely depending on the degree of heat and period of exposure². Burn deaths have tremendous medico-legal importance as they may be considered to be the commonest cause of unnatural deaths in India. Often, the circumstances of burns are enveloped in mystery, obscurity and unreliable statements. The reason behind this action may be personal, domestic, occupational or social tragedy and more recently dowry deaths³.

Married female burn death where death of female occurs within 7 years of her marriage such death cases investigated by Magistrate under Cr.P.C 176(Dowry death) and other burn deaths as routinely investigated

by police as per section 174 of Cr.P.C. In India all newly married female burn deaths are linked with Dowry death, where a young married women commits suicide in consequent to their being subjected to cruelty or harassment by their husband or in-laws or his relative constitute the offence of Dowry death, a monstrous social evil is widely prevalent and deep rooted in society inspite of stringent Legal system and administration. A burn injuries death is very painful but what compels or in what circumstances women or men commits suicide or those accidentally burned but most heinous is burning of newly married women i.e. homicidal burning. In this respect it is very difficult or next to impossible to find out the manner (Suicidal, Accidental and Homicidal) of burn injuries that in what circumstances the burn injuries took place it can only be possible up to some extent by meticulous investigation of scene of crime and interrogation of person concerned. In most of the cases of female burn deaths as per interrogation of her parents are homicidal in manner i.e. their daughter was alleged to be killed

by burning by in-laws and their relative but at the same time as per in-laws she committed suicide or burned accidentally while cooking, in very few cases both the sides are agreed on the same theory.

MATERIAL AND METHOD

This retrospective study was carried out on the burn death cases brought to the Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, from Varanasi itself and nearby districts and western part of Bihar for medico-legal autopsy examination.

Data was collected from postmortem record register for the period from 1st January 2009 to 31st December 2010. During this period total of 706 burn deaths cases were recorded out of 4031 medico-legal postmortem conducted. Data was analyzed retrospectively in respect of incidence of burn deaths, age, sex, cause of death, place of death and other relevant data.

RESULTS AND OBSERVATION

Out of 4031 medico-legal autopsy cases conducted during the study period from 1st January 2009 to 31st December 2010, total of 706 cases (17.51%) of death from fatal burn injuries were recorded. If we split the finding year wise 357 cases (17.98%) and 349 Cases (17.07%) in year 2009 and 2010 respectively (Table-1), which is almost static. Male comprised of 20.25% of total burn death. Female (79.75%) preponderance was seen in burning with male female ratio equal to 1:4 (Table2 & Table6). Maximum of the victims of burn deaths were in the age group 21-30 year followed by 31-40 years in the year 2009 but 11-20 age group in the year 2010 with slight difference (Table 3 & 7). Most of the victims of burn deaths were recorded between 21-40 year (which is more than half of the total burn death) with peak incidence at 21-30 year (Table3 &7). Extremes of ages are least involved as compared to adult age group as seen in tables for age and sex incidence.

If we consider Season wise distribution of burn victims maximum death were reported in summer season in 2009 (43.98%) and 2010(47.27%) irrespective of sex followed by winter in the year 2009 and equal incidence in year 2010 (Table2&6). Married person (68.63%) in year 2009 and (77.75%) in 2010 outnumbered the unmarried(27.73%) in 2009 and (19.36%) in 2010 (and widow and widower Table4 &8). Regarding cause of death most of the victims died of septicemia followed by primary shock (including

spot deaths or death on the way to hospital and hospital death within 48 hours of burn infliction) (Table5 &9).

Table1: Incidence of burn deaths in Medico-legal autopsy

Year	Total cases	Thermal Burn Death	%
2009	1986	357	17.98
2010	2045	349	17.07

Table2: Season wise incidence of Thermal burn death in year (2009)

Season	Male	Female	Total	%
Summer	46	111	157	43.98
Rainy	12	75	87	24.37
Winter	22	91	113	31.65
Total	80(22.41%)	277(77.59%)	357	100

Table 3: Age and Sex wise incidence of burn death in year (2009)

Age in years	Male	Female	Total (%)
0-10	5	6	11(3.08%)
11-20	16	54	70(19.61%)
21-30	23	130	153(42.86%)
31-40	20	56	76(21.29%)
41-50	6	15	21(5.89%)
51-60	4	5	9(2.52%)
61-70	5	8	13(3.64%)
71- above	1	3	4(1.12%)

Table 4: Marital status of burn death cases in year (2009)

Marital Status	Male	Female	Total (%)
Married	48	197	245(68.63%)
Unmarried	27	72	99(27.73%)
Widow/Widower	5	8	13(3.64%)
Total	80	277	357(100%)

Table 5: Cause of death of burn death cases in year (2009)

Cause of death	Male	Female	Total (%)
Primary shock	32	111	143(40.06%)
Septicaemic Shock	48	166	214(59.94%)
Total	80	277	357(100%)

Table 6: Season wise incidence of burn death in Year (2010)

Season	Male	Female	Total(%)
Summer	32	135	167(47.27%)
Rainy	15	76	91(26.30%)
Winter	16	75	91(26.30%)
Total	63(18.05%)	286(81.95%)	349(100%)

Table 7: Age and sex wise incidence of burn death cases in year (2010)

Age in years	Male	Female	Total (%)
0-10	5	4	9(2.60%)
11-20	13	60	73(21.10%)
21-30	19	145	164(47.40%)
31-40	13	49	62(17.92%)
41-50	6	12	18(5.20%)
51-60	3	7	10(2.89%)
61-70	4	3	7(2.02%)
71-Above	Nil	3	3(0.87%)
Total	63	286	349(100%)

Table 8: Cause of Death in burn death cases in year (2010)

Cause of death	Male	Female	Total (%)
Primary Shock	30	127	157(44.5%)
Septicaemic Shock	33	159	192(55.49%)
Total	63	286	349(100%)

Table 9: Marital status of burn death victims in year (2010)

Marital status	Male	Female	Total(%)
Married	40	230	270(77.75%)
Unmarried	21	48	69(19.36%)
Widow/Widower	2	8	10(2.89%)
Total	63	286	349(100%)

Table 10: Cause of Death in burn victims in year (2009)

Cause of death	Male	Female	Total	%
Primary shock	32	111	143	40.06
Septicaemic shock	48	166	214	59.94
Total	80	277	357	100

Table-11: Cause of death in burn victims in year (2010)

Cause of death	Male	Female	Total (%)
Primary shock	30	124	154(44.13)
Septicemia shock	33	162	195(55.87)
Total	63	286	349(100)

DISCUSSION

Human society ever since its inception has never been free from criminal activity. Burn injuries occur worldwide in all society irrespective of its developed, developing or poorly developed condition. These injuries constitute a medical and psychological problem but also have severe economic and social consequences not only to the victim but also to their family and society in general⁴.

Analysis of sex and age record in our study showed that females (77.59%) in 2009 & (81.95%) in 2010

superseded males with percentage of 22.41 and 18.05 in 2009 and 2010 respectively. The overall female preponderance in the present study confirms with some previous study^{5, 6, 7,8,9}. Married females 563 (79.75%) most common victim of present study followed by married male 143 (20.25%) which is consistent with the study of Usama B Ghaffar et al & H.M.Mangal, Akhilesh Pathak^{5,9}. In this study most of the patients have died due to septicemia in both the years 59.94% and 55.49% (Table-5&9) and is consistent with study done by Prabhsharan singh & Dasari Harish. This shows the prompt and proper health services provided to people suffering from burn injuries. In the present study most of the victim were died in Summer season followed by winter and rainy this for 2009 and in 2010 Summer season accounts for most burn deaths followed by same in both winter and rainy season, reason behind this is during summer results of various schools and colleges declared, and a person loses temperament easily or failure in love and also this is the season for marriages. I did not find a single study where this parameter was studied.

As the female burn deaths reported to Police irrespective of its manner and registered under 304BIPC (Dowry death) all the family members of in-laws side alleged in causing death of female are arrested and send to jail.

ACKNOWLEDGEMENT

Author would like to thank of Department of Forensic Medicine for their support and help in data collection.

Source of Funding: This research was not financially supported by any funding agencies.

Ethics statement: The study was approved by "Institutional Ethics Committee" of Institute of Medical Sciences, Banaras Hindu University. All the information has been taken under consideration of medical ethical committee.

Conflict of Interest Nil

REFERENCES

1. Rong Xiang Xu, Karger. Brief introduction to history of burn medical Science. Burn regenerative medical and therapy, 2004; 1-3.
2. Apurba Nandy. Principles of Forensic Medicine. Thermal injuries. Reprint. New central Book agency (P) Limited. 1998. pp-269.

3. Mohanty et.al. Self inflicted burn fatalities in Manipal. *Medicine science and law*: 2005; 45: 27-30.
4. Xiao Jie, Cai Baoren. Mortality rates and among 5321 patients with burn admitted to a burn unit in China: 1980-1988. *Burn* 2003; 29:239-45.
5. Usama B Ghaffar et al. Thermal burns: An epidemiological prospective study. *Journal of Indian Academy of Forensic Medicine* Vol.30(1); 2008 pp10-14.
6. Rooh-Ul-Muqim, Mohammed Zareen, Dilbag, Muhammad Hayat. Epidemiology and outcome of burns at Khyber teaching hospital Peshawar. *Pak J Med Sci*, 2007; 23(3):420-24.
7. Dhiraj Buchade, Hemant Kukde, Rajesh Dere, Ramesh Savardekar. Pattern of burn cases brought to Morgue, of Sion Hospital, Mumbai: A two year study. *Journal of Indian Academy of Forensic Medicine*. Oct-Dec 2011, Vol.33, No.4, pp309-310.
8. Bangal RS., Thermal injuries- A study of mortality pattern. *JFMT*:1995, XII (1&2), 1-4.
9. H.M. Mangal, Akhilesh Pathak., The Fire is both 'A Blessing and Scourge to the Mankind' *JIAFM*, 2007-29(4)75-77.
10. Prabhsharan Singh, Dasari Harish. Incidence of post burn septicemia at a tertiary care hospital. *JIAFM*. Oct-Dec 2011, Vol.33, No.4, pp317-321.

Fusion of Epiphyses of Ischial Tuberosity in Relation with Age: A Cross Sectional Study

Anita Verma¹, Kanan Shah²

¹Associate Professor, Department of Physiology, ²Associate Professor, Department of Anatomy, Smt. NHL Muni Medical College, Ahmedabad, Gujrat

ABSTRACT

Introduction: Fixing a person's individuality has got its own importance. Age being one of the cardinal parameter for establishing the identity, its estimation is of paramount importance and requires special attention. It is important when the liability and punishment are dependent on maturity of the individuals. It is important in developing countries, where many births take place in rural settings and poorly recorded or more often not recorded.

Aims & Objective: Study the progress of union of epiphyses of ischial tuberosity in natives of Gujarat state, in relation to age & sex.

Material & Method: In the present study radiological examination (digital X-ray) was done, for fusion of epiphyses of ischial tuberosity, in 300 individuals of both the sexes of 17-22yrs.

Observation: 100% union of ischial tuberosity seen at age of 21-22yrs. Fusion of epiphyses occur at same age group in both gender.

Discussion: The observations in this study are comparable to previous studies done by McKern & Stewart, Dr Gaurang & Dr Alok.

Conclusion: Among many factors used for age estimation, none has withstood the test of time which necessitates the continuous work on this vital issue by the medico legalists. Radiological examination of bones is quick, precise & reliable method for estimation of age.

Keywords: *Epiphyseal Union, Ischial Tuberosity, Radiological Examination, Age Estimation*

INTRODUCTION

Fixing a person's individuality has got its own importance. Age being one of the cardinal parameter for establishing the identity, its estimation is of paramount importance and requires special attention^{1,2}. It is important when the liability and punishment are dependent on maturity of the individuals³. It is important in developing countries, where many births take place in rural settings and poorly recorded or more often not recorded. In many other cases, records are falsely projected for some gain, e.g. to get government jobs or pensions.⁴

The assessment of age can be done by anatomist, physiologists and persons engaged in medico legal works. And it should be done with great attention as conclusions are debated in court of law. A wide variety

of methods are used. Though the general development including height, weight, secondary sexual character, are less reliable data for estimation of age, changes in bones specially time related fusion of epiphyses in growing periods are valuable indices. These changes can be studied by means of X-rays and these changes are age related. It is therefore possible to determine the approximate age of an individual by radiological examination of bones till ossification is complete⁵.

Epiphyseal union of long bones & eruption of teeth are reliable data till 25yrs of age +/- 6months. And fusion of sutures of skull is reliable data after 25 years of age +/- 5 years⁶. Work on the determination of age of epiphyseal union has been carried out in different states of India as well as abroad and from the finding of various workers; it is evident that there is difference

in the age of epiphyseal union in the different states of India. These differences may be on account of varying hereditary factors, climate, and diet⁷. Among many factors used for age estimation, none has withstood the test of time which necessitates the continuous work on this vital issue by the medico legalists. Very little work in this regard has been carried out in Gujarat state. The present study is an attempt to add to the knowledge in this field by studying the epiphyseal union of ischial tuberosity among the natives of Gujarat state.

AIMS & OBJECTIVE

Study the progress of union of epiphyses of ischial tuberosity in natives of Gujarat state, in relation to age & sex.

MATERIAL & METHOD

This descriptive cross sectional study was carried out in Smt NHL MMC in 2011-2012. For the study 300 students of both sexes, aged 17-22 years were selected. Only natives of Gujarat having sound health and definite birth records were included for this study & as study was aimed to establish the age of epiphyseal union in persons from Gujarat state only those residing in Gujarat state since birth were selected. These cases

were selected after ruling out the nutritional, developmental, and endocrinal abnormality which can affect the skeletal development & growth. Participants selected were X-rayed (digital X ray) & their radiographs were studied for progress of epiphyseal union of ischial tuberosity. Data was recorded & analyzed to draw conclusions and compared with available results of previous studies. Evaluation of epiphyseal union was carried out as it was analyzed by McKern and Stewart in 1957 i.e. as follows.

- 0 = nonunion
- 1 = 1/4 union
- 2 = 1/2 union
- 3 = 3/4 union
- 4 = complete union

OBSERVATIONS

In the present study radiological examination was done, for fusion of epiphyses of ischial tuberosity, in 300 individuals of both the sexes of 17-22yrs. Attempt is also made to analyze the stages of ossification and co-relate them with the age of the individuals

Table No 1. Shows numbers of students in different known age group.

Age group in years	No of males	No of females
17-18	18	12
18-19	36	6
19-20	60	24
20-21	72	36
21-22	24	12
Total	210	90

Table: 1 show, out of 300 subjects 210 belongs to male gender & 90 belong to female.

Table no 2: Showing degree of fusion of epiphyses of ischial tuberosity in cases studied under different age groups. Here % are calculated for specific age group

Age group in years	No of cases studied	No of cases showing various degrees of fusion					% of cases showing 50% or more union	% of cases showing complete fusion
		0	1	2	3	4		
17-18	30	12	12	0	6	0	20	0
18-19	42	12	12	12	6	0	42.86	0
19-20	84	0	18	18	36	12	78.57	14.29
20-21	108	0	0	18	42	48	100	44.44
21-22	36	0	0	0	0	36	100	100

Table: 2 Shows that fusion of ischial tuberosity has not yet started in 40% of cases in age group 17-18 years and 28.57% of 18-19 years age group. ⁸ 100% union of ischial tuberosity seen at age of 21-22yrs.

Table No 3a & 3b: % of cases showing complete fusion in both sexes separately at different age group in both sexes separately.

Table No 3a: % of fusion of ischial tuberosity in relation to age in males

	17-18 yrs	18-19yrs	19-20yrs	20-21yrs	21-22yrs
No of cases	18	36	60	72	24
% of cases with 50% or more union	0.00	33.33	70	100	100
%of cases with 100% union	0.00	0.00	10	50	100

Table No 3b: % of fusion of ischial tuberosity in relation to age in females

	17-18 yrs	18-19yrs	19-20yrs	20-21yrs	21-22yrs
No of cases	12	6	24	36	12
% of cases with 50% or more union	50	100	100	100	100
% of cases with 100% union	0.00	0.00	25	33.33	100

In table 3a & 3b, percentages are calculated for specific age group in relation to sex. In age group 17-18 and 18-19 years among both sexes, none of the subjects show complete union of the epiphyses. In age group 17-18 years not a single boy's x-ray show 50% or more fusion. All the cases of age group 20-21 and 21-22 years show 50% or more union in x- ray of boys. 50% cases of girls in age group 17-18 years show 50% or more union. All cases of 18-22 years among the girls show 50% or more union of epiphyses of ischial tuberosity. In age group 21-22 years fusion of ischial tuberosity is found to be 100%.

Table No 4:-Relation of complete fusion of ischial tuberosity with complete fusion of iliac crest at different age groups.

Age groups	Total cases studied	[A]no of cases showing complete fusion of ischial tuberosity	[B]no. of cases showing complete fusion of iliac crest	[C]% of cases with complete fusion of ischial tuberosity showing complete fusion of iliac crest
17-18	30	0	6	-
18-19	42	0	6	-
19-20	84	12	48	50%
20-21	108	48	78	100%
21-22	36	36	36	100%
Total	300	96	174	

According to present study table no 4 shows complete fusion of iliac crest in age group 20-21yrs & thereafter. In age group 20-21 yrs all cases show fusion at iliac crest while 44.44% cases show fusion in ischial tuberosity. This suggests that union of iliac crest occur earlier than ischial tuberosity.

DISCUSSION

As per Krogman's finding difference between bone finding & x ray finding are not too great, usually it is plus or minus 6 months¹¹. In this study 100% of the cases show complete fusion of ischial tuberosity at the age of 21-22 years age group. In this study 50% union or more union found in 33.33% cases, at age of 18-19 years age group, 70% cases at 19-20 years age group & 100% cases thereafter in males; in females 50% or more union is found in all cases after age of 18yrs, 100%

union found in male in 10% cases of 19-20 yrs age group, 50% cases of 20-21 yrs age group & 100% cases of 21-22 years age group. 100% union found in female in 25% cases in 19-20 yrs age group, in 33.33% cases age of 20-21 yrs and 100% cases in 21-22 yrs age group. However study carried out by McKern & Stewart in 50% of the cases union has not yet started in age group 17-18 years & in 52% of the cases in age group 18-19 years⁶. ,% of the cases showing 50% or more union were ,40% at the age of 17-18yrs, 35% at the age of 18-19 yrs, 62% at the age of 19-20yrs, 76% at the age of 20-21 yrs, 84% at the age of 21-22 yrs, 96 % at the age of 22-23 yrs ,100% in age of >23 yrs .

Findings of our study are different from findings observed by McKern & Stewart. However findings of our study are comparable to the findings in the study done by Dr William who observed fusion in 100% cases

by 21 years age⁹. As per study carried out by Dr Pratik Patel¹² fusion in 100% cases observed at 21-22 yrs age group and Dr Gaurang patel⁴ observed complete fusion of ischial tuberosity after 21 yrs in males & at 19-20 yrs age group in females in state of Gujarat. Findings of present study are consistent with findings of Dr Pratik, however findings differs from the findings of Dr Gaurang. In present study 100% union is found in same age group as far as gender is concerned : however as per study carried by Dr Gaurang complete union is found one year earlier in female sex that means 19-20 years, 20-21 yrs in female & male sex respectively. And finding of Flecker¹⁰ is different in which fusion of ischial tuberosity occurs earlier in male than in female.

As per study done by Dr Alok average age of fusion was found 20.5years in males & 19.5 yrs in females. Dr Yatiraj Singh who also observed fusion of the epiphyses occur earlier in females compared to males.⁷This finding is contrasting in our study. Study done by S.S.Bhise showed 50% union in 14.3% cases at 17-18yrs, 64.3% cases at 18-19yrs & 21.4% cases at 19-20yrs age group and ; complete union seen in 14.3% cases at 20-21 yrs age group, 23.8% cases at 22-23 yrs & 19% cases at 23-24yrs & 9.5% cases at 24-25yrs age group. These findings are different from the findings observed in our study. This difference could be due to various factors like climate, diet & familial.

CONCLUSION

The pelvis of three hundred boys and girls are radiologically examined and the results were concluded, the epiphyses of ischial tuberosity showed complete fusion in cases of 21-22 years. The females show beginning of fusion of ischial tuberosity earlier than those of males. The epiphyses of iliac crest show fusion at an earlier stage than that of ischial tuberosity. Age estimation from morphological changes in bone had always been a matter of debate as it was very erratic and affected by various factors such as climatic, dietetic, hereditary, sociological, racial, environmental, geographical etc. Among many factors used for age estimation, none has withstood the test of time which necessitates the continuous work on this vital issue by the medico legalists. Radiological examination of bones is quick, precise & reliable method for estimation of age before 25 yrs. However this study was carried out on relatively smaller sample size & no statistical formula or test was used. We recommend further study

on larger sample size with appropriate statistical method & test.

ACKNOWLEDGEMENT

The authors sincerely thank to the Students who consented for radiological examination in research. The authors also thank to the entire staff of the radiology department and the forensic medicine department of Smt NHL municipal medical college for their support and guidance rendered.

Conflict of Interest: None declared.

Source of Funding: None

Ethical Clearance: Informed written consent of each subject was taken.

REFERENCES

1. Singh Pradeep, Gorea R.k., Oberoi S. S., Kapila A.K.: Age estimation from medial end of clavicle by X-ray examination, J Indian Acad Forensic Med, 32(1)28
2. Singh Pradeep, Gorea R.k., Oberoi S. S., Kapila A.K.: Estimation of age from epiphyseal fusion in iliac cre, J Indian Acad Forensic Med, 33(1) 24-6
3. Kumar Alok, Srivastava A.K., Yadav Mukesh, Kumar Virendra, Bhagoliwal A., Mathur S.P. Arora S.K. Gupta :R.K. Estimation of age from pelvis – A radiological study
4. Gaurang Patel, Pankaj Prajapati, Dharmendra Dodiya, Bhavik Doshi: Study of Fusion of Ischial Tuberosity in Gujarati Population:-By using Digital X-Ray Method Indian Acad Forensic Med. April-june 2012, Vol.34, No.2 0971-0973
5. Bhise, S S., chavan, G S, chikhalkar, BG Nanandkar, S D: Age determination from clavicle a radiological study in Mumbai region.j of Indian academy of forensic medicine 2012 Jan; 34(1):7-9
6. McKern T.W.and Stewart T.D.: skeletal age changes in young American males, analysed from the standpoint of identification. Head quarter QM Residence and development command, Tech Rep EP-45, Natick, Mass, 1957
7. Singh Yatiraj, Kiran Deshmukh, Nagaraj Bijapur Assesment: of age in adolescents by radiological examination of pelvis & hip joint: international J of Medical & Health Sciences, April 2012, vol-1: issue-2, p10-15

8. Bhise S.S, S.D.Nanandkar: Age determination from pelvis: A radiological study in Mumbai region Indian Acad Forensic Med. April-june 2012, Vol.34, No.2, p104-7
9. Bilkey William, Sangma Ch., Fermingston K.Marak, Singh Shyamao M., Kharrubon Biona: Age determination in girls of north-Eastern region of India: JIAFM, 2007-29(4)0971-3
10. Flecker, H: Time of appearance & fusion of ossification centers as observed by roengenographic methods. J Roentgenol & Rad Ther.47 (1):97-159, 1942
11. Krogman W.M., Iscan M.Y.: The human skeleton in Forensic Medicine.2nd edn, 1986, p 76
12. Patel Pratik: A study of fusion of epiphyses of ischial tuberosity in relation with age, A.J.B.A.M.S. Sept 2003, 101-2

Role of DNA in Forensic Identification

Karthavya Sampath¹, Nithya Jagannathan²

¹BDS Undergraduate Student, ²Senior Lecturer, Department of Oral Pathology, Saveetha Dental College, Saveetha University, No 162, Poonamale High Road, Vellapanchavadi, Chennai, India

ABSTRACT

Forensic identification of dead and decayed had always posed a problem, as there is any evidentiary material available for forensic analysis. In such cases DNA analysis plays a role in identification of the victims. DNA plays a significant role at various points through the criminal case from the initiation of any investigation till the confirmation of a death. DNA is available in two forms namely the chromosomal DNA present in the nucleus and mitochondrial DNA present in the cytoplasm of a cell. DNA is available from numerous sources in a human body. However, when there is complete decomposition of the body, DNA from dental tissues helps in revealing the identity. DNA from dental tissues can be extracted from dental pulp, cementum and dentin. DNA analysis also forms a prime role in Bite mark analysis when traces of saliva are left behind as DNA is rich in saliva and it helps in identification. This review serves as a primer on the basics of DNA, its application in dentistry and the methods of extraction.

Keywords: Identification, Analysis, Bite Marks, Saliva, Mitochondria, Chromosome

INTRODUCTION

Forensic odontology is a branch of dentistry which involves the proper handling, examination and evaluation of dental evidence which along with dental records and antemortem records interest the justice¹. Advances in technology have made DNA testing a vital tool in sexual assault investigation and prosecution, primarily were the detection of primary issue is of concern. Further, they also serve as a tool in serology to establish identity using blood, saliva, and semen². Over the past decade, forensic analysis has made tremendous contributions in producing valuable evidence with the use of DNA technology which has been an additional potential to identify criminals.

DNA is present in saliva, oral tissues and teeth and they serve as an aid in forensic analysis which is often extracted and typed. Hence it is important that forensic

odontologist get familiar with these for the extraction and analysis of DNA from oral tissues^{3,4}. The following review discusses in detail the DNA structure, the analysis, extraction and analysis and its potential role of DNA as an investigative tool.

Structure and role of DNA

DNA is a molecule of genetic materials that encoding the hereditary information of an individual. The DNA strand has a double helix composed of three fundamental macromolecules namely the polysaccharides, proteins and nucleic acids. The steps connecting either side of the helical structure are pairs of molecules called bases. Genomic DNA is a polymer composed of four bases in the DNA strand namely purines (adenine (A), guanine (G)) and pyrimidines (cytosine (C) and thymine (T)). The nucleotides from separate DNA strands bond are specific for each individual and this accounts for the genetic diversity of all humans^{3,5,6}. DNA which is a source for forensic applications is usually found in the nuclei.

DNA proteins perform diverse functions in the body serving as components of organs. They transport proteins and bind certain substances; they also serve as protective proteins enabling the defense

Corresponding author:

Nithya Jagannathan

Department of Oral Pathology, Saveetha Dental College, Saveetha University, No 162, Poonamale High Road, Vellapanchavadi, Chennai, India - 600077

Mail id: dr.nithya@ymail.com

Ph no : 9884754910

mechanisms in the body. They act as regulatory proteins and control the biochemical process in the body through enzymatic activity⁶.

Cellular and Mitochondrial DNA

The DNA material is contained in the nucleus as chromosomes and a small fraction is also present in mitochondria⁶. Apart from the genomic DNA, a cell also contains mitochondrial DNA which differs from nuclear DNA also making it an alternative tool for forensic analysis⁷. Unlike nuclear DNA, which is a genomic material containing the paternal and maternal components, mitochondrial DNA is distributed throughout the cytoplasm and contains only maternal components⁸. It is responsible for the synthesis of Adenosine triphosphatase³. The mitochondrial DNA is usually double stranded structure with light and heavy strands with a circular structure containing 16569 base pairs coding for 2 r RNA, 22 tRNA^{3,9}. The base pairs of mt DNA is usually numbered in a clockwise direction beginning at the origin of replication. The area of forensic investigation is centered on the control region which a highly diverse segment³.

The advantage of mtDNA is that it is easily available as they are present in almost all the cells resulting in more than hundreds of copies. It is also present in blood cells where the chromosomal DNA is absent due to absence of nuclei. It also serves as a method of identifying the maternal family members as it is strictly inherited from mothers. It is also successful when there is a failure in nuclear DNA test identification when the DNA is too degraded. Mt DNA is haploid and thus makes it easier to handle and work. DNA also contains high polymorph regions, and it augments the value of the test as they contain numerous variations within the DNA sequence. This decrease the possibility of resemblance between the donor and volunteer^{6,10}

Basis of DNA analysis

The DNA testing provides information in the course of biological specimen found at the crime scene. The type of test to be performed depends on the amount of DNA obtained. The more than 50ngs of high molecular weight DNA is obtained, RFLP can be performed. If degradation has occurred, Ampli-type

RHLA DQ alpha and polymarker tests can be performed. In case of extensive degradation where hardly any DNA is recovered, mitochondrial DNA can be performed. Nuclear DNA can be used in determination of an individual when immediate relatives are available. However when the DNA extracts is insufficient, alternative methods like mtDNA come into role³.

DNA can be split by restriction enzymes which cleaves the DNA at certain points called loci. The split parts can be joined together by DN ligase. Following the extraction of DNA, the fragments are usually separated by gel electrophoresis. The electrophoretic process separates the DNA into short and long pieces and based on the charges carries on them. A DNA or RNA marked probe with complimentary segments are subjected on them through a process called blotting and made visible by radioactive marking⁶.

Source of DNA from Oro dental tissues

The most common dental identification to prove identity of an individual is based on conventional methods. However when they are not sufficient or fail, the role of DNA comes into place to prove identity. DNA material from teeth serves as an excellent tool due to their resistant nature to incineration, immersion, trauma, mutilation and decomposition^{4,7}. The dentin polymerase chain reaction and enamel present in the tooth provide the genomic and mitochondrial DNA for basic analysis. The hard tissues should be intact and initial documentation should be done using conservative techniques including radiographic, ultrastructural and biochemical analysis. After the documentation is complete, the DNA investigations can be performed with a more aggressive technique using polymerase chain reaction,^{7,11,12}.

The DNA rich site in dental tissues is the dental pulp including the pulp chamber in the coronal region, root canals and accessory canals. DNA can also be isolated from dentin or cementum in small quantities. The amounts of DNA from molar teeth are easy to extract due to the presence of large pulp chamber. Thus the basic targets for DNA sampling are the gross volume of the dental pulp followed by the odontoblastic process, accessory canals and cellular cementum. In mass fatality, when the body tissues are

decomposed, there is persistence of dental structures from which DNA can be extracted. The most common method of obtaining DNA from teeth is by a cryogenic grinding¹².

Principles of DNA extraction

The DNA sample obtained from a tooth should be examined before further sampling is being done. The tooth should be deprived of any soft tissue or blood before the sampling. A complete debridement of plaque and calculus from the tooth should be done mechanically (curettage) and chemically (hydrogen peroxide and ethanol). If the tooth is untreated and intact with a normal extraction done recently, a conventional endodontic removal of pulpal tissue can be performed. However a greater access can be obtained by sectioning a tooth vertically exposing the large pulp chamber¹².

Following the exposure of the pulp chamber, the walls of the pulp should be curetted and the pulp tissue should be extirpated and dispensed into a wide mouth sterile container. When the specimen is old, the pulp gets dried and there exists only parched and flaky strand of tissue attached to the walls of the pulp chamber and root canals giving a mummified appearance. The root canal is then irrigated with TE buffer and the ultrafiltrate is usually rich in cellular material needed for forensic analysis¹².

The DNA can be extracted by a tooth through a crush of the entire tooth and then picking the DNA's from pulp, dentin and cementum or by a conventional endodontic access removing only the pulpal tissue. However other methods can also be used like horizontal sectioning of the tooth with either partial extirpation of coronal and radicular half of tooth, or with any aggressive extirpation or aggressive pulpectomy and crushing the radicular half of the tooth¹¹.

Cryogenic grinding

The procedure is performed in the freezer mill where in the ferromagnetic plunger is oscillated back and forth in an alternating current. The tooth is subjected to liquid nitrogen, to freeze the sample to resist from heat degradation. Following this the tooth is grounded to powder to increase the surface area and expose the cells for the DNA to be released into the solution. The

procedures are conducted in a sterile environment to prevent contamination from infection. The most frequent contaminants are blood or saliva including bacterial contaminants like feces, decaying tissue, vomit or animal hair which restricts the enzymatic activity during the procedural steps of PCR^{13,14,15}.

DNA ANALYSIS

Restriction fragment length polymorphism

RFLP is a method wherein the restriction enzyme cuts the DNA into fragments. They are later electrophoresed using an agarose gel and incubated with a radioactive probe on a nylon membrane. The complementary pieces of polynucleotides on the radioactive probe hybridize with the fragments resulting in marking of various parts of the DNA. RFLP detects genetic variations in the DNA. It helps in detection of mutation and insertion, deletion or variations in number of repeating units¹¹.

Polymerase chain reaction

PCR enables the DNA analysis by amplifying the polymorph regions and thereby determine the sequence of an allele by a specific primer. The PCR products can be investigated in three ways. (i) hybridization with marked sequence specific probes. (ii) electrophoretic analysis of PCR products (iii) determination of DNA sequence of PCR product. PCR is sensitive and specific and so PCR based DNA analysis is an advantageous method. It is also less time consuming and less extensive with no radioactive markers^{16,17,18}.

DNA extraction from human bite marks

Traces of saliva are usually left behind on a human skin following a contact of the mouth and oral structures on a skin¹⁹. The extraction of DNA from these sources on the skin has a potential role in identifying the suspect²⁰. The DNA is usually collected from such areas by swabbing the skin. Double swabbing can also be done and tested for enzymes like amylase. A positive result confirms that the observed mark is a bite mark. Several techniques have been employed for obtaining the saliva from bite marks. One method is a classical stain recovery technique which uses a wet cotton swab against one utilizing a wet filter paper. Another common method is a double swab technique,

which uses wet cotton first followed by a dry cotton swab which was later analyzed by Chelex method and quantified with a slot- blot procedure^{19,20}.

Salivary DNA

Human saliva contains high molecular weight DNA and the collection of saliva from the crime scene serves as a vital tool in forensic evidence and in identification¹⁴. The DNA obtained from a site can be recovered up to 48 hours after its deposition on the skin. In case the skin is unwashed, DNA may be retrievable for up to 72 hours. However contamination, degradation and putrefaction makes it difficult to isolate and give positive results posing potential problem^{19,20}.

DNA analysis is used in routine criminal investigations, family investigations and mass disasters and serves as a powerful method of human identification. DNA has a pivotal role in establishing the identity of a suspect, victim, parent or a historic person²¹. The DNA technology in forensic science not just serves as a tool in identification but also to reassociate the body part in mass disasters proving a powerful method of identification.

ACKNOWLEDGEMENT

The authors thank the Department of Oral Pathology, Saveetha University for the technical assistance and guidance in preparation of the manuscript.

Declaration of Interest: The authors report no conflicts of interest.

Source of Funding: The paper is a review paper and requires no source of funding.

Ethical Clearance: The article does not involve with patients/ animals and is a review paper. Hence it is not relevant.

REFERENCES

1. C Stavrianos, A Eliades, A Kokkas. The role of DNA in forensic Odontology (Part I) DNA Analysis methods. *Res J Med Sci.* 2010; 4:334-339.
2. Travis C. Pratt, Michael J. Gaffney, Nicholas P. Lovrich and Charles L. Johnson, This Isn't CSI : Estimating the National Backlog of Forensic DNA Cases and the Barriers Associated With Criminal processing. *Criminal Justice Policy Review* 2006; 17: 32
3. Smith BS, MM Holland, DL Sweet, JA Dizinno. DNA and the forensic odontologist in: *The manual of forensic odontology.* Amer Soc Foren Odontol. 1995.. 283-300
4. Sweet DJ, CH Sweet, DNA analysis of dental pulp to ink incinerated remains of homicide victim to crime scene. *J Forensic Sci.* 1995;40:310-314
5. K Gehring, JL Leroy, M Gueron. A tetrameric DNA structure with protonated cytosine cytosine base pairs. *Nature.* 1993; 363: 561-565
6. I Lijnen, G. Willems. DNA Research in Forensic Dentistry. *Methods Find Exp Clin Pharmacol.* 2001; 23(9): 1-7
7. Pretty IA, D . Sweet . A look at the forensic dentistry Part 1. The role od teeth in the determination of human identity. *Br Dental J.* 2001; 190: 359 – 366
8. Cann RL, M Stoneking, AC Wilson. Mitochondrial DNA and human evolution. *Nature.* 1987; 325: 31-36
9. Hutchinson CA, JE Newbold, SS Potter, MH Edgell. Metarnal inheritance of mammalian mitochondrial DNA. *Nature.* 1974; 251:536-538.
10. Ginther C, Issel Tarver L, King M. Identifying individuals by sequencing mitochondrial DNA from teeth. *Nat Genet* 1992;2:135-8
11. Smith BC, DL Fischer, VW Weedn, GR Warnock, MM Holland. A systematic approach to the sampling of dental DNA. *J Forensic Sci.* 1993; 38:1194-1209
12. Stavrinou C. Forensic Dentistry. University Studio express.. 2009; 45-98.
13. Ginther C, Issel Tarver L, King M. Identifying individuals by sequencing mitochondrial DNA from teeth. *Nat Genet* 1992;2:135-8
14. Stevens A, Lowe J. *Human Histology,* Mosby; 1995; 182
15. Walsh DJ, Corey C, Cotton R et al. Isolation of deoxyribonucleic acid from saliva and forensic science samples containing saliva. *J Forensic Sci.* 1992; 37: 387-95
16. Reynolds R, Sensabaugh G, Blake E. Analysis of genetic markers in inforensic DNA samples using the polymerase chain reaction. *Anal Chem* 1991;63:2-15

17. Lee HC, Ladd C, Scherczinger CA, Bourke MT. forensic application in DNA typing. *Am J Forensic Med Pathol* 1998;19:10-18
18. Hochmeister MN, Budowle B, Jung U, Borer CT, Comey N, Dirnhoffer. PCR based typing of DNA extracted from cigarette butts. *Int J Legal Med.* 1991;104:229-233.
19. Sweet D, M Lorente, JA Lorente, A Valenzuela, E Villanueva. An improved method to recover saliva from human skin: The double swab technique. *J Forensic Sci.* 1997a; 42:320-322
20. Sweet D, M Lorente, JA Lorente, A Valenzuela, E Villanueva. PCR based DNA typing of saliva stains recovered from human skin. *J Forensic Sci.* 1997b;42: 447-451
21. Vernesi C, G Di Benedetto, D Caramelli, E Secchieri, L Simoi et al. genetic characterization of the body attributed to the evangelist. *Luke Proc Natl.* 2001; 98: 13460-13463.

Morphometric Analysis of Foramen Magnum for Sex Determination in Karnataka

Kazi, S A K¹, Aadamali A Nadaf², Pramod B Gai³

¹Associate Professor, Dept. of Anatomy, ²Assistant Professor, Dept. of Forensic Medicine, Karnataka Institute of Medical Sciences (KIMS) Hubli, Karnataka, India, ³Professor of Anthropology and Director, Karnataka Institute for DNA Research, Dharwad, Karnataka. India

ABSTRACT

In most of the day today forensic practice the skeleton will be incomplete and makes gender identification difficult. Many of craniofacial skeletal structures are damaged in mass disasters; natural or manmade, making it difficult to determine the gender. In such cases the skull base and the occipital bone protected by virtue of its anatomical position and packed with large amount of soft tissue, which makes an access for sex assessment. The most conspicuous feature of the cranial base is the large foramen magnum (FM). Length and breadth of the FM was measured using Vernier calipers and the area of FM was calculated. The length, breadth, and area of FM were found to be larger in males than females and were statistically significant. Using discriminant function accuracy of sexing using FM parameters analyzed and found that Morphometric analysis of FM for sex determination should be used only as a supportive finding in estimation of sex of skeletal remains of skull.

Keywords: Forensic Anthropology, Skeletal Remains, Identification, Sex Estimation, Foramen Magnum

INTRODUCTION

Sex determination is one of the first step in the identification of any human skeletal remains discovered in a forensic or archaeological context. In most of the forensic studies the skeleton will be incomplete and makes gender identification difficult. The determination of gender in human skulls is based on morphological differences, mainly on size and prominences of certain structures, which are characteristic to particular ethnic groups and are influenced by genetic, environmental and nutritional factors¹. Many of craniofacial skeletal structures are damaged in mass disasters; natural or manmade, making it difficult to determine the gender. In such cases the skull base and the occipital bone protected by virtue of its anatomical position and packed with large amount of soft tissue, which makes an access for sex assessment. In such cases identification may not be complete, but partial identification by means of sex determination would be of vital importance, which helps in further investigation proceedings. The most conspicuous feature of the cranial base is the large FM (FM); through which cranial cavity communicate with

vertebral canal. Characteristics of FM and cranial base have identifying features for sexing². Significant craniometry differences exist in the FM between two sexes with in a restricted geographical region and historical period.³ As studies of FM dimensions are not common and there is a paucity of literatures available in sexual dimorphism based on FM in Indian populations. Hence the present study is been attempted to determine the presence of sexual dimorphism among Karnataka skulls using the discriminant function analysis.

MATERIALS AND METHOD

The study was carried out in Department of Anthropology, Karnataka University, Dharwad, Karnataka, India. An approval was obtained from the Institutional Ethical Committee of Karnataka University, Dharwad, before conducting this study. The study sample included 264 dry skulls (137 male, 127 female) available in the Department of Anatomy and as well as from the personal bone set collection (Osteological Purpose) of I Year MBBS students, of the

various Medical and Dental Colleges of Karnataka which invariably belong to the same and nearby areas. The data collected after obtaining permission of head of the department of Anatomy of concerned colleges. The sex of the skulls was assigned based on morphological examination of the sexually dimorphic traits described in literature⁴. The adult age of the crania was confirmed based on the closure of sphenooccipital synchondrosis and dentition. The Skulls of dimorphic sex and mutilated or fractured were excluded from this study. The data obtained from the crania were selected on the basis of systematic sampling technique. The following parameters were

studied using the Vernier calliper to the nearest millimetre.

Length or Antero posterior diameter of FM (LFM): Maximum length of the FM as measured from basion to opisthion along the mid-sagittal plane.

Width or Transverse Diameter of FM (WFM): Maximum width of the FM as measured from perpendicular to the mid-sagittal plane.

The data were incorporated in SPSS 17.0 software and analyzed for descriptive statistics and discriminant function.

RESULTS

Table 1: Descriptive statistics: dimensions, area and index of the FM

	Males (n=137)			Female (n=127)			t-value	p-value
	Mean	SD	Range	Mean	SD	Range		
LFM	34.91	3.32	28-48	33.75	3.70	24-48	1.562	0.008
WFM	28.18	2.90	20-38	27.29	3.03	20-35	1.486	0.015
Area(R)	777.36	135.50	471.43-1244.57	728.27	139.84	449.43-1206.86	0.710	0.004
FMI	81.01	7.63	59.46-102.7	81.27	8.42	44.44-108.33	0.373	0.794

LFM :Length or Antero posterior diameter of FM (mm), WFM:Width or Transverse Diameter of FM (mm), FMI-FM Index=LFM/WFM x100, Area(R)-Area from Roual et al(1984) formula =LFMxWFMxδ/4, S.D. - Standard Deviation

Table 2: Classification of skulls using discriminant function Results^a

Sex		Predicted Group Membership		Total
		Female	Male	
Count	Female	63	64	127
	Male	44	93	137
%	Female	49.6	50.4	100.0
	Male	32.1	67.9	100.0

a. 59.1% of original grouped cases correctly classified.

Table I shows the descriptive statistics for the length, breadth, area and the index of the foramen in males and females. The length, breadth, and the area of FM are found to be larger in males than females. However, FM index is marginally higher for females than males. Statistically significant sex differences were observed for the length, breadth, and area of the FM. However sex difference with FM index is statistically insignificant. Overlapping of the male-female values is apparent for the different variables analyzed in the study. The percentage of correctly classified skulls using discriminant function is 59.1% as shown in table 2.

DISCUSSION

The determination of the morphological differences between genders and ethnic groups requires practice and precision. Many a times forensic anthropologist face problem to estimate sex from cranial fragments when only a part of skull is brought for identification. The adult human occipital bone tends to survive inhumation and physical insults more readily than other bones of the cranium. It is therefore logical to examine the occipital region of the human skull for sex and ethnicity differences. Some observers maintain that sexual differences in the occiput are better

described than measured⁵, while others believe that measurements and discriminant functions are useful to a certain degree⁶.

In current study it is evident from the results that males displayed larger mean values than females except for FM index, which is marginally higher in females. Excluding FMI all the variables exhibited statistically significant difference between the sexes. Our findings are consistent with the results reported on British sample⁷ and UNIFESP sample⁸, which show statistically significant differences between males and females for length and breadth. However, in French sample⁹ the length of FM did not reveal significant differences but width showed the significant results. Our findings are in contrast with results reported by them¹⁰, as they did not find statistical significance with length and breadth of FM, However statistical significance was observed with area of the FM and same observation also observed in our study. Our findings are inconsistent with results observed by them¹¹, as they did not find any statistical significance with length, breadth and area of FM. We found that accuracy of sexing from FM in our study is 59.1%, hence sexing of human skull based only FM parameters is low and similar findings notated in the studies from different parts of India¹²⁻¹⁵ have not found the FM measurements to be a reliable in sexing of skulls. These studies however, do not mention the details of analysis for determining the sexing accuracy of the FM measurements.

In contrast to our study, Gapert et al⁷ showed significant differences between men and women classifying 70% of male skulls and 69.7% of female skulls by discriminant function. A recent study from this region¹⁵ has reported a low predictive accuracy of FM length in sex estimation based on BLR analysis while FM breadth was not found to be a useful criterion for sex estimation.

Though we observed significant differences in various parameters of FM in our sample but the accuracy in the classification is lower and most of the researchers are of the opinion that the dimensions of the FM and its area are not a very reliable indicator in estimation of sex of an unknown skull and thus, these should only be used as a corroborative finding along with other qualitative features of the occipital bone, such as the roughness of the nuchal lines, the shape of the occipital condyles, and the characteristics of the external occipital protuberance.

CONCLUSIONS

The length, breadth and area of the FM were found to be significant in assessing sex of human skull but accuracy in estimation of the sex of the skulls using FM parameters is lower. Hence the present study observes that the Morphometric analysis of FM for sex determination should be used only as a supportive finding in estimation of sex of skeletal remains of skull.

ACKNOWLEDGEMENT

We would like to thank all the head of the departments of Anatomy of all medical colleges who have given permission to utilize their museum skulls for our study. We also would like to thank all the students for providing their skull samples for our study.

There were no source of funding for this research study and there is no conflict of interest among authors and the institute.

REFERENCES

1. Saunders, Sr and Yang, D. sex determination: XX or XY from the human skeleton, in Fairgrieve, SI (Ed) *Forensic osteological analysis*, Springfield: Charles C Thomas, 1999 p, 36-59.
2. DURIC, M., RAKOCEVIC, Z. and DONIC, D. "The reliability of sex determination of skeletons from forensic context in Balkans". *Forensic Science International*. 2005, p. 159-164.
3. Joy O, Ahemed E, Gabriel O, Ezon-ebidor E, "Anthropometric study of the facial and nasal length of adult Igbo ethnic group in Nigeria", *Internet J Biol Anthropol* 2009;2(2)
4. Krogman WM, Iscan MY. *The human skeleton in forensic medicine*, 2nd ed. Springfield Illinois: Charles Thomas Publisher, 1986;189-243.
5. Olivier G, *Biometry of the human occipital bone. Journal of Anatomy*. 1975;120: 507-518.
6. Holland TD. Sex determination of fragmentary crania by analysis of the cranial base. *American Journal of Physical Anthropology* 1986;70; 203-208.
7. Gapert R, Black S, Last J. Sex determination from the FM: discriminant function analysis in an eighteenth and nineteenth century British sample. *Int J Legal Med* 2009; 123:25-33.
8. Sauzo GIC, Russo PP, Zavando MDA, Smitl. RL. Sexual dimorphism in FM dimensions. *Int J. Morphol.* 2009; 27(1):21-23.

9. Macaluso Jr PJ. Metric sex determination from basal region of occipital bone in a documented French sample. *Bull Mem.Soc. Anthropol. Paris.*2011;23:19-26
10. Tanuj Kanchan, Anadi Gupta, and Kewal Krishan. Craniometric Analysis of FM for Estimation of Sex World Academy of Science, Engineering and Technology 79 2013
11. Gagandeep Singh and Indu Talwar, Morphometric analysis of FM in human skull for sex determination. *Human Biology Review* Dec:2012; 29-41
12. Routal RR, Pal GP, Bhagawat SS, Tamankar BP. Metrical studies with sexual dimorphism in FM of human crania. *J Anat Soc India* 1984;33:85-89.
13. Sayee R, Janakiram S, Thomas IM. FM measurements of Crania from Karnataka. *J. Anat Soc India* 1987;36:87-89.
14. Deshmukh AG, Devershi DB. Comparison of Cranial Sex Determination by Univariate and Multivariate Analysis. *J Anat Soc India* 2006;55:48-51.
15. Raghavendra Babu YP, Kanchan T, Attiku Y, Dixit PN, Kotian MS. Sex estimation from FM dimensions in an Indian population. *J Forensic Leg Med* 2012;19(3):162-7.

Analysis of Fatal Railway Accidents in District Hospital, South India: A Retrospective Study

Chandru K¹, Rajendra Kumar R², Rudramurthy S³

¹Associate Professor, ²Associate Professor, Dept of Forensic Medicine, Shree Siddhartha Medical College, Tumkur,

³RMO and senior specialist (forensic medicine), District hospital, Tumkur

ABSTRACT

A three year retrospective study of railway related fatal cases was carried out, in district hospital, Tumkur, Karnataka, South India. Fatal railway cases form 4.65 %(total 65 cases) of all autopsies (1398 cases). Victims were predominantly males (46 cases), maximum were in age group of 21-40years i.e. 38 cases. More number of railway fatalities were accidental (86.15 %) followed by the suicidal (13.85 %) in nature. Crush injury involving extremities followed by injury to thorax and abdomen were the most common injuries, shock and hemorrhage being the commonest cause of death.

Keywords: Fatal Railway Accidents, Crush Injury, Decapitation, Public Awareness

INTRODUCTION

A good railway network is an essential indicator for economic development of the country. With increased rail network the deaths associated with it has become inevitable. Indian railways are considered as one of the world's largest railway network containing 1, 15,000 km of track with more than 20 million passengers travelling daily. About 15,000 people die every year trying to cross the tracks of India's mammoth rail network¹. Most of the death occurs at unmanned rail road crossings. Many lives are lost trying to catch running train or fall from railway coaches and lastly due to derailment of railway coaches. Increase in population of the country has led to increase in railway traffic which in turn has contributed to increase in unnatural deaths due to railway mishap². Railway injuries and illness cause an average 3 billion dollars in fatality costs and 650 million dollars in nonfatal incident costs annually¹¹.

Railway fatalities do not raise many medico legal questions, but medico legal expert opinion is sought for logical and fair conclusion as to manner of death and nature of injuries³.

A train accident is defined as "a collision, derailment or any other event involving the operation

of on-track equipment". Fatal railway injury is characterized by extensive disruption of more than one body region⁴.

Railway accidents may be broadly classified into the following groups

- Accidents where the casualties are actually to the people on-board the train.
- Accidents where the people other than on-board are involved.
- Accidents where people on railway premises are involved.
- Collision between train and another vehicle or another train⁵.

Railway injuries are studied under primary impact injuries, secondary injuries and run-overs. Primary impact injuries may be sustained over the front, back or one or the other side of the body. After being hit, if he is thrown clear, he can sustain secondary injuries due to impact against the rail tracks, the ground, rocks or boulders, posts or trees.

If there is run over by train, the injuries are unusually in the form of decapitation, amputations at

various levels, transection of trunk, etc., which can be either instantly fatal, or extensively mutilating. Decapitation alone without the presence of other injuries usually indicates suicide, where-in the victim has laid on the tracks with the neck on one of the tracks, and the rest of the body lying outside the tracks⁶.

MATERIAL AND METHOD

The present study involves study of fatal railway cases brought for autopsy to District Hospital, Tumkur. Study period is for three years. Retrograde study involves collection of data from the Inquest report, post mortem report, relatives of deceased and police regarding the circumstances of death. Subjects for the present study include all age group and sexes. Pattern and distribution of fatal injuries were noted. All the data thus collected were analyzed and findings are presented in this paper.

OBSERVATION

A total number of 65 cases were received for autopsy in deaths due to railway accidents in a period of three years with total autopsies being 1398 cases, which accounts for 4.65% of total cases. 46 railway fatalities (70.76%) were male and remaining 19 cases (29.23%) were female Maximum number of cases was reported in the age group of 21 to 40 years, i.e.; 38 that includes the major working class of people. Males are dominating in all age groups except in old age. Least number of cases was reported in extremes of age group. Majority of railway fatalities were accidental in nature i.e. 56cases followed by suicidal i.e. 9cases. Injuries to thorax and abdomen were predominant followed by extremities and finally injury to head, neck and spinal cord. Cause of death was given as shock and hemorrhage as a result of multiple injuries sustained.

Table 1: Gender distribution in fatal railway injuries

Sl. No	Sex	No. of Cases	Percentage
1	Male	46	70.76%
2	Female	19	29.23%

Table 2. Age wise distribution in railway fatalities

Sl. No	Age Group	No of Cases	Percentage
1	1 TO 20	10	15.38%
2	21 TO 40	38	58.46%
3	41 TO 60	13	20%
4	61 TO 80	04	6.15%

Table 3. Railway fatalities based on age & sex

Sl.no	Age in Years	Male	Female
1	1 TO 20	6	4
2	21 TO 40	32	6
3	41 TO 60	7	6
4	61 TO 80	1	3

Table 4. Type of injuries in railway fatalities

Sl. No	Type of injuries	No of cases	Percentage
1	head and neck	32	49%
2	thorax and abdomen	52	80%
3	upper and lower limbs	54	83%
4	spinal cord	13	20%

DISCUSSION

A total number of 65 cases were received for autopsy in deaths due to railway accidents in a period of three years with total autopsies being 1398 cases, which accounts for 4.65% of total cases. The incidence of railway deaths is less compared to other studies conducted at Surat where 25.79% of cases were railway deaths, studied in one year⁷ and 5.99% of total cases conducted at Nagpur in two years.⁴ Given the fact that tumkur is a small district place 4.65% is a significant number compared to bigger cities. The tumkur railway station forms an important transit place for the trains travelling to northern part of Karnataka as well as north India.

46 railway fatalities (70.76%) were male and remaining 19 cases (29.23%) were female which is in correlation with studies conducted at Gulbarga⁸, khammam² and nagpur⁴. Deaths were predominantly male due to the fact that males travel more in search of work or other personal commitment. Males also indulge more in risk taking like crossing railway track, alighting or boarding moving train and movement over unmanned railway level crossing.

Maximum number of cases was reported in the age group of 21 to 40 years, i.e.; 38 that includes the major working class of people .Least number of cases was reported in extremes of age group. Similar findings were seen in other studies^{2,8,9}. This age(21 to 40) group people involve in more travelling, outstation activities, irresponsible acts like boarding the running train, hanging on to the doors, windows or side bars and travelling on the roof. It is very disappointing that they are the bread winners for their family. Steps have to

be taken to educate frequent travelers about the importance of safe travelling.

Study clearly shows that majority of railway fatal deaths were accidental in nature, i.e. 56 cases followed by suicidal i.e. 9 cases. These findings were in consistent with studies done at Gulbarga⁸, Nagpur⁴, Khammam². Accidental railway deaths were due to injuries sustained while crossing railway tracks, unmanned level crossing accidents, while travelling on footboard near door and boarding running trains.

The study revealed that majority of victims sustained crush injuries to extremities, followed by thorax and abdomen injuries and lastly to head and spinal cord, which is in agreement with studies conducted at Nagpur³. Decapitation and head injury were common among suicidal deaths similar to the earlier study⁹. Crush injuries to the extremities was observed in 54 cases which was due to railway run-over caused by the rotating effect of train wheels. Pedestrians are more prone to traumatic amputation of lower extremities in consistent with other study¹⁰. Injury involving thorax and abdomen (52 cases) were the next commonest findings among the victims. These injuries may be due to primary impact by portions of the engine or bogies. Head injuries are seen in almost half of the cases. These injuries are result of primary impact as well as secondary injuries.

CONCLUSION

India carries one of the largest railway networks in the world and accidents from rail operations may not be unexpected. From the present study we can conclude that maximum victims were males in the working age group who died in accidental manner. Hence these untimely deaths caused mainly by carelessness can be prevented by creating awareness among the people. Public should be educated about the dangers of travelling footboard, boarding and alighting moving train, observing caution while crossing unmanned level crossing. Railway authorities should take strict measures to prevent trespassing by awarding fine or punishment. Pedestrians, passenger over bridges, manned railway crossing, barricading/fencing to avoid trespassing are urgently needed. Public on their part should follow the rules and regulations regarding safety to prevent railway fatalities.

ACKNOWLEDGEMENT

I would like to thank Dr Shivakumar.S, Head of the department, Forensic Medicine, Sri Siddhartha

medical college, Tumkur, for providing valuable guidance during the entire study. I also thank Mrs. Shwetha for providing technical support in bringing out the article.

Source of Funding and Ethical Clearance: Ethical clearance and funding was not necessary as it was a retrospective study which included only collection of data.

Conflict of Interest Statement: The authors declare that there is no conflict of interest.

REFERENCES

1. Nirmala George. Indian Rail Track deaths, www.Huffingtonpost.com; 2012/02/21.
2. Kumar K.M., Roop, Khaja Shaikh. Demographic Profile of Railway Accidents Occurring In Khammam Region- *Indian Journal of Forensic Medicine and Toxicology*, 2013; 7(1): 254-287.
3. K.R.Nagesh, Y.P.Raghavendra Babu. Excavation of Chest due to railway Mishap, *Australian Journal of Forensic Sciences*, 2011; 1-6.
4. Ramesh Manaji Wasnik. Analysis of Railway Fatalities in Central India, *Journal Of Indian Academy Of Forensic Medicine*, 2012; 32(4) : 311
5. Krishan Vij. *Textbook Of Forensic Medicine and Toxicology*, Third Edition; Transportation Injuries: 455-456.
6. V.V.Pillay. *Textbook Of Forensic medicine And Toxicology*, 14th Edition; Medico legal Aspects Of Injuries and death: 210-211.
7. Sheikh.M, Sha.J.V. Study Of Death due To Railway Accident, *Journal Of Indian Academy Of Forensic Medicine*, 2008; 30 (3): 122-127.
8. Patel Basavraj. A study On Pattern of Injuries in Railway Deaths, *Indian Journal of Forensic Medicine and Toxicology*. 2011; 5 (1): 20-22.
9. Manoj Kumar Mohanty. Death due to Traumatic Railway Injury, *Medicine, Science and the law*, Royal Society Of Medicine Journals; April 2007; 47(2): 156-160.
10. Marc.J.Shapiro, William.B.Luchtefeld. Traumatic Train Injuries, *The American Journal Of Emergency Medicine*, Jan 1994; 12(1): 92-93.
11. Ted.R.Miller, John.B.Douglass, Nancy.M.Pindus. Railroad Injury: Causes, Cost and Comparisons with other transport modes, *Journal Of Safety Research*; 1994; 25(4): 183-195.

An Epidemiological Study of Fatal Firearm Cases in Varanasi, UP

Kaulaskar Shashikant V¹, S K Pandey², Pravin N Yerpude³, Manoj Pathak⁴, Keerti S Jogdand⁵

¹Assistant Professor, Dept of Forensic Medicine, Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat,

²Asso. Prof., Dept of Forensic Medicine, IMS, Banaras Hindu University, ³Asso.Prof,Dept of Community Medicine,GAIMS , Bhuj, Gujarat, ⁴Asst. Prof. IMS, Dept of Forensic Medicine Banaras Hindu University,

⁵Asso.Prof,Dept of Community Medicine,GAIMS , Bhuj, Gujarat

ABSTRACT

Introduction: Use of firearm is a worldwide increasing and Varanasi is no exception to this. This is due to increasing number of hijacking, urban terrorism, dacoity, rioting, robberies, smuggling of drugs, political motivation, personal and group rivalry, quarrel over land, Property, caste feuds and the like.

Materials and Method: Fifty four cases of fatal firearm injury has been drawn from the medicolegal autopsies brought to the mortuary of Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, U.P. India, during the period from 1 June,2009 to 30th March 2011 which were studied for a detailed epidemiological and medicolegal analysis.

Results: Out of total 3534 autopsies conducted during the above period, 54 (1.52%) victims had died due to fatal firearm injury. Most of the victims (98.15%) were male. Majority (66.65%) were young adults in the age group of 21-40 years. Most of the victims, (83.33%) of fatal firearm injury were Hindus followed by Muslims (12.96%). The maximum number, 46.3% of victims came from rural areas. The occupational status of most of the victims was agriculture (40.74%) followed by business (31.48%).

Conclusion: Overall incidence of fatal firearm injury is reduced because of legal restriction on license of personal firearms weapon while the incidence of firearm injury due to country made guns are increased which are illegal, easily available and cheap.

Keywords: Epidemiology, Fatal Firearm Cases

INTRODUCTION

Invention of fire was the greatest invention for the human civilization but the invention of firearm has proved to be a curse to this world, it has become the most dreaded killing tool used by human beings to kill them. Though, in western countries, suicidal fatal firearm injury is very common, in region of the world, it is mostly used in the homicide cases only^[1]. Firearms

have passed through continuous evolutionary changes and have been established as the most popular instrument for committing homicide, whether during peace or in war time.

Since guns are recognized as being highly lethal, all assailants who use such weapons were believed by Wolfgang to have been highly determined to kill. Wolfgang proposed the 'weapon substitution hypotheses (1986). This hypothesis posits that the intentions of an assailant, whether they are to kill or injure, determines the weapon selected. For example, if an assailant has a single minded, thoroughly 'determined' intention to kill one's victim, one will seek out the kind of weapon that is most likely to ensure the desired outcome. Because a gun is well recognized

Corresponding author:

Kaulaskar Shashikant

Flat No. G-1, BRJ Tower,Sarpanch Nagar, Malegaon Road, Nanded-431605, Maharashtra

Mobile No: 09423802898

Email id: drkaulaskar@gmail.com

as being a highly lethal weapon, that intent of killing will, if it is available, seek out such a weapon. If a firearm is not available, then this effective weapon will be substituted for the next most available and lethal weapon. This hypothesis suggests that if an assailant did not intend to kill but only harm one's victim, then one would have selected some other less lethal weapon [2].

MATERIALS AND METHOD

The present study comprised of Fatal Firearm injuries drawn from the Medico-legal autopsies held in mortuary of the department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, U.P., India, during period of 1st June 2009 to 30th March 2011, accompanied by sufficient number of relevant persons who were thoroughly interviewed at the time of autopsy on the body of deceased victim of fatal firearm injury. Before the start of the study, ethical clearance was taken from Ethical Committee of IMS, BHU. For the study, relevant questionnaires schedule were prepared to collect various information related to, socioeconomic factors, about incidence of fatal firearm injuries, medico legal crime investigation and evidential data etc. These cases were studied for the history of the cases, their epidemiological characteristics e.g. Age, sex, community character etc. nature, distribution and types of injuries including their medico legal aspect.

The various data relating to the cases were collected from sources as under

- A. Examination of inquest reports and connected papers
- B. Interviewing the police personnel accompanying the cases
- C. Interviewing the relatives, friends and neighbors of the deceased
- D. The autopsy examination paper

RESULTS AND DISCUSSION

Out of total number of 3534 cases which were brought for postmortem examination during the period of study i.e. 22 months from 1.6.2009 to 30.03.2011, 54 (1.52%) cases were declared to be due to fatal firearm injuries (Table 1).

Age and sex distribution of victims of fatal firearm injuries observed that most of the victims (98.15%)

were male and only one victim (1.85%) was female. Over majority (66.65%) were young adults in the age group of 21-40 years. 16.66 per cent victims were of middle age group of 41-50 years (Table 2).

In other studies, autopsies of 89 cases of firearm deaths were conducted in Varanasi area which found that 33.67% cases were from the age group of 31 to 40 years, followed by (28.08%) the cases who came under 21 -30 years [3]. On the basis of religion, most of the victims (83.33%) of fatal firearm injury were Hindus followed by Muslims (12.96%) (Table 3).

As per educational status maximum (27.77%) victims were of secondary school education, followed by graduate (25.92%), illiterate (16.66%), intermediate (12.96%) and post-graduation (9.25%) (Table 4).

The community character of victims of fatal firearm injury reveals that the maximum number, 46.3% of victims came from rural areas followed by suburban areas (31.48%) and urban areas (20.37%) (Table 5). This is more or less similar to the study of Gupta et al who have observed the percentage distribution of community character of the firearm victims and recorded 43.82% rural, 21.95% urban and 17.17% suburban of Varanasi area. The other study showed preponderance of rural (65.86%) over the urban (17.17%) victims in firearm fatalities [4]. However, a small fraction (10.2%) belonged to sub-urban area of Varanasi.

One of the most important parameter is marital status of victims which shows, that majority (64.1%) were married followed by unmarried (18.51%), widower (5.55%), separated (3.7%) (Table 6). Similar study done by Gupta, in their study also found a high rate of married cases amongst the victims of fatal firearm injuries (80.91) [3]. In other study, it was revealed that 62% victims of fatal firearm injuries, were married and 37% victims were unmarried in Delhi [5]. The occupational status of most of the victims was agriculture (40.74%) followed by business (31.48%), labourers (9.25%), services (7.4%) and unemployed (1.85%) (Table 7).

The incidence of firearm casualty indicates that majority (77.77%) of victims came from joint families followed by those from nuclear family type (12.96%) (Table 8).

In case of manner of death in fatal firearm injury, homicide accounted for maximum percentage (81.48%), followed by accident (9.25%), suicide (5.55%) (Table 9).

In case of motive in fatal firearm injury enmity accounted for maximum percentage (38.88%) followed by Property dispute (16.66%), Robbery (12.96%) (Table 10).

Conclusion and recommendations

The overall incidence of fatal firearm injury is reduced as compared to previous studies conducted in this area. Though overall incidence of fatal firearm injury is reduced because of legal restriction on license of personal firearms weapon, the incidence of firearm injury due to country made guns are increased which are illegal, easy available and cheap. In our study we observe enmity was the major motive behind the fatal firearm injury as compared to previous studies conducted in this area in which dispute over landed property was major motive. Police patrolling for early detection of crime and shifting of injured to the hospital/critical care center and provision of prompt ambulance service by state/private hospital or NGOs for medical care is another aspect, which may decline mortality due to such crimes.

To prevent killings, there should be combined effort from all sections of the society.

Following steps should be of help in its prevention

- A) Proper employment facility for the youth.
- B) Social stability and creation of proper political environment.
- C) Strong and effective measures to control the unlicensed arms.
- D) Need to eliminate illegal gun making units in our region in order to decrease the rate of firearm fatalities.
- E) Various law enforcing agencies have to make concerted efforts and be more vigilant on this account in order to accomplish these goals.

Table1: Incidence of fatal firearm injuries in medico legal autopsies (22 months from 1.6.2009 to 30.03.2011)

Total number of autopsies	Fatal firearm injuries	
	Total number	Percentage
3534	54	1.52

Table 2: Age and sex wise distribution of victims of fatal firearm injury

(n=54)

Age group (year)	Male	Female	Number	Percentage
11 to 20	2	-	2	3.7
21 to 30	21	-	21	38.88
31 to 40	15	-	15	27.77
41 to 50	8	1	9	16.66
51 to 60	5	-	5	9.25
61 to 70	1	-	1	1.85
71 to 80	1	-	1	1.85

Table 3:Religion wise distribution of victims of fatal firearm injury.

(n=54)

Religion	Percentage
Hindu	83.33
Muslim	12.96%
Other	Nil
Not known	3.7%

Table 4: Distribution of victims of fatal firearm injury according to their educational status(

n=54)

Educational status	Number	Percentage
Illiterate	9	16.66
Primary	2	3.7
Secondary	15	27.77
Intermediate	7	12.96
Graduate	14	25.92
Post graduate	5	9.25
Unknown	2	3.7

Table 5: Area wise distribution of victims of fatal firearm injury

(n=54)

Area	Number	Percentage
Rural	25	46.3
Urban	11	20.37
Suburban	16	29.62
Unknown	2	3.7

Table 6: Distribution of victims of fatal firearm injury according to their marital status

(n=54)

Marital status	Number	Percentage
Married	35	64.81
Unmarried	10	18.51
Widow	1	1.85
Widower	3	5.55
Divorcee	1	1.85
Separated	2	3.7
Unknown	2	3.7

Table 7: Distribution of victims of fatal firearm injury according to their occupation

(n=54)

Occupation	Number	Percentage
Agriculture	22	40.74
Business	17	31.48
Labourer	5	9.25
Service	4	7.4
Unstable job	3	5.55
Unemployed	1	1.85
Not known	2	3.7

Table 8: Distribution of victims of fatal firearm injury according to their family type

(n=54)

Family type	Number	percentage
Alone	3	5.55
Joint	42	77.77
Nuclear	7	12.96
Unknown	2	3.7

Table 9: Distribution of victims of fatal firearm injury according to their manner of death

(n=54)

Manner	Number	Percentage
Accident	5	9.25
Homicide	44	81.48
Suicide	3	5.55
Not known	2	3.7

Table 10: Distribution of victims of fatal firearm injury according to their motive of death

(n=54)

Motive	Number	Percentage
No	5	9.25
Enmity	21	38.88
Property dispute	9	16.66
Robbery	7	12.96
Damage to prestige	4	7.4
Encounter	3	5.55
Depression	2	3.7
Loan	1	1.85
Unknown	2	3.7

ACKNOWLEDGEMENT

I would like to thanks for the valuable support from Head of Department Dr.(Prof) C.B.TRIPATHI for allows me this study in Department of Forensic Medicine and Thanks to Dr. S.K Tripathi, Prof. Dept. of Forensic Medicine, IMS, Banaras Hindu University, for kind support.

Ehical Clearance: From Ethical Committee of IMS,BHU

Conflict of Interest: None declared

Financial Support: None declared

REFERENCES

1. Patowary AJ. Study of pattern of injuries in homicidal firearm injury cases. JIAFM 2005; 27(2):92-93.
2. Wright JD, Rossi PH. Armed and considered dangerous: a survey of felons and their firearms. New York: Aldine.1986; 12:332-34.
3. Gupta AK. Das Gupta SM, Rastogi BL. Study of Injuries from Firearm in Medico legal Autopsies. Thesis Submitted for the Degree of Doctor of Medicine (Forensic Medicine), Institute of Medical Science, B.H.U., Varanasi, 1979.
4. Das Gupta SM ,Tripathi CB. A Study of the Homicide Cases Occurring in Varanasi Area. Indian Medical Gazette. CXVII (9) 1983; 285-288.
5. Krishna KP. Victims of Homicide: A Study in Personal and Sociocultural Antecedents. Police Research and Development. 1981:11.

Sexual Dimorphism of Cranial Sutures in Maharashtra and North-Karnataka Region

Makandar U K¹, Kaushal Vishuddha M², Rajendra R³, Sharieff J H⁴

¹Associate Professor of Anatomy, A.I.M.S. B.G.Nagar, Belur, Nagamangala, (Tq) Mandya, Dist, ²Assistant Professor of Community Medicine, Geetanjali Medical College Udaipur, Rajasthan, ³Professor and HOD of Anatomy A.I.M.S B.G.Nagar, Belur, Nagamangala, (Tq) Mandya, Dist, ⁴Professor of Anatomy D.M.Wynad Institute of Medical Sciences, Meppadi, Kerala

ABSTRACT

112 dried non-pathological adult crania of known sex were studied from Maharashtra and North Karnataka cranial sutures were traced by sketch pen then transparent butter paper was fixed and suture was traced by micro tipped pen. Each suture was studied in three equal segments and classified into closely widely and straight type of sutures.

Widely serrated sutures were common in male crania of coronal suture and in female crania closely and straight type of suture was common while sagittal suture of male crania also had widely serrated suture but female crania of sagittal suture had only closely serrated type of sutures. Lambdoid suture of male crania had widely and straight type of suture and female crania had closely serrated sutures. The angle between two halves of lambdoid was highly significant ($P < 0.01$) in Female crania. This study will certainly help the Anatomist, Anthropologist and Medico Legal Expert because Morphometric Values of Dermal Bones are uncertain.

Keywords: *Closely Serrated, Widely serrated, Straight Type, Butter Paper*

INTRODUCTION

“Suture” is a Latin word (Sutura=Seam) which is restricted to skull it has mainly three functions Unite the bones while still allowing slight moments. Act as growth areas to absorb mechanical stress. During growing period these sutures contain connective tissues, blood vessels, osteogenic cells to facilitate the oppositional growth of the bone margins to meet at the suture⁽¹⁾ and obliterate at certain age.

Many Criteria are available to differentiate sex of the crania after puberty like length of mastoid process, prominence of glabella, superciliary arches, width of

zygomatic arches, diameter of foramen magnum, depth of digastric groove but least data is available regarding sexual dimorphism of cranial sutures. Moreover evolutionary point of view also sutures developed in the armored jawless fishes since then no mammals show evolutionary progress of sutures⁽²⁾ As our ancestors were cannibolic they approached the tasty brain through normaverticalis. ⁽³⁾ Hence attempt was made to study the sexual dimorphism of the sutures. Medico-legally serrations of the sutures are anomalous to estimate the age of the subject but in our study serrations of the sutures have great significance for sexual Dimorphism.

Corresponding author:

Makandar U K

C/o. A.M Pathan,

Behind S.P Office, Kumbar Galli, Jorapur Peth, Bijapur - 586101 (Karnataka).

E - Mail ID - dr.uk1991@yahoo.com

Cell No. : +91-9341610428

MATERIAL AND METHOD

112 adult, non-pathological crania of known sex were studied from medical colleges of Sholapur and Bijapur. Out of 112, 67 crania were male and 45 were female. Each cranium was put in anatomical position

the coronal, sagittal and Lambdoid sutures were traced by color sketch pen then transparent butter paper was fixed on the crania with the help of rubber band and sutures were traced by micro tipped pen. Each cranial suture was studied in three equal segments from right to left but in sagittal suture anterior to posterior to observe the maximum serrations morphologically and metrically. Sutures were classified under three headings closely serrated, widely serrated and straight type. Breadth of the suture was measured by the vernier caliper. Length and Breadth of the crania was measured by measuring (tailors tape).

OBSERVATIONS AND RESULTS

a=widely serrated, b=closely serrated, c=straight type

Table No. 1 Comparison of coronal suture in both sexes in all three segments.

Segment-I

a= in Males 25 (37.5%) in Females 17 (37.70%)

b=in Males 34 (50.7%) in Female 24 (53.42%)

c=in Males 8 (11.8%) in Female 4 (8.88%)

Segment-II

a= in Males 15 (22.4%) in Females 6 (13.4%)

b=in Males 10 (14.9%) in Female 8 (17.8%)

c=in Males 42 (62.7%) in Female 31 (68.88%)

Segment-III

a= in Males 32 (47.7%) in Females 15 (33.3%)

b=in Males 26 (38.8%) in Female 20 (44.4%)

c=in Males 9 (13.5%) in Female 10 (22.3%)

Table No. 2 – Comparison of Sagittal Suture in both sexes

Segment-I

a= In Males 28 (41.7%) and Female 15 (33.3%)

b= In Males 21 (31.5%) and Female 14 (31.2%)

c= In Males 15 (22.4%) and Female 16 (35.5%)

Segment-II

a= In Males 31 (46.3%) and Female 16 (35.5%)

b= In Males 21 (31.5%) and Female 14 (31.2%)

c= In Males 15 (22.4%) and Female 15 (33.3%)

Segment-III

a= In Males 45 (67.6%) and Female 27 (60%)

b= In Males 12 (17.9%) and Female 8 (17.7%)

c= In Males 10 (14.5%) and Female 10 (22.3%)

Table No. 3. Comparison of lambdoid suture in both sexes

Segment-I

a= In Males 35 (52.2%) and Female 21 (46.6%)

b= In Males 23 (34.4%) and Female 19 (42.2%)

c= In Males 9 (13.4%) and Female 5 (11.2%)

Segment-II

a= In Males 38 (58.7%) and Female 26 (57.7%)

b= In Males 23 (34.3%) and Female 13 (28.8%)

c= In Males 6 (9%) and Female 6 (13.5%)

Segment-III

a= In Males 23 (49.3%) and Female 22 (48.8%)

b= In Males 21 (31.3%) and Female 18 (40.6%)

c= In Males 13 (19.4%) and Female 5 (11%)

Table-4 Comparison between lengths of Nasion toinion which was insignificant ($P>0.01$) pterion to pterion was insignificant ($P>0.001$) and length between bitemporal width was also insignificant ($P>0.01$).

Table-5 The angle between coronal and sagittal, sagittal and lambdoid sutures were insignificant ($P>0.01$) but angle between two limbs of lambdoid sutures was highly significant ($P<0.01$).

Table 1. Comparative study of coronal suture segment in both sexes with %

Segment	Male Crania (67)			Female Crania (45)		
	a	b	c	a	b	c
I	25(37.5%)	34(50.7%)	8(11.8%)	17(37.7%)	24(54.42%)	4(8.88%)
II	15(22.4%)	10(14.9%)	42(62.7%)	6(13.4%)	8(17.8%)	31(68.8%)
III	32(47.7%)	26(38.8%)	9(13.5%)	15(33.3%)	20(44.4%)	10(22.3%)

a= widely serrated

b= closely serrated

c= straight type

Table 2. Comparative study of sagittal sutural segment in both sexes with %

Segment	Male Crania			Female Crania		
	a	b	c	a	b	c
I	28(41.7%)	21(31.5%)	18(26.8%)	15(33.3%)	14(33.3%)	16(33.5%)
II	31(46.3%)	21(31.3%)	15(22.4%)	16(33.5%)	14(31.2%)	15(33.3%)
III	45(67.6%)	12(17.9%)	10(14.9%)	27(60.0%)	8(60.0%)	10(22.3%)

Table 3. Comparative study of lambdoid suture segment in both sexes with %

Segment	Male Crania (67)			Female Crania (45)		
	a	b	c	a	b	c
I	35(52.2%)	23(34.4%)	9(13.4%)	21(46.6%)	19(42.2%)	5(11.2%)
II	38(56.7%)	23(34.3%)	6(9.0%)	26(57.7%)	13(28.8%)	6(13.5%)
III	33(49.3%)	21(31.3%)	13(19.4%)	22(48.8%)	18(40.8%)	15(11.2%)

Table 4. Comparison between (a)length of Inion to Nasion. (b) Pterion to Pterion. (c) Length between bitemporal width in both sexes.

Sl No	Observations	Male crania (67)		Female Crania (45)		
		Mean	SD	Mean	SD	'P' value
a	Inion to Nasion	317.16	20.6	316.55	18.46	P> 0.01
b	Pterion to Pterion	182.01	17.5	182.33	18.7	P> 0.01
c	Bitemporal width	221.41	18.4	224.44	20.9	P> 0.01

All the values are insignificant (P >0.01)

Table 5. Comparison of angle between two limbs of lambdoid suture in both sexes

Male Crania 67		Female Crania 45		T Test Value	P Value	Results
Mean Value	S1	Mean Value	S1			
Highly significant	117.31	16.39	128.66	25.24	1.98	P<0.01

DISCUSSION

In this present study of coronal suture in (Table-1) had more number of widely serrated sutures observed in the male crania, closely serrated and straight were common in female. In sagittal suture (Table-2) widely serrated sutures were common in male crania and closely serrated sutures were common in female crania. In lambdoid suture (Table-3) widely serrated and straight type of suture was common while closely serrated sutures were common in female crania. These findings are more or less in agreement with previous studies but they classified the sutures of the crania into nine types viz closely, more closely, widely,

more widely etc...⁽⁴⁾No English Literature is available to compare the findings of present study. The probable reasons of these finding could be due to gravity of masticatory differences between both sexes because masticatory stress play vital role in the morphology of sutures⁽⁵⁾The regional and genetic factors, might be responsible for such type of sutural development, TWIST and BMP genes enhances the serration of sutures, FGF gene accelerates the closure and suture.⁽⁶⁾but sexual dimorphism and these genes is yet to be established, moreover earlier closure of the sutures in female crania ⁽⁷⁾Could be one of the factor for closely serrated suture in female. Moreover growth of the

cranial suture is influenced by the muscular attachments independently.⁽⁸⁾Hence influence in the weaker muscles of female might have resulted into closely serrated suture. Intracranial contents, intracranial volume and intracranial pressure decide the pattern of suture.⁽⁹⁾Pattern and position of suture is determined before completion of ossification.⁽¹⁰⁾Regarding the pattern of suture it can be hypothesized that, brain was not last organ to evolve, rather brain was clearly a focus for important and stage setting selective postures early in hominoid evolution associated with changes in erect posture.

The angle between the two limb of lambdoid suture significant (Table-5) was highly significant ($P < 0.01$) studied in 1900.⁽¹¹⁾This significance value could be due to migration of neutral crest between the formation of caudal part of sagittal and whole part of lambdoid suture in the Intra uterine life which juxtaposes the two limbs of lambdoid suture to facilitate the normal growth of the brain⁽¹²⁾.

SUMMARY AND CONCLUSION

These significance incidences of widely serrated suture common in male crania and closely serrated in female crania and significant of lambdoid angle in female crania will certainly help the anatomist, anthropologist and medico legal expert but these inferences demand further genetic, Hormonal, Embryological, histological, environmental, nutritional studies because exact mechanism, factors of formation and closure of sutures in both sexes is yet to be established. Due to early obliteration of cranial sutures least attention is paid in the literature, so far.

ACKNOWLEDGEMENT

Author is grateful to Prof. Gaikawad P.G of Sholapur and Prof. Patil B.G of Shri B.M Patil Medical College Bijapur for their kind permission to carry out this research work in their department above all to my beloved Principal Dr Shivramu M.G for his constant encouragement.

Ethical Clearance: Taken from AIMS & RC B.G Nagara, Belur. Nagamangala (TQ.) Mandya (Dist)

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

1. Dixon A.D sarnat B.G – factors and mechanism influencing bone growth, progress in clinical and biological research 1982, Vol. 101,153-59, Newyork.
2. Hartwig W.C – Fractal analysis of sagittal suture morphology. Journal of morphology (1991), Vol. 210, 289-298.
3. Garns and Block.W – The limited nutritional values of cannibalism American Anthropologist (1970), Vol. 72 (1), 106-108.
4. Parez-Parez A, Espur.z – Nan-occlusal dental microware variability in sample of middle and late Pleistocene Human Population from Europe and near east. Journal of Human Evolution (2003), Vol. 44, 497-513.
5. Biswas U.N and Bhattacharya – Sexual Dimorphism of cranial sutures Ph.D. Thesis submitted to Delhi University, (1986).
6. David P.C, Rice Thomas, Abergo Tchany Tangz – Integration of FGF and TWIST in calvarial bone and sutural development. Journal of Development (2000) Vol 127, 1845-1855.
7. Ridson Dz – study of crania and other excavated at tell. Duweir (Lachish) by welcome – mortson Archeological research expedition Biometrika (1902), Vol.1, 99-166.
8. Washburn.S - The study of human evolution. In Dolhinow.P and serich Boston, (1971), 87-117 Brown and company publication.
9. Babler. W.J – Relation of altered cranial suture grown to cranial base and midface. In persing J.A. Edgerton M.R.Jane J.F. Scientific Foundation M.R.Jane Surgical treatment of craniosynostosis, IIIrd edition (1989), 87-95William and wilkins publications Baltionmore publication.
10. Clerk Le gross W - Tissues of the body IInd edition 1945,110, Oxford University Publication.
11. Tidsley M.L – Metrical Study of skull in different races. Biometrika (1900), 9, 176-262.
12. Jiang X, Isekis'Maxon RE, Kay GM – Tissue origins and interactions in mammalian skull vault Dev. Bio, (2002), Vol. 24, 106-116.

Post Mortem and the Risk of HIV Infection

Mukesh Kumar Bansal¹, SK Naik², Poonam Gupta³, Yashoda Rani⁴, BL Sherwal⁵

¹Post Graduate Student, ²Associate Professor, Department of Forensic Medicine and Toxicology, ³Assistant Professor, Department of Microbiology, ⁴Professor, Department of Forensic Medicine and Toxicology, ⁵Director Professor, Department of Microbiology, Lady Hardinge Medical College, New Delhi

ABSTRACT

The present study "Post Mortem and the risk of HIV infection" was conducted upon 200 randomly selected cases having known and unknown identities. (100 each) at the Department of Forensic Medicine and Toxicology and Department of Microbiology, Lady Hardinge Medical College from November 2011-March 2013. Out of 200 cases, 10 (5%) were positive for HIV by ELISA test. Positivity in known bodies was 2% compared to 8% in unknown bodies. Males outnumbered, with maximum prevalence in the Age group of 31-40 years (9.52%). Drug abuse was found in 1(14.28%) case in known bodies and in 8(10.12%) cases in unknown bodies. HIV infection could be detected by ELISA test from 12 hours till 7 days post-mortem.

Keywords: Claimed, Unclaimed Bodies, HIV, ELISA test

INTRODUCTION

The common occupational hazards likely to be encountered in an autopsy room include infections, toxicity and radiation. However, there is more chance of infections than any toxicity or radiation.¹ Streptococcal sepsis, tuberculosis, blastomycosis, AIDS, hepatitis B and C, rabies, tularaemia, diphtheria, erysipeloid fever and certain viral hemorrhagic fevers are some of the serious infections that can be transmitted through these routes.²⁻⁸

The major hazards HIV transmission to pathologists and technical staff in performing autopsies come from skin injuries from sharp instruments and bone spicules, and from inhaling virulent pathogens such as Mycobacteria tuberculosis. Oral and conjunctival infection are also possible but can be prevented by simple barriers. Even prior knowledge of the patients HIV status has not been shown to reduce the rate of percutaneous exposure.

The infectivity of HIV in samples decays slowly with time. This decay in infectivity is variable, depending on environmental and viral factors. In high concentration, HIV may remain infectious upto three weeks.⁹

Most of the unclaimed dead bodies brought to the mortuary of Lady Hardinge Medical College and Smt. S.K. Hospital, New Delhi are either beggar or destitute commonly involved in different kind of drug abuses and sexual activities. Post-mortem examinations over such dead bodies in the past have revealed tuberculosis (which is commonly associated with HIV infection) as a predominant cause of deaths.

The time for which a corpse remains potentially contagious with HIV is controversial. Infectious virus has been recovered from liquid blood held at room temperature for three weeks and virus in high concentration has been found to remain viable for three weeks.^{10,11}

Corresponding author:

BL Sherwal

Director Professor, Department of Microbiology
Lady Hardinge Medical College, New Delhi, India
drblsherwal703@gmail.com
+919868168400

Considering the risk posed by post-mortem dissection of unclaimed bodies at autopsies, the present study is taken to weigh the actual risk pose by HIV during routine dissection of the unclaimed dead bodies compared to claimed dead bodies at medico-legal autopsies.

OBJECTIVES

To screen out HIV infection in all the claimed and unclaimed dead bodies brought for medico-legal autopsies to observe whether the unclaimed dead bodies pose more risk of contracting HIV infection to the persons involved in autopsy works in the morgue at Lady Hardinge Medical College and Associated Hospital, New Delhi.

MATERIAL AND METHOD

All the Unclaimed dead bodies brought to the Department of Forensic Medicine of LHMC and SSKH for medico-legal post-mortem examination are kept preserved in the cold storage of the morgue for at least 72 hours, for possible identification of the dead bodies by near and dear ones/relatives before conducting post mortem examinations, as per the general principle followed by Delhi Police.

This was a Cross sectional study from November 2011-March 2013 conducted in the Department of Forensic Medicine and Toxicology and Department of Microbiology, Lady Hardinge Medical College, New Delhi. All the claimed and unclaimed dead bodies brought for medico-legal autopsies during study period constituted the study population. Exclusion criteria: cases where time of death was not known and Decomposed bodies. 100 cases each were taken.

The selected cases were subjected to standard autopsy procedure. 5 ml of blood sample was collected in plastic test tubes from either femoral vein or cardiac chambers depending upon the availability of blood. The sample was centrifuged at room temperature (4000rpm for 10 min) and serum was withdrawn. If it was not possible due to haemolysis, haemolysed samples were diluted 1:2 or 1:4 in phosphate buffer saline. The blood samples were again centrifuged for 10 minutes and the supernatants were used for analysis. Samples were screened for HIV antibodies by ELISA kit, Microlisa-HIV kit.

RESULTS

A total of 200 cases out of which 100 cases were having known identities and 100 cases having unknown identities. Individuals with unknown identities were mostly beggars, vagabonds residing in central Delhi areas.

Maximum number of cases was found in the age group of 21-30 years, followed by age group of 41-50 years. (Table 1)

Table 1. Age-wise distribution of the cases

Age Group in Years	Known Cases	Unknown Cases	Total
1-10	2	0	2
11-20	7	0	7
21-30	34	15	49
31-40	14	28	42
41-50	22	32	54
51-60	10	16	26
61-70	9	9	18
71-80	2	0	2
Total	100	100	200

In case of known cases, most of the blood samples were collected within 72 hours post-mortem (n=86) whereas in case of unknown cases, all blood samples were collected between 3-7 days post-mortem, after obtaining consent from relatives or concerned police. (Figure 1)

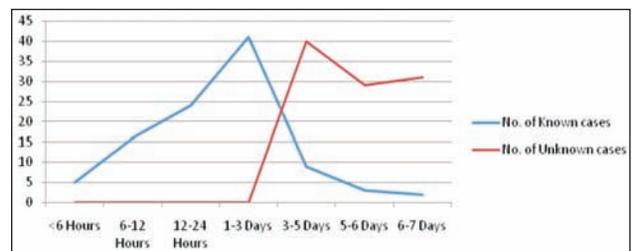


Fig. 1. Post-mortem Duration of Collection of the Samples (Time since Death)

Out of the total 200 cases, 10(5%) cases were found ELISA positive for HIV. Rest 190 cases were found ELISA negative for HIV. Out of the 100 known cases, HIV infection could be detected in 2 (2%) cases whereas out of 100 unknown cases, HIV infection could be detected in 8 (8%) cases. Thus HIV infection was found four times more prevalent among unknown dead bodies than known dead bodies brought for medico-legal autopsies. (Figure 2)

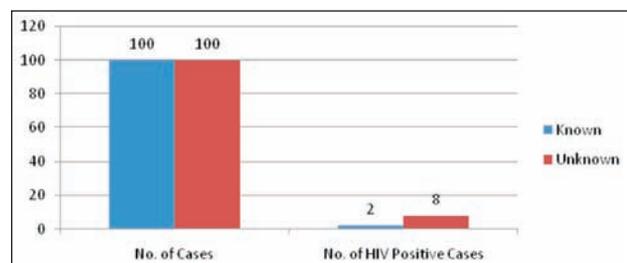


Fig. 2. Distribution of HIV Positive Cases as per the Identity

Prevalence of HIV infection observed in the study was maximum in the age group of 31-40 years (n=4:9.52%) followed by 21-30 years (n=3: 6.12%) and 51-60 years (n=1:3.84%). Age groups of 1-20 years and 61-80 years did not show any HIV positive cases. (Table 2)

Table 2. Distribution of ELISA positive HIV cases as per Age

Age Group in year	Total Autopsy Cases	Positive Cases	Percentage
1-10	2	0	0.00%
11-20	7	0	0.00%
21-30	49	3	6.12%
31-40	42	4	9.52%
41-50	54	2	3.70%
51-60	26	1	3.84%
61-70	18	0	0.00%
71-80	2	0	0.00%

HIV infection could be detected upto 7 days post-mortem that is the maximum period of preservation of dead bodies in the present study. (Figure 1)

In present study, ELISA positive for HIV were found in 10 cases where the post-mortem interval were ranging from 12 hours to 7 days. (Figure 3)

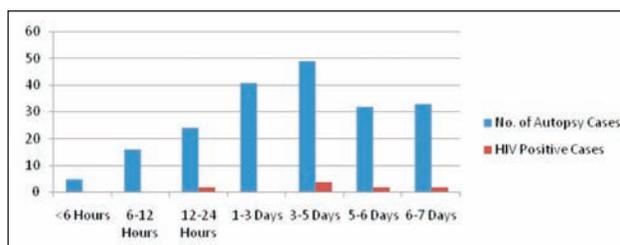


Fig. 3. Distribution of HIV Positive Cases as per Time since Death

DISCUSSION

Hepatitis viruses usually died within 48 hours after death of individual or cooling of the dead bodies. Therefore, possibility of transmission of Hepatitis B infection to the autopsy surgeon or supporting staffs is expected to be about zero percent. Autopsy safety was not much of consideration until 1980's when HIV infection appeared. The concern about contracting an infectious disease during course of an autopsy is great; the concern is heightened when the devastating infections such as HIV that could be transmitted are considered. Mortuaries, dissecting rooms and forensic laboratories are high risk areas for infection and the staff have the risk of occupational exposure to

infectious agents, especially during post-mortem examinations.

Emphasis should be placed on the prevention of infection by establishing "universal precautions, but later to screen out HIV in all claimed and unclaimed dead bodies brought for medicolegal autopsies. ELISA can be the screening test of choice before conducting the autopsy to prevent the exposure of HIV to persons involved in mortuary works. It is easy to perform, adaptable to large number of samples, is sensitive and cost effective. Spread of HIV infection from dead bodies occurs from contact with high risk fluid by a needle or a sharp instrument injury. Limited data is available regarding these risks to forensic medical personnel who are exposed daily to large number of severely traumatized bodies in India¹²

In the present study prevalence of HIV by using ELISA on post-mortem serum samples was found to be 5% (10 positive cases out of 200 cases). A study by Karhunen et al. on prevalence of HIV by using Enzyme immunoassay (ELISA) on post-mortem sera found HIV positive results in 0.12% cases (9 positive out of 7305 cases).¹³ Zhang et al. found 5.6% were seropositive for HIV.¹⁴ Christensen PB et al. in his study on post-mortem blood samples of drug related deaths for HIV, found the prevalence of 4% and similarly Achusi IB et al found 5.8% positive cases (44 out of 754 cases).^{15,16}

The infectivity of HIV in samples decays slowly with time. This decay in infectivity is variable, depending on viral and environmental factors. In high concentration, HIV may remain infectious for upto three weeks.⁹ Post mortem interval during which the blood sample could remain HIV positive had been studied by Nyberg M et al. and Edler C et al.^{17,18} Nyberg M et al. had studied 10 patients with HIV infection in which post-mortem intervals were 1 to 6 days and found positive in 8 cases. Edler C et al. in his study taking samples from 6 HIV positive deceased persons had detected HIV infection in all the samples 24 h post mortem. In the present study, HIV infection could be detected till 7 days post-mortem that was maximum period of preservation of dead body before conduction of autopsy, supporting the study by Nyberg M et al.

HIV infection can reduce the survival period of affected individuals to great extent. In the present study, maximum prevalence of HIV positive cases were observed in the age group of 31-40 years (9.52%) followed by 21-30 years (6.12%) and 51-60 (3.84%). Age

groups of 1-20 years and 61-80 years did not show any HIV positive cases. This could be because positive cases were mostly among unknown individuals who indulged in drug abuse and different kind of sexual activities after puberty as only sources of entertainment and died early because of chronic malnutrition and diseases.

Christensen PB et al. found that in drug related deaths 45% were intravenous drug abusers showing HIV positivity in 4% cases.¹⁵ NACO in 2008 report shows that prevalence of HIV in injecting drug users is 7.2%.¹⁹ Increased prevalence of HIV was seen in the present study is due to more number of drug abuser are either destitute or vagabond who have least knowledge and information about transmission of HIV. Besides they are crippled with poverty, chronic malnutrition, chronic infection in the absence of proper medical attention etc.

Blood was taken as sample because it was easier to obtain and process and there is higher chance of detection of HIV virus as compared to other tissue samples. Blood has maximum chances of detection of HIV virus compared to other body fluids due to its amount and persistence in the blood.

ELISA is the most commonly performed screening test, testing a large number of specimens a day. It is easy to perform, adaptable to large number of samples, is sensitive and cost effective. ELISA has always been the method of choice for screening of HIV in blood tissues during life time or after death.

CONCLUSION

Post mortem testing of HIV infection in Medico legal autopsies can be useful in monitoring the surveillance of HIV-infection in the population. It is convenient and effective "back-up" for epidemiological studies and could be used instead of unlinked anonymous tests from hospital and other similar patient materials. Screening of HIV infection prior to autopsy especially in high risk cases such as unclaimed bodies, drug abusers etc. can alarm to take utmost precautions while conducting autopsy in HIV positive cases. ELISA being cost effective and easy method to screen out HIV infection should be applied on post-mortem blood samples to detect HIV infection prior to autopsy. More studies should be conducted on post-mortem prevalence of HIV infection in relation to its detection with time since death and accidental transmission in health care workers along with viability of HIV virus in dead bodies in Indian scenario.

Acknowledgement: To forensic department and HIV staff

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Cleared from Ethical committee of Lady Hardinge Medical College

REFERENCES

1. Sharma BR and Reader MD. Autopsy Room: A potential Source of Infection at Work Place in Developing Countries. *American Journal of Infectious Diseases*. 2005;1 (1):25-33.
2. Hawkey PM, Pedler SJ, Southall PJ. Streptococcus pyogenes: a forgotten occupational hazard in the mortuary. *BMJ*. 1980; 281: 1058.
3. Goette DK, Jacobson KW, Dotty RD. Primary inoculation tuberculosis of the skin (prosectors paronychia). *Arch. Dermatol*. 1987; 114: 567-9
4. Johnson MD, Schaffner W, Atkinson J, Pierce MA. Autopsy risk and acquisition of human immunodeficiency virus infection: a case report and re-appraisal. *Arch. Pathol. Lab. Med*. 1997; 121: 64-6.
5. Collins CH, Kennedy DA. microbiological hazards of occupational needle stick and sharp injuries. *J. Appl. bacterial*. 1987; 62: 385-40 Shapiro CN. Occupational risk of infection with hepatitis C virus. *Surg.Clin. North Amr*. 1995; 75: 1047-56.
6. Shapiro CN. Occupational risk of infection with hepatitis C virus. *Surg.Clin. North Amr*. 1995; 75: 1047-56.
7. Little D, Ferris JAJ. Determination of human immunodeficiency virus antibody status in forensic autopsy cases in Vancouver using a recombinant immunoblast assay. *J. For. Sci*. 1990; 35: 1029-34.
8. Sadler DW, Pounder DJ, Urquhart FED, Porter-Boveri M. Prevalence of HIV antibody in Forensic cases. *BMJ*. 1992; 304: 1027-8.
9. Draft DGAFMS Memorandum on Draft on cadavers infected with the Human Immunodeficiency Virus. [www.cdapmerrut.nic.in/writereaddata/Documents/Drafts% 20DG% 20Memo-HIV%20Autopsy](http://www.cdapmerrut.nic.in/writereaddata/Documents/Drafts%20DG%20Memo-HIV%20Autopsy) accessed on 20th April, 2013.
10. Knight B. Precautions regarding potential infective conditions. *Forensic Pathology*, 2nd edition, Arnold publication, London, 1996: p. 10-11.

11. Cao Y, Ngai H, Gu G, Ho DD. Decay of HIV-1 infectivity in whole blood, plasma and peripheral blood mononuclear cell. 1993; *AIDS* 7: 596-7.
12. Mehta S, Singh V, Kaur B, Aggarwal OP. Pretesting screening for HIV before conducting Post-mortem examinations. April-June 2012; *14*:2, 70-73.
13. Karhunen PJ, Korvenkontio B, Laaksonen H et al. A Study -Surveillance of Human Immunodeficiency Virus (HIV) Antibodies in Medico legal Autopsies in Finland—Monitoring Early Changes in HIV-Seropositivity Among Risk Groups and Average Population,” *Journal of Forensic Sciences, JFSCA*, 1992;37(5):1261-1268.
14. Zhang Li L X, Constantine NT, Smialek JE. Seroprevalence of parentally transmitted viruses (HIV-1, HBV, HCV and HTLV-I/II) in forensic autopsy cases. *J. Forensic. Sci.* 1993; 38: 1075-83.
15. Christensen PB, Kringsholm B, Banner J, et al. study on Surveillance of HIV and viral hepatitis by analysis of samples from drug related deaths, *European journal Of Epidemiology.* 2006; 21; 383-387.
16. Achusi IB, Obiajulu FJN, Abdulkareem FB, Banjo AAF et al. prospective study- Spectrum of hepatic histopathologic findings in HIV/AIDS patients at autopsy in Lagos University Teaching Hospital (LUTH) ,Oct 2012.
17. Nyberg M, Sunni J, Haltia M. Isolation of Human Immunodeficiency Virus at Autopsy One to Six Days Post-mortem. *Am J Clin Patho* 1990; 94 422-425.
18. Elder C, Wulff B, Schroder AS, Wilkemeyer I, Polywka S, Meyer T et al. A Prospective time – course study on serological testing for human immunodeficiency virus, hep B virus and hep C virus with blood samples taken up to 48 h after death. *Journal of Medical Microbiology.*2011; 60, 920-926.
19. NACO (2008, October) ‘HIV sentinel surveillance and HIV estimation in India 2007: A technical brief.

Fetal Head Circumference: An Important Criterion for Gestational Age Estimation

Sachin Sudarshan Patil¹, Ravindra Baliram Deokar¹, Jyoti Rahul Sul², Sandeep Shivaji Gosavi³,
Varsha Pratik Mahajan⁴

¹Assistant Professor, Department of Forensic Medicine and Toxicology, Seth G.S. Medical College & K.E.M. Hospital, Parel, Mumbai, ²Assistant Professor, Department of Obstetrics and Gynaecology, MIMER Medical College, Latur, Maharashtra, ³Private Consultant in Obstetrics and Gynaecology, Navi Mumbai, Maharashtra, ⁴Private Consultant in Obstetrics and Gynaecology, Indore, Madhya Pradesh

ABSTRACT

Background & Objective: Fetal age estimation is of considerable importance in civil and criminal cases. In addition, accurate fetal age estimation is cornerstone in management of any obstetric and pediatric case. The objectives of the current study were to estimate relation between gestational age and head circumference and also in determining the accuracy of head circumference in estimating gestational age. Another objective was to compare the values with that obtained from previous studies.

Material and method: The present study was conducted in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur for the duration of two years having sample size of 99 fetuses. Head circumference was measured as per standard method and regression analysis was used for analyzing the collected data.

Result: A statistically highly significant linear co-relationship between Head circumference (HC) and gestational age ($r = 0.897$, $p < 0.0001$) was observed.

Conclusion: Head circumference of the fetuses has shown a significant correlation with gestational age, which is suggestive of accuracy of the present study. Thus it is highly dependable & reliable criterion to estimate the gestational age of fetus.

Keywords: Fetus, Gestational age estimation, Head circumference

INTRODUCTION

Fetal age estimation is of considerable importance in civil and criminal cases⁰¹. It plays vital role to support a charge of infanticide to know that the baby was born alive and had a separate existence from the mother and that a wilful act of commission or omission caused its death⁰². In addition, accurate fetal age estimation is cornerstone in management of any

obstetric and pediatric case⁰³. Utility of gestational age estimation for variety of purposes including monitoring the incidence of preterm delivery and intra uterine growth retardation, investigating the potential risk factors associated with preterm birth, constructing prenatal care use indices and evaluating interventions focused on the prevention of preterm labour and delivery⁰⁴.

Fetal head circumference is trustworthy parameter used for fetal age estimation as well as fetal growth evaluation and type of growth restriction (symmetrical or asymmetrical)⁰⁵. The fetal head was first body part used for determining fetal growth using ultrasound⁰⁶⁻⁰⁸. The fetal fronto-occipital head circumference is an integral component of the neonatal indices of maturity. Head circumference can be used as more reliable indicator in assessing fetal maturity in cases in which

Corresponding author:

Sachin Sudarshan Patil

Assistant Professor, Department of Forensic Medicine, Seth G.S. Medical College & K.E.M. Hospital, Parel, Mumbai, Maharashtra.

Contact No. 9757179483.

E- mail: drsach_patil7@rediffmail.com

E- mail: ravideo80@gmail.com

variations in head shape like dolicocephaly, brachycephaly etc adversely affect the accuracy of the biparietal diameter in predicting gestational age⁰⁹. The objectives of the current study were to estimate relation between gestational age and head circumference and also in determining the accuracy of head circumference in estimating gestational age. Another objective was to compare the values with that obtained from previous studies⁰⁵.

MATERIAL AND METHOD

The present study was carried out in the Department of Forensic Medicine and Toxicology, Indira Gandhi Govt. Medical College, Nagpur, Maharashtra for the duration of two years. Present study consisted of 99 fetuses which were obtained from the labor room, womb of deceased pregnant women & fetuses brought for medicolegal postmortem examination. An inclusion criterion consists of fetuses more than 10 weeks of gestation and fetuses with anencephaly excluded from the study. Last menstrual period and ultrasonography report were used for intrauterine Gestational age of foetus. The Fetal head circumference was measured with the help of measuring tape in centimeters. Fetal head circumference was measured in horizontal plane at fronto-occipital level passing through glabella and above supra orbital ridges anteriorly and external occipital protuberance posteriorly¹⁰.

The data obtained were analysed statistically using SPSS (Statistical package for social sciences, Version 8.0). Head circumference obtained with reference to each case was statistically compared with the gestational age. Statistical significance was defined at the 0.05 level.

OBSERVATIONS

The present study was carried out in Department of Forensic Medicine and Toxicology, in this Medical College, for the duration of two years. Total 99 cases were studied for estimation of fetal age out of which 45 were males, 50 were females and 04 cases were of unrecognizable sex.

In the present study, observations were made from 11 weeks to 37 weeks (Mean ± SD, 24.67 ± 6.87) of intrauterine life (IUL). Out of the measured head circumference from 99 subjects the minimum value for head circumference was 5.7 cm and the maximum value of 35.5 cm (Mean ± SD, 21.62 ± 7.48)

Table no 1. Distribution of cases according to gestational age and Head circumference.

(n=100)

Gestational age (Weeks)	Number of cases	Head Circumference	
		Range	Mean
11	04	5.7-7	6.13
12	00	—	—
13	02	8.3-8.4	8.35
14	02	9-9.3	9.15
15	06	9-12.4	11.38
16	00	—	—
17	02	9.5-13	11.25
18	00	—	—
19	07	13-35.5	21.14
20	06	16-19	17.25
21	03	18-19	18.67
22	09	17-20.5	18.74
23	03	17-19.5	18.67
24	03	18.4-21	19.3
25	07	21-25.5	22.34
26	02	22-23	22.5
27	06	22-28.4	23.65
28	03	22.3-25.5	23.67
29	08	23.5-27.6	25.75
30	05	25.5-30	28.32
31	05	26.5-30.8	28.78
32	02	29.3-31	30.15
33	02	28.5-30.5	29.5
34	03	31-33.5	32.3
35	05	29-31.4	30.42
36	00	—	—
37	04	30.5-32.4	31.38
38	00	—	—

Maximum number of fetuses were present in 22 weeks consisting of 9 cases followed by 8 cases which were present in 29 weeks and no cases were present in 12, 16,18,36 and 38 weeks. The mean Head circumference progressively increased with increase in gestational age.

Statistical analysis of the study

The head circumference values were used as the dependent variable to calculate the gestational age of fetus. The resulting linear regression equation in the form of $y = ax + b$ (where, 'y' is head circumference; 'x' is actual gestational age in weeks; 'a' is the slope of regression line and 'b' is the intercept of the regression line) were:

$$y = 0.9049x - 1.084.$$

Conflict of Interest: None.

Source of Support: Self.

Ethical Clearance: Institutional ethical committee clearance of Indira Gandhi Govt. Medical college, Nagpur, Maharashtra.

REFERENCES

1. Bardale R., Sonar V. Assessment of Gestational Age from Hand and Foot Length. *Indian Journal of Forensic Medicine and Pathology*. April -June, 2008, Vol.1, No.2:47-51.
2. Kumar GP, Kumar UK. Estimation of gestational age from hand and foot length. *Medicine, science and law*, 1993; Vol.33, No.4, 48-50.
3. Joshi K S, Marahatta S B, Karki S, Tamrakar S, Shrestha N C. Fetal foot length and femur/foot ratio: significance in Nepalese context. *NJR* July-Dec 2011, Vol no 1, Issue no 1, 15-22.
4. Alexander G. R., Tompkins M. E., Cornely D. A., Gestational Age Reporting and Preterm Delivery, *Public Health Reports*, 1990; Vol. 105, No. 3: 269-275.
5. Quddus S. R., Correlation of Fetal Head Circumference with Menstrual Age in Bangladesh, *Bangladesh journal of Ultrasonography* 2004 Vol. 11 Np. 2.
6. Donald I, Brown T.G., Demonstration of tissue interfaces within the body of ultrasonic echo sounding. *Br.J. Radiol*, 1961; 34; 539-546.
7. Willocks J., Donald I., Duggan T.C., Day N. Fetal cephalometry by ultrasound. *J. Obstet. Gynaecol.Br. Cwlth*.1964; 71:11-20.
8. Campbell S. An improved method of foetal cephalometry by ultrasound. *J. Obstet. Gynaecol.Br. Cwlth*.1968; 75:568-576.
9. Hadlock F. P., Deter R. L., Harrist R. B., Park S. K., Fetal Head Circumference: Relation to Menstrual age, *American Journal of Roentgenology*, 1982; 138:649-653.
10. Kurniawan Y S, Deter R L, Visser G H A., Predicting head circumference at birth: a study in Dutch population using the Rossavik growth model. *Ultrasound obstet gynecol* 1995; 5: 123-128.
11. Davidson S., Sokolover N., Erlich A., Litwin A., Linder N., Sirota L. New and Improved Israeli Reference of Birth Weight, Birth Length and Head Circumference by Gestational Age: A Hospital-Based Study. *IMAJ* 2008; 10:130-134.
12. Archie J.G., Collins J.S, Lebel R.R. Quantitative Standards for Fetal and Neonatal Autopsy. *Am J Clin Pathol* 2006; 126: 256-265.
13. Fok T F, So H K, Wong E, Ng P C, Chang A, Lau J, Chow C B, Lee W H, Updated gestational age specific birth weight, crown-heel length, and head circumference of Chinese Newborns. *Arch Dis Child Fetal Neonatal* 2003; 88:229-236.
14. Aryal DR, Gurung R, Misra S, Khanal P, Pradhan A, Gurubacharya SM Intrauterine Growth Curves for Singleton Live Babies in Paropakar Maternity and Women's Hospital in Nepal. *J Nepal Health Res Counc* 2012 Jan; 10(20):160-6.
15. Ghosh S et al, Intra-uterine growth of north Indian babies, *Pediatrics*, 1971; vol.47, No. 5:826-830.
16. Usher R, Mclean R. Intrauterine growth of live born Caucasian infants at sea level: Standards obtained from measurements in 7 dimensions of infants born between 25 and 44 weeks of gestation. *J Pediatr* 1969; 74:901-910.
17. Campbell S. Fetal head circumference against gestational age. In Sanders R, James AE eds. *The principles and practice of ultrasonography in Obstetrics and gynecology*. New York: Appleton-Century-Crofts, 1980: 454.
18. Hoffbauer H, Arabin PB, Baumann ML. Control of fetal development with multiple ultrasonic body measure. *Contrib Gynecol Obstet* 1979; 6:147-156.

A Study on Pattern of Injuries due to Railway Accidents Occuring at Khammam Region - Andhra Pradesh

Roop Kumar KM¹, Udaypal Singh², Satya Sai Panda³, Shaikh Khaja⁴

¹Assistant Professor, Department of Forensic Medicine, Sri Venkateswaraa Medical College and Research Center, Ariyur, Puducherry, India, ²Professor and Head, ³Professor and Head, Great Eastern Medical School and Hospital, Srikakulam, Andhra Pradesh, ⁴Professor, Department of Forensic Medicine, Mamata Medical College, Khammam, Andhra Pradesh, India,

ABSTRACT

Accident is an unexpected, unplanned occurrence which may involve injury or it may be defined as an unpremeditated event resulting in recognizable damage. Railway related injuries are not those uncommon occurrences in forensic practise. Among the varied presentation of injuries, superficial injuries along with fractures were commonly observed. Proper history taking along with performance of meticulous autopsy following standard protocols is mandatory to resolve the cases associated with railway traffic related deaths. Public awareness linked with strict legislative control is the key for the prevention of railway related injuries and deaths.

Keywords: Railway Accidents, Pattern of Injuries, Deaths, Preventive Measures

INTRODUCTION

The well-developed Indian Railway system is playing a pivotal role in the development of the country's economic as well as in the domestic transport system. The Indian Railways have been a great integrating force of transportation and freight carriage in the country for the past 15 decades. Subsequent to the ever increasing railway traffic the accidents related to the railway transportation are also on the increasing front, hitting hard on the victims physical, psychological and financial status, when they meet with Railway injuries. Even though the Railway lines were laid some distance away from the dwelling places, the principle reason for the Railway accidents is fast urbanization, leading to enormous extension of residential as well as industrial infrastructure in the vicinity of Railway tracks. In a few cases a determined suicide victim will deliberately lie across the railway track or even place his/her head so that self – destruction is inevitable¹, other reasons for death may be a train and automobile accident, a collision between trains or passengers hanging out of compartment doors who are hit by posts, trees or electrical poles

and outbreak of fire in a running train^{2,3,4}. The Railway accidents present with a vast variety of injuries which are often very difficult to assess as to their patterns at the postmortem examination. Certain features such as wheel marks on the body, dirt and grease contamination and the manner of severance of tissues deserve special observation to rule out criminal violence^{1,5}. In this present study, an effort has been made to analyze various patterns of injuries due to the railway fatalities occurring in Khammam region of Andhra Pradesh.

MATERIALS AND METHOD

The present study was undertaken during August 2006 to July 2007 under the jurisdiction of Khammam Railway Police Station limits. A total number of 62 cases were studied during the said period. The data was collected from the visiting the scene of incidence, hospital case records, police records, post-mortem reports and by interviewing the victims and their attendants. The data was tabulated in a pre-tested proforma and the results were analysed using appropriate statistical methods.

OBSERVATION

Railway related deaths accounted to 8.7% (62) of total 653 unnatural deaths where autopsies were performed during the period August 2006 to July 2007 at Khammam town.

Of a total number of 62 cases, fatalities following the incident were resulted in 57 cases (91.9%) and only five of the victims survived, amounting to (8.6%). Among the afore mentioned cases, 51 (82.3%) cases the victims died on the spot, 3 (4.8%) cases within one day, and in another 3 (4.8%) cases the victims succumbed to death within two days.

With regard to the history related to the sequence of events occurred, only in 16 (25.8%) cases there are witnesses, whereas the first hand information regarding the incident was not available in 46(74.2%) cases.

The railway accidents presented with a bizarre range of injuries ranging from simple abrasions to a complex range of fractures and crush injuries, a brief account of various patterns of injuries are highlighted in the following paragraphs

Abrasions, being the most common pattern of injuries were found in all the 62 (100%) cases, of which Grazed abrasions were present in 49 (79%), while Impact abrasions were seen in 13(20.9%) cases.

Lacerated injuries are found in 55(90.3%) cases, of which 23(41.0%) cases have split lacerations whereas, in 16(28.5%) cases avulsions were noticed. 10(17.8%) cases showed tears and in 7 (12.5%) cases stretch lacerations were observed.

Among the other patterns observed, contusions were found in 59(95.2%) cases, crush injuries were present in 36(58.1%) cases, and traumatic amputations were seen in 21 (33.9%) cases. With regard to bony injuries, individual fractures as well as multiple bone fractures were observed. In 4(6.5%) cases only Skull is fractured. Skull, Ribs and Limbs fractures were seen in 14(22.6%) cases, of which 9(14.5%) cases showed fractures of Skull and Limbs, while 7 (11.3%) cases revealed Spine fractures, 6(9.7%) cases presented with isolated Limb fractures. 6 (9.7%) cases presented with combined fractures of Skull, Ribs, Limbs and Pelvis. while another 6(9.7%) cases revealed mixed fractures of Skull, Spine, Ribs, Limbs and Pelvis. Fractures involving Skull, Spine, Ribs and limbs were found in 3 (4.8%) cases and rib and limbs fractures were seen in

2(3.2%) cases, while 2(3.2%) cases revealed Skull, Spine and Limbs fractures. In one (1.6%) case Skull and Ribs fractures were noticed and only one (1.6%) case presented with combined fractures involving Skull, Spine and Ribs. In another one (1.6%) case, Spine, Ribs and Limbs were fractured.

Visceral injuries contributed for the fatal outcome in 53(85.4%) cases. Among the notable visceral injuries Brain injuries alone contributed for fatality in 12(19.4%) cases, followed by brain, lung, liver injuries in 8 (12.90%) cases, isolated spinal cord injuries were noted in 5(8.1%) cases and combination of Brain, Lung, Liver and Kidney were injured in 4 (6.5%) cases, while 3 (4.8%) cases revealed total visceral injuries. Other visceral injuries noted include those of brain and lungs in 2 cases, brain, lung, heart, liver and kidneys in 3 cases, brain, spinal cord, lung and liver in 2 cases, brain, lung, heart, liver spleen and kidneys in 1 case, brain spinal cord liver and kidneys in one case, brain and spinal cord in one case, liver, spleen and lung in one case, lung, liver, spleen and kidneys in one case while involvement of all organs except pancreas, stomach and intestines was observed in one case. One case revealed injury of all visceral organs except spinal cord, stomach and intestines and involvement of all organs except brain, involvement of all organs except stomach, intestines and heart were the other noticeable findings in one case each.

Haemorrhage, both external and internal was a consistent finding that was noticed in all most all cases. Internal bleeding was observed in 48(77.4%) cases, while intracranial, intrathoracic and intraperitoneal was noticed in 26 cases (41.9%), intra cranial bleeding in 14 cases (22.6%), intra thoracic and intraperitoneal in 3 cases (4.8%), intracranial and intraperitoneal bleeding in 2(3.2%) cases, intracranial and intra thoracic bleeding was noted in 2(3.2%) cases and isolated intra peritoneal bleeding was a conspicuous finding in only one (1.6%) case.

The cause of death could be established with a reasonable accuracy in 55 cases (88.7%). 44(80.0%) cases appeared to have died due to injury to vital organs, 7(12.7%) cases due to decapitation, 3(5.4%) cases due to combination of both of the above factors and in one (1.8%) case, the cause of death was hemi section of the body. 5(8.0%) cases survived the death

Regarding the manner of death, most of the cases were accidental amounting to 44(71.0%) cases and 18(29.0%) cases were suicidal. A slight male

preponderance was observed in the incidence, with a male to female ratio of 2.87:1.

As for as the position of the victim at the time of incident to the direction of train is concerned, it has been observed that 7(43.8%) cases were crossing the railway track while train approached them, in 6(37.5%) cases victims slipped from running train and while in two (12.0%) cases victims were hit while walking along the side of the track. Position of the victim could not be assessed in 46(74.1%) cases and one (6.3%) case was found lying over the railway track.

DISCUSSION

Accident is an unexpected, unplanned occurrence which may involve injury or it may be defined as an unpremeditated event resulting in recognizable damage. Deaths have occurred in association with railways since the inception of railway industry⁶ The present study enlightens that the railway accidents amounting to around 8.7% of the total unnatural deaths occurring in the region which is quite significant when compared to the studies conducted by Gargi et al⁷ where the percentage was only 5.41. This finding is probably because of the increased frequency of railway transport in the region. Only 8.6% victims survived the incidents indicate the threshold of the railway injuries which are mostly incompatible with life.

The sequence of events that occurred at the time of incident was known only in 25.8% of cases which speaks about the array of problems that these cases pose to forensic expert and indicates that these are the cases which requires lot of imagination and subject back ground to solve them. To get a clear idea about the mechanisms of wounding in these cases demand a good grip over the aspects of mechanical forces which are possible in such incidents.

As with many other transportation injuries, the abrasions were the commonest injuries which were found in all the cases because frictional forces play a pivotal role in the wounding in railway injuries. This finding is consistent with the opinion of many authors such as Mukherjee J.B⁸, Gradwohl etc⁹. Least number of abrasions [9.18%] was found on the head, probably because this part of the body is the least accessible structure during these mishaps. However the combination of abrasions and lacerations formed the

largest group of injuries irrespective of what so ever the manner of death amounting to 45.57%. This fact indicates blunt force is the major element contributing to the injuries in the railway mishaps. Among the lacerations, split lacerations are occupying the top of table amounting to 41%, followed by avulsions and stretch lacerations indicating the sustained blunt forces acting over the affected regions. This fact is in compliance with the study conducted by Amarjith singh et al¹⁰.

Traumatic Amputations involving the limbs was a consistent finding manifested in 32.2% of cases. Crush injuries were seen in 61.2% of cases which is again a quite significant finding of this study. These findings indicate the combination of heavy mass and high velocity which will be present in the railway accidents.

In the railway accidents, most of the victims had fatal injuries over the head which correlates with the findings of other authors^{11, 12, and 13}. In majority of cases 67.7% skull is fractured either singly or in combination with other bones, single bone / single region fractures are not commonly seen in this study rather multi regional fractures were quite common. These findings indicate that multiple wounding forces will act simultaneously on different regions of the body at the given moment of time which is also seen in other transportation injuries, similar findings were observed by Lerer et al¹² in their study conducted in 1997.

As for as visceral injuries were concerned, individual organ injuries were found but rare. Multi organ involvement was quite common. Isolated brain injuries were seen in 19.45 of cases while rest of the cases were related to multi organ involvement. Internal haemorrhage was common and consistent finding noticed in 77.4% cases of which combination of intracranial, intra thoracic and intra peritoneal haemorrhages was seen in 41.9% of cases. These findings indicate that shock following haemorrhage is an important cause of death among these cases.

Cause of death though could be established in majority of cases still in 3.2% cases it was not possible to establish the cause of death due to various factors like lack of history, severe mutilation of the body, large post-mortem interval etc.,. The rarest pattern of injury observed in the current study was hemi section of the body, seen in one case.

Regarding to manner of death, most of the cases were accidental in nature amounting to 71%. These figures shows that the carelessness of the public , ignorance , overcrowding of trains and disobedience to the rules of the safety framed .Correction of these factors are expected to bring down the railway related fatalities to a maximum extent .Most of the accidents were occurred due to fall of the victims from a running train as observed in 37.5% of cases .This finding indicates the potential danger of foot board travel as well as smoking, speaking on phone or standing near the door of a running train. These findings are consistent with the study conducted by Lerer and Matzopolis¹¹. Though suicidal deaths stood second to accidental deaths and were reported in 29% cases. In this modern era where there is struggle in each and every step of life and increased stress for early settlement little failures combined with other factors compel the victim to take decision for ending his life ,this corresponds with other studies undertaken by Lerer et al¹¹, Cina .S.j, et al¹⁴ ,Pelletier et al¹⁵. These findings are consistent with the study conducted by Amarjith singh et al¹⁰. If the person lie down on the track then there will be extrusion of organs, traumatic amputation of the limbs or trunk or decapitation may occur, wheel marks, dirt and grease contamination may be found on the body¹⁶.

In spite of various measures taken by the railway department to reduce the railway related deaths / injuries like displaying sign boards , construction of overhead pathways , manned crossing levels , advertisement in electronic media , frequent announcement of upcoming trains at railway stations most of the victims fail to comply¹⁷.

CONCLUSION

Though it is possible to prevent most of the railway related injuries and deaths, unfortunately still they are quite common incidents in the modern days, A part from the measures taken by railways we suggest Public education and awareness program directed at school age children and people are necessary ,improved surveillance system , sophisticated engineering, regarding safety like automatic doors with electronic sensor devices ,very strict vigilance regarding trespassing over the tracks ,strict law enforcing with more effectiveness and more research on various aspects may help reduce the fatalities .

ACKNOWLEDGEMENT

I extend my due gratitude to the following with whose help I completed this study

1. Almighty, 2.Entire Departmental staff, 3.Railway police department [GRPS] Khammam, 4.Authors of text books and journals, 5.Mortuary staff and 6.To the victims of Railway fatalities.

Conflict of Interests: Nil

Source of Funding: Self

Ethical Clearance: Approved by the Ethical committee

REFERENCES

1. Text book of Forensic medicine and Toxicology Principles and practices -5th Edition, Krishnan Vij. Page no .301-303.
2. Principles of Forensic medicine including Toxicology, Apurba nandy -3rd Edition -2010,Page no 473-475.
3. H.W.V Cox – Medical Jurisprudence and Toxicology by Bernard Knight -5th Edition -1987 Page no 309-311
4. Text book of Forensic Medicine and Toxicology – V.V.Pillay -14th Edition ,Page no 210
5. Sarvesh Tendon , Ajay Aggarwal , Sharma K I and Das gupta P S .-Suicide simulating homicide – A Rail way Track mystery ,a case report journal of Karnataka medicolegal society 2001 ;10(2):60-62
6. Davis G.G.,Alexander B and Brissie R M (1997) A 15 year review of railway –related deaths in Jefferson County , Alabama . Am.J.Forensic Med.Pathol.18,363-8.
7. Gargi.J, GoreaRJK and Chanana A: Death due to railway injuries, a 5 years study JFMT Vol.,No.1 and No.2 Jan .Jun 1990 pp 19 to 26
8. Mukherjee B
9. Gradwohl's Legal medicine –Wounds and trauma –page no 289
10. Amarjith singh,-Pattern of injuries and manner of death in alleged Railway accident deaths.2001
11. Lerer LB. and Matzopoulos R.G. Fatal Railway injuries in Cape Town, South Africa AMJ Forensic Med. Pathol Jan: 18(2) 144-7.
12. Strauch H .,Wirth I and Geserick G (1998) Fatal accidents due to train surfing in Berlin . Forensic sci.int .94,119-27

13. Kejlaa G (1990) Fatal accidents at train intersections in Denmark .Ugeskr Laeger 152 (1),22-5
14. Cina S.J ,Koeipin J.L Nichols C.A and Conradi S E (1994) A decade of train –pedestrian fatalities .
15. Pelletier A .(1990) Fatal death among rail road trespassers .The role of alcohol in fatal injuries .JAMA 277,1064-6
16. K.S.N Reddy (2008)Essentials of Forensic medicine and Toxicology (27th edition) Hyderabad Page no –253
17. Basavaraj patil – A study on pattern of injuries in Railway deaths – Indian journal of forensic medicine and Toxicology. Jan- June ., 2012 , vol .6 ,No.1. Page no .71-73

Pattern of Railway Fatalities in Western Vidarbha Region of India

SN Hussaini¹, AA Mukherjee², PA Wankhede³, AS Rahule⁴, SV Tambe⁵, MSM Bashir⁶

¹Assistant Professor, ²Associate Professor in Department of FMT GMC Akola, ³Assistant Professor in Department of FMT MGIMS Sewagram, ⁴Associate Professor, ⁵Assistant Professor in Department of Anatomy GMC Nagpur, ⁶Associate Professor in Department of Pharmacology, RIMS Adilabad

ABSTRACT

The study was carried out to understand the epidemiology of railway fatalities and injuries which may help in reducing such incidences. It was carried out in Akola region from January 2011 to December 2012. The data was obtained from medico-legal post mortem reports, police inquest report and other relevant documents. Among all the post mortems, 4.5% of cases belonged to railway fatalities. Males (89.65%) were the major victims. The common age group was 21-40 years (51%). Majority of victims died on the spot (91.37%) and a large number of victims identity was not established (29.31%). Cause of death in most of the victims was shock due to hemorrhage as a result of multiple injuries (67.24%). We conclude that most of the incidences are accidental in nature with young adult male predominance. Negligence of safety norms, poor medical facilities, illegal vendors and beggars are some of the factors for incidences.

Keywords: Postmortem Cases, Railway Fatalities, Unclaimed Bodies

INTRODUCTION

Railway since its inception in India in 1853⁽¹⁾ has spread its reach and network throughout country connecting all major cities, states, ports and also with neighboring countries. It has become largest public transport system in the world, and in our country it serves as second largest transport system for public as well as goods⁽²⁾.

In modern way of life accidents and injuries are inescapable but most of the times we think about vehicular or road traffic accidents although fatalities due to railway is also not negligible especially in those areas and cities where railway traffic is higher. Trains are often involved in accidents which injure the

passengers, bystanders of railway tracks and platform. Accident prone spots, unmanned crossing and railway tracks passing through the city limits which are usually not covered by fencing further worsens the situation.

Akola is one of the major and important city of Western Vidarbha regions of Maharashtra India, which connects western India to central as well as eastern parts of country through railway. Because of this reason railway traffic is more in this region which results in more incidences of railway mishaps and fatalities at this junction. The study was carried out to focus and understand the epidemiology of railway fatalities and pattern of injuries so that suggestion can be drawn on the basis of study which may help in reducing incidences as well as damages to human life.

Corresponding author:

Sayed Numan Hussaini

Assistant Professor

Dept. of Forensic Medicine, Government Medical College, Akola (MS)

Email: numan_hussaini2009@rediffmail.com

rahuleanil@yahoo.co.in

Mob: 9673899621

MATERIAL AND METHOD

It was a retrospective study which was carried out in the department of Forensic Medicine and Toxicology Government Medical College Akola. All the cases from the period; January 2011 to December 2012 (two years) were included in the study. Present study includes all cases of railway fatalities brought by railway police

and other police stations of Akola during the study period.

The data for study was obtained from medico-legal post mortem reports, police inquest report and other relevant documents of each individual case. Age, sex, type, pattern and distribution of fatal injuries were noted. In unidentified bodies age and sex was determined and other data are recorded with the help of police records.

RESULTS

A total of 2570 autopsies carried out during the study period from Jan 2011 to December 2012. Among all the cases, 116 cases (4.5%) were of railway fatalities. There were 104 males and 12 females. The male to female ratio was 8.6:1. It was observed that maximum number of victims were in age group of 31-40 years (26.72%) followed 21-30 years (25%) and the combined figure in age group 21-40 years was 51.72% of cases (Table-1).

Table 1: Age wise distribution of cases

Age Group	Number of Cases	Percentage
0 - 10	03	2.28
11 - 20	04	3.44
21 - 30	29	25.0
31 - 40	31	26.72
41 - 50	19	16.37
51 - 60	15	12.93
61 and above	15	12.93

We found fatalities due to accidental or suicidal in nature. Most of the cases were of accidental deaths 109 (93.96%) while least number of cases belonged to suicidal deaths 7 (6.34%) and not a single cases of homicidal death was observed. Most of the victims were unidentified 82 (70.69%) and only few victims can be identified 34 (29.31%). We also observed that majority of victims died on the spot 106 (91.37%) and hospital deaths were only 10 (8.63%). Seasonal variations were not seen in the pattern of death as in all the seasons significant differences were not observed (Table-2). It was observed that commonest involved region was head (54.31%) followed by upper and lower limb (63.79%) thorax (43.9%) abdomen (38.7%) and spine (21.5%) table-3. We found majority of victims died due to sustenance of multiple injuries (67.24%) followed by cranio-cerebral injury (22.41%) table-4.

Table 2: Seasonal variations

Season	Number of cases	Percentage
Summer	40	38.48
Rainy	41	35.34
Winter	35	30.17

Table 3: Major site of injuries

Body region	No. of cases	Percentage
Head	63	54.31
Upper and Lower limb	74	63.79
Thorax	51	43.9
Abdomen	45	38.7
Spine	25	21.5

Table 4: Cause of death

Type of Injury	No. of cases	Percentage
Multiple Injuries	78	67.24
Cranio-cerebral	26	22.41
Decapitation	7	6.03
Transection	5	4.31
Total	116	100

DISCUSSION

Out of 2570 autopsies carried out during study period of which 4.51% of the cases were of railway fatalities. Almost similar trends of railway fatalities were also observed in various parts of India. Wasnik in eastern Vidarbha (central India) region found 5.99% autopsies related to railway fatalities in two year period from January 2001 to December 2002 ⁽²⁾. Mohanty MK et al ⁽³⁾ found 9.1% railway related deaths in two year study period from January 2000 to December 2001 in Berhampur region of eastern India. But substantially high numbers of cases were observed by Sheikh MI et al ⁽¹⁾ in Surat region of western India as during one year period 25.79% cases belonged to railway related injuries. We cannot pin point the unusually high number of cases observed by Sheikh MI al but probably since it is one of the busiest railway station in India and about 200 trains pass per day from this station in which almost one lack people travel daily from this station. Moreover, the station is hardly 1.5 Km from the institute and situated in the centre of the city ⁽¹⁾. The present study also revealed that fatalities by railway occur throughout year without any seasonal variations. As far as our study is concerned our both the findings are consistent with other studies ^(2,3).

Railway fatalities are seen mainly in males (89.65%) as compared to females (10.34%). Wasnik found male predominance as male to female ratio was 8.62:1⁽²⁾. Mohanty et al⁽³⁾ also reported male predominance as 79.5% were males and 20.5% were females in their study. Similar trends were also seen in other countries as Cina et al⁽⁴⁾ and Schmidtke⁽⁵⁾ found male predominance. Male predominance over females is because of fact that males are the earning members of most of the families and they are involved in most of the out station activities which exposes them to risk of an accident more than females similar findings are reported by other workers also.

Maximum numbers of victims of railway fatalities were in the age group of 21 to 40 years (51.72%). Similar findings were observed by other researchers Shikh MI et al in Surat⁽¹⁾, Wasnik in Nagpur⁽²⁾ Mohanty et al in Berhampur⁽³⁾ and Pathak et al in Vadodra⁽⁶⁾. The reason for this is that individuals in this age group are the young adults at the peak of their physical and mental capabilities which make them to take unnecessary risk by boarding in running trains hanging on doors of trains when trains are overcrowded.

Present study shows that amongst all railway fatalities the commonest manner was accidental (93.96%), followed by suicidal deaths. Similar findings are also reported by other researchers^(1, 2, 7). This may be due to fact that most of the railway fatalities occurs at railway tracks or railway stations seen amongst the passengers or among the poor or homeless they stays either at platforms or by the side of railway tracks. Often they are exposed to accidental railway injuries.

It was observed that majority of victims died on the spot because of sustainance of severe type of injuries and also because of poor medical facilities at railway stations, in trains and insufficient ambulance services at railways stations. Our findings are supported by other studies^(2, 3, 8, 9). It was also noted that amongst victims of railway fatalities, a large number of victims' identities were not established (29.31%). Our findings are in agreement with the findings of others studies⁽¹⁾. This is because of reason that in our country most of the poor, beggars and homeless having some chronic illness or handicappers who do not have any family or relatives they spent their lives by begging in trains or platforms and sometimes they met with an accident. Since there no data of such homeless people, establishment of identity becomes difficult.

The study also shows that the most commonly affected body region was head (54.31%) followed by lower and upper limbs (63.79%). It was noted that maximum number of victims died due to hemorrhagic shock following severe injuries to vital or (67.24%) followed by cranio-cerebral injuries (22.41%). This may be due to fact that fatal railway injuries are devastating characterized by extensive damage to more than one body region or organ. Findings of our study are supported by the findings of other similar studies^(1, 2, 8).

CONCLUSION

We conclude that most of the incidences are accidental in nature with young adult male predominance. Negligence of safety norms, poor medical facilities, illegal vendors and beggars are some of the factors for incidences. The number of railway fatalities can be brought down by combined efforts by passengers and railway authorities. Passengers must follow some of the safety laws regarding boarding, getting down from trains, and use of foot over bridges at railway stations etc. Railway authorities must take some steps to prevent the accidents by taking of safety measures. Railway tracks within city limit should be surrounded by compound wall or fencings. Railway stations and railway platforms should be kept free of beggars. The railway police must have adequate communications with all other police stations of state and other state especially in cases of missing persons, so that it helps in establishing the identity of unidentified victims.

Conflict of Interest: Nil

Source of Funding: Nil

Acknowledgement: Nil

Ethical Clearance: Obtained

REFERENCES

1. Sheikh MI, Shah JV, Patel R. Study of death due to railway accident. Journal of Indian Academy of Forensic Medicine 2008; 30 (3): 122-127.
2. Wasnik RN. Analysis of railway fatalities in central India. Journal of Indian academy of Forensic Medicine 2010;32(4): 311-314.
3. Mohanty MK, Panigarhi MK, Mohanty S, Patnaik KK. Death due to traumatic railway injury. Medicine Science and Law 2007; 47: 156-160.

4. Cina SJ, Koelpin JL, Nichols CA, Conradi SE. A decade of train-pedestrian fatalities: Charleston experience. *J Forensic Sci* 1994; 39: 668-73.
5. Schmidtke A. Suicidal behaviour on railways in FRG. *Soc Sci Med* 1994; 38: 419-26.
6. Pathak A, Barai P, Mahajan AK, Rathod B, Desai KP, Basu S. Risking Limbs and Life- Railway fatalities in Vadodara: (A Retrospective Study). *Journal of Forensic Medicine and Toxicology* 2009; 26(1): 54-58.
7. Lerer LB, Matzopouosetal. Fatal Railway injuries in Cape Town South Africa. *American Journal of Forensic Medicine and Pathology* 1991; 18(2): 144-147.
8. Sabale PR, Mohite SC. Railway fatalities in South west Mumbai. *Medico-legal update* 2010; 10(I): 36-39.
9. Rautji R, Dogra TD. Rail traffic accidents: A retrospective study. *Medicine Science and law* 2004; 44 (1): 67-70.

A Study on Estimation of Stature from Foot Measurements

Kazi S A K¹, Aadamali A Nadaf², Vijayachandra³, B G Shalawadid⁴

¹Associate Professor, Dept. of Anatomy, ²Assistant Professor, Dept. of Forensic Medicine, ³Prof. & Head, Dept. of Anatomy, ⁴Prof. & Head, Dept. of Forensic Medicine, Karnataka Institute of Medical Sciences(KIMS) Hubli, Karnataka

ABSTRACT

Stature is an important measure of physical identity. The identification of an individual from mutilated body remains is a challenge in Forensic practice. It is of vital importance in estimating stature of unknown individual, especially when portions of body parts are available like in disasters. It has been established that the dimensions of lower extremities show greater association with the body height than those of upper extremity. There is a scarcity of literature on the estimation of stature from foot length and foot breadth among various Indian populations. Hence this study was undertaken in this part of Karnataka, study group comprised of 173 individuals between 17 to 22 completed years. There were 85 male individuals and 88 female individuals for the examination. The data is subjected to stepwise linear regression and correlation statistical tools applied using SPSS Software. The present study has established significant correlation between stature and foot length and also derived regression equations. It is observed that higher strength of correlation between height and LFL in males and combined RFL and LFL in females.

Keywords: Stature, Foot Length, Forensic Anthropology

INTRODUCTION

Stature is the height of person in upright posture. It is an important measure of physical identity. The identification of an individual from mutilated body remains is a challenge in Forensic practice. Most often a foot is brought for identification of an individual in mass disasters; natural or manmade. In such cases identification may not be complete, but partial identification by means of estimation of stature would be of vital importance, which helps in further investigation proceedings. For estimation of stature, more emphasis has so far been laid in the study of long bones which involves tedious and time consuming process of cleaning and preparing bones for examination. Ossification and maturation of bones of foot occur earlier than the long bones and height would be more accurately predicted from foot measurement as compared to that from long bones.¹ It has been established that the dimensions of lower extremities show greater association with the body height than those of upper extremity². There is a scarcity of

literature on the estimation of stature from foot length and foot breadth among various Indian populations³. Hence in this study an effort is made to find out correlation between foot dimensions with stature and to derive regression formulae to estimate height from the foot length in this part of Karnataka.

MATERIALS AND METHOD

The current study was conducted in the department of Anatomy, Karnataka Institute of Medical Sciences Hubli during the period from September 2011 to November 2011. The ethical clearance was obtained prior to the conduction of this study from ethical committee of KIMS Hubli. The relevant data collected from 173 medical students - 88 females and 85 males, after taking informed consent, whose age range is between 17 years and 22 years, and are born and residing in Karnataka. The data regarding, the right foot length (RFL), left foot length (LFL), right foot breadth (RFB), left foot breadth (LFB), and the Height of the individual students were collected.

For the feet lengths before measuring the length it is ensured that both the feet are firmly placed on a flat surface, both feet bearing the body weight evenly. The length is measured between most backward and prominent part of the heel (pternion) and the most distal part of the longest toe of the foot (acropodion). For the feet breadths distance between the most prominent point on the inner side of foot (metatarsal-tibiale) and the most prominent point on the outer side of foot (metatarsal- fibulare). Foot dimensions are measured using sliding calipers.

Stature is measured as the distance between vertex and floor. It is measured by making the individual to stand erect in barefoot against the wall, both feet kept

close together and the hands hanging down on the sides, and measured using standard measuring stands.

The individuals with abnormal heights and foot deformities were excluded from the study. Data was tabulated and analyzed as per standard statistical methods using SPSS software.

OBSERVATIONS AND RESULTS

The study group comprised of 173 individuals between 17 to 22 completed years. There were 85 male individuals and 88 female individuals for the examination.

Table No.1: Height, foot length and breadth, correlation coefficient, regression coefficient and value of constant in males and Females

SI No	Statistical Data	Male	Female
1	Total Number (173)	85	88
2	Mean height(cm)	168.6094	154.7386
3	SD of Height	6.68753	5.47692
4	Mean of foot dimensions		
	a. Right foot length	25.5682	22.6568
	b. Left foot length	25.4835	22.7341
	c. Right foot Breadth	9.8306	8.6625
5	d. Left foot breadth	9.7259	8.5920
	Correlation Coefficient (r)		
	a. Height and Right foot breadth	0.789	0.815
	b. Height and Left foot Breadth	0.803	0.813
6	c. Height and Right foot breadth	0.312	0.314
	d. Height and Left foot Breadth	0.317	0.324
	Regression Coefficient(b)		
	a. LFL	3.69 and R square 0.645	
7	b. RFL and LFL	2.341 and 2.098, R square 0.683	
	Value of constant (a)	74.530	54.008

Table No. 2. Model Summary, Correlation between Stature and foot length in Males and females

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
Male	0.803 ^a	0.645	0.641	4.00625	0.645	151.063	1	83	.000
Female	0.815 ^b 0.826 ^c	0.6650.683	0.6610.675	3.189753.12171	0.6650.018	170.4964.790	11	8685	.000.031

a. Predictors: (Constant), LFL. b. Predictors:(Constant), RFL. c. Predictors:(Constant), RFL,LFL

After splitting sex groups, the stepwise linear regression and correlation statistical tools applied using SPSS Software. Table No1, Show a descriptive analysis. Among males, mean height was 168.6094, and mean values of RFL, LFL, RFB and LFB were 25.5682, 25.4835, 9.8306 and 9.7259 respectively. Among females, mean height was 154.7386, mean values of

RFL, LFL, RFB and LFB were 22.6568, 22.7341, 8.6625 and 8.5920 respectively. The S.D for height was 6.68753 and 5.47692 for males and females respectively.

After stepwise linear regression of height on RFL, LFL, RFB and LFB, the statistical analysis results in our study showed in Table No 1 &2, "LFL" showed

significant correlation in stature estimation with R square value 0.645, (r) value of 0.803, (a) value of 74.53, (b) value of 3.692 for male individuals. Among the females it was combined "RFL and LFL" which showed the higher correlation with R square value 0.645, (r) value of 0.815 for RFL and 0.813 for LFL, (a) value of 54.008, (b) value of 2.341 for RFL and 2.098 for LFL. As depicted in table No 2, R square coefficient of determination will tell us strength of relationship between height and other variables. Thus higher the R square value is the better model. Thus based on above statistical values following equations for males and females are derived:

$Y = a + bx$ for males and $Y = a + (b_1 x_1 + b_2 x_2)$ for females

Y- height of person, a-constant, b-Regression coefficient, x- LFL in males, b₁- Regression coefficient for RFL in females, b₂- Regression coefficient for LFL in females, x₁- RFL in females and x₂- LFL in females.

$Y = 74.53 + 3.692 * (X)$. {MALES}

$Y = 54.008 + (2.341 * X_1 + 2.098 * X_2)$. {FEMALES}.

DISCUSSION

Various studies have been conducted on estimation of stature from the human skeleton and there are various methods to estimate stature from the bones but the easiest and reliable method is by regression analysis⁴. In our study we studied 173 sample size (85 males and 88 females) from Karnataka. Table No 1 shows the descriptive analysis along with correlation coefficients between various parameters, between height and foot dimensions. The correlation coefficients between height and foot length indicate the foot length provides highest reliability and accuracy in estimating stature of a person. We found that in case of males there is higher strength of correlation between height and LFL and combined RFL and LFL in females. Also significant correlation was obtained for male individuals with 0.803 height and LFL, whereas in females it showed significance of 0.815 and 0.813 for height with RFL and LFL respectively. For gender estimation our study did not show any significance with foot dimensions. Height estimation using long bones has been attempted by many researchers and have derived own formula for calculating height. However a foot measurement has not frequently been used for this. It was Rutishauser who for the first time showed that reliability of

prediction of height from foot length was as high as that from long bones and derived a regression equation by inserting the value of foot length in the equation $y = a + bx$ ⁵.

Study by Hilmi Ozden, Turkey, 2004⁶, showed highest correlation was found in length measurements, which corresponds to our study. Similar to our study a study by Sultan G. Sanli, Turkey, was carried out to estimate relationship between hand length, foot length and stature using multiple linear regressions based on sample of adult male and female residing in Adana, Turkey. Sample size was 80 males and 75 females aged 17-23 years;. The all possible multiple linear regression models for both genders were tested and were found to the best model.⁷

Foot prints study involving 200 subjects (100 males and 100 females), at Mangalore, Karnataka, India was studied and in this study, correlation coefficient (r) of 0.698 in males, 0.738 in females and 0.848 in the combined data was obtained between the height and foot print length of the subjects. The standard foot print length obtained was 23.55 Cms. The accuracy of sex determination by this method is reported to be 80%,⁸ compared to our study it is 64.5% in male and 68.3% in females.

References and further reading may be available for this article. To view references and further reading you must purchase this article.

Similar findings were observed in his study⁹ the measurements of foot length and stature were taken from 250 medical students (125 males and 125 females) aged 18–30 years. General multiple linear regression model was highly significant ($P < 0.001$) and validated with highest values for the coefficients of determination $R_2 = 0.769$ and multiple correlation coefficient $r = 0.877$.

A study in Gujarath by them¹⁰, comprising of 278 males, 224 females medical students the correlation coefficient between height and foot length was +0.65 in males and +0.80 in females which was most significant and similar findings were observed in our study. In their study¹¹, the differences of the foot length between the genders were found to be highly significant. A positive correlation between height and foot length was observed in both sexes and it was statistically significant. Regression equation for stature estimation was formulated using the foot lengths for both sexes. The results indicated that foot length

provides an accurate and reliable means in estimating the stature of an unknown individual and same kind of results are obtained in our study.

The present study supports the results of study by them⁴ in that the correlation coefficient between height and foot length is +0.688 in males and +0.587 in females, which were highly significant.

From above facts, it is clear that if either of the measurement (foot length or total height) is known the other can be calculated and this is of practical use in medicolegal investigations and in Anthropometry.

CONCLUSION

The present study has established significant correlation between stature and foot length and also derived regression equations. It is observed that higher strength of correlation between height and LFL in males and combined RFL and LFL in females. It is of vital importance in estimating stature of unknown individual, especially when portions of body parts are available like in disasters. In such cases either of foot is available then using equation derived in this study one can able to establish stature of person, which would be useful for Forensic experts and Anthropologists. There are lot of variations observed in different studies in establishing stature from foot dimensions among different regions and race. Hence it is suggested to conduct more studies among people of different ages, regions and ethnicity so that stature estimation becomes more reliable and identity of an individual is easily established.

ACKNOWLEDGEMENT

We profusely thank Dr. M V Muddapur, professor and consultant statistician, S D M Dental College Dharwad, Dr. Raviraj. K G Assistant professor of Forensic medicine, Vydehi Institute of Medical Sciences Bangalore, and Dr. Promd B Gai, Professor of anthropology and Director of KIDNAR Karnataka University Dharwad, for providing their knowledge in this study. Our thanks also goes to the medical students of our college who were part of this study as subjects and the valuable comments of anonymous reviewers and editors, contributed to this script.

No authority/agency has funded for this study and
Conflict of Interest: Nil.

REFERENCES

1. Tanuj Kanchan, Ritesh G. Menezes, Rohan Moudgil, Remneet Kaur, M.S. Kotian, Rakesh K.Garg. Stature estimation from foot dimensions. *J Forensic Sci Int.* 2008; 179: 241.e1-241.e5.
2. Ozaslan, A.et al. Estimation of stature from body parts. *Forensic science International* 2003; vol 132,p 40-45.
3. Sen J, Ghosh S, Estimation of stature from foot length and foot breadth among the Rajbanshi: an indigenous population of North Bengal. *Forensic Science International* 2008, 181(1-3); 55e1-6.
4. Mansur DI et al, Estimation of Stature from Foot Length in Adult Nepalese Population and its Clinical Relevance, *Kathmandu Univ Med J* 2012;37(1):16-19
5. Ingrid H. E. Rutishauser. Prediction of height from foot length: Use of measurement in field surveys. *Arch. Dis. Childh.*, 1968; 43, 310.
6. Hilmi Ozden, Yasemin Balci et al., Stature and sex estimate using foot and shoe dimensions. *Forensic Science International.* 147; 2004, 181-184.
7. Sultan G. Sanli, Ozkan Ogz, et al. Stature estimation based on hand length and foot length. *Clin. Anat.* 2005, 18:589-596.
8. Oberoi Devesh V, Kuruvilla Ajee PhD, Saralaya K M,M.D., et al., Estimation of stature and sex from foot print length using regression formulae and standard foot print length formula respectively. *Journal of Punjab Academy of Forensic Medicine & Toxicology*; 2006, Volume: 6; Print ISSN: 0972-5687.
9. Arun Kumar Agnihotri MD et al., Estimation of stature by foot length. *Journal of Forensic and Legal Medicine*; Volume 14, Issue 5, July 2007, Pages 279-283
10. Patel S.M., Shah G.V., Patel S.V. Estimation of Height from measurements of foot length in Gujarat region. *Journal of the Anatomical Society of India.* Vol. 56, No. 1 2007-01 – 2007-06
11. I Ilayperuma1, BG Nanayakkara2, et al. A model for reconstruction of personal stature based on the measurements of foot length. *Galle Medical Journal*, Vol 13: No.1, September '08,

A Study of Ligature Mark in Deaths due to Hanging in Warangal Area, Andhra Pradesh

Bharathi Rama Rao¹, V Chand Basha², K Sudhakar Reddy³

¹Assistant Professor, ²Professor, ³Professor & HOD, Department of Forensic Medicine and Toxicology, Bhaskar Medical College, Yenkapally (V), Moinabad (M), R.R.Dist., Andhra Pradesh

ABSTRACT

Back ground: Death due to hanging is one of the most common forms of suicide in most parts of the world. It is the commonest method of suicide in India, Canada, second most common method in USA and most common method of suicide in men in UK. The incidence of suicide in all metropolitan cities in India is on the rise. Their magnitude is also quite significant among the total number of deaths.

Aims & Objectives: To evaluate the types of hanging, the pattern of ligature mark and the type of material used as ligature in relation to the ligature mark.

Material and Method: The study is done on dead bodies that were subjected to post-mortem examination. The study included 100 cases out of 108 cases selected from both the sexes for statistics.

Result: The total of hanging deaths is 6.9%. The male to female ratio is 2:1 remains unaltered from previous studies. Age group is 21 years to 40 years. Rural area 54% outnumbered the sub-urban 24% and urban area 22%. Low socio economic status 65% ranged over middle class 25% and higher income 10%. Typical hanging is seen in 22 cases and atypical hanging in 88 cases. Partial hanging is seen in 68 deaths where as complete hanging is seen in 32 deaths. The ratio of male to female 2:1. Ligature mark impression prominent in 94 percent deaths. In 6 cases ligature mark was faint.

Conclusion: Suicidal atypical hanging deaths are common. Ligature mark is prominently seen and Ligature Material was whatever available in the surroundings- rope, electric wires, loop of trousers, nawar patti, neck threads bed sheets, dupatta, sari etc.

Keywords: *Suicides, Hanging, Ligature mark and Ligature material*

INTRODUCTION

Hanging is the most common method of suicide because of painless death and easy availability of the ligature material at the surroundings. Suicide is a major socio-economic and public health issue worldwide. Hanging is one of the 10 leading causes of death in the world, accounting for more than a million

deaths annually^{1,2}. In India, hanging is the second common method of committing suicide after poisoning^{3,4, and 5}. Their magnitude is also on the rise in Warangal area of Andhra Pradesh. Hanging is that form of asphyxia, which is caused by suspension of the body by a ligature around the neck, the constricting force being the weight of the body⁶. If the body completely suspends from above and is called Complete hanging. When some part of body touches the ground, it is called Incomplete or Partial hanging⁷. The presence of ligature mark is more prominent in many cases depending upon the type of material used. Ligature mark is more prominent with plastic ropes, jute ropes and electric wires compared to soft materials like chunni and sari. In hanging the

Corresponding author:

Bharathi Rama Rao

Department of Forensic Medicine and Toxicology,
Bhaskar Medical College, Yenkapally (V), Moinabad
(M), R.R.Dist., Andhra Pradesh.

E-mail: dr.bharathi1011@gmail.com

ability to appreciate the external signs, particularly the ligature mark plays a vital role. Hence a proper observation and study of ligature mark is necessary, which is the characteristic hallmark of hanging^{8,9}. An attempt is being made to study the correlation between the ligature mark and the material producing it along with the external and internal features in the neck in cases of hanging.

MATERIAL AND METHOD

The present study is done on those dead bodies which are subjected to post-mortem examination in the mortuary of The Department of Forensic Medicine and Toxicology, Kakatiya Medical College, Warangal, Andhra Pradesh. In all 108 cases out of which 100 cases were selected from both sexes. Inquest reports, statements made by the relatives at the scene of offence were collected from the police.

RESULTS

The total numbers of autopsies done in the mortuary of Kakatiya Medical College, Warangal between 2006 to 2009 were 4733, out of which the total number of autopsies done on cases of hanging were 306(6.46%). A detailed study of 100 cases of death due

to hanging were analysed with special reference to ligature mark and material. Overall, the age group 21-40 years accounted for the maximum number of cases, the Male: Female ratio being 2:1. When the type of hanging was analysed, typical hanging cases were about 22(22%) and atypical hanging cases were about 78 (78%). When the posture of the body was analysed in partial hanging, cases with the feet touching the ground were 46 (46%), cases in sitting posture were 5(05%) ,cases in kneeling posture were 12 (12%) and cases in lying posture were 05 (05%). Analysis in relation to the nature of the ligature material showed 27 cases out of 100 cases(27%) where the ligature material was soft, 63cases out of 100 cases (63 %), where the ligature material was firm and in 10 cases out of 100 cases (10%), the nature of ligature material was not known. The Ligature Mark (Ligature impression) was prominent in many cases as seen in 94% deaths. In addition to ligature marks the presence of other injuries, out of 100 cases, in 56 cases (56%) contused abrasions were present, out of which 20 cases had contused abrasions on platysma muscle and 11 cases had contused abrasions on the strap muscles of the neck (sterno-mastoid, sterno-hyoid, sterno-thyroid etc.,). Fracture of Thyroid cartilage and Hyoid bone were seen in 3cases.

Table No.1: Total No of Hanging Deaths

Year	Total No of Autopsies	Total No of Hanging Deaths	Percentage
2006	1536	96	6.25%
2007	1596	102	6.39%
2008	1601	108	6.74%

Table No.2: Type of Hangings

Type of Hanging	Sex	Complete Hanging	Footing	Kneeling	Sitting	Prone	Supine
Typical	Male	4	8	1	1	1	0
	Female	3	2	1	0	1	0
Atypical	Male	20	24	5	2	1	0
	Female	5	12	5	2	2	0

Table No.3 Ligature Materials

Ligature Material	<10 y	11-20y	21-30y	31-40y	41-50y	51-60y	61-70 y	> 71 y	Total
Coir rope	0	2	3	3	2	1	0	1	12
Plastic rope	0	8	7	10	8	3	3	0	39
Sari / Chunni	0	6	3	3	3	2	0	0	17
Bed sheet	0	1	2	5	1	1	0	0	10
Electric wire	0	0	1	1	1	1	0	0	4
Waist / Sacred thread	0	0	1	3	1	2	0	0	7
Ladder rang	1	0	0	0	0	0	0	0	1
Others	00	10	21	2	2	2	00	00	10

Table No 4: Characters of Ligature mark

Ligature mark	<10 y	11-20y	21-30y	31- 40y	41-50y	51-60y	61-70 y	> 71 y	Total
Contused Abrasion	0	11	9	18	9	7	1	0	55
Imprint Abrasion	1	6	10	8	8	3	2	1	39
Faint Abrasion	0	1	1	1	1	2	0	0	6

Table No.5 Internal injuries in the neck region

Internal Injuries in neck under ligature mark	<10 y	11-20y	21-30y	31-40y	41- 50y	51-60y	61-70y	> 71y	Total
Contusion of Sub-Cutaneous tissue	0	4	3	5	6	2	0	0	20
Contusion of Neck Muscles	1	3	3	3	1	0	0	0	11
Paler Band under Ligature mark	0	11	14	17	10	10	3	1	66
Cervical spine injury	0	0	0	0	0	0	0	0	0
Hyoid / Thyroid Fracture	0	0	0	2	1	0	0	0	3

DISCUSSION

Out of total number of autopsies, percentage of hanging cases was 6.4%. This is similar to the study conducted by Sheikh et al¹⁰. Majority of the deceased were found to be in the age groups of 20-40 years^{5,9,11}. The most vulnerable sex was Male –the male: female ratio being 2:1. Incidence of female sex was more in the adolescent age group, owing to the early physical and mental maturity and the influence of emotional factors^{9, 11, and 12}. In our present study it was found that partial hanging was the cause of death in 68% of the cases, while the rest of the 32% cases were complete hanging^{9, 12, 14, and 15}. This finding is in conformity with the well accepted fact that partial hanging is mostly suicidal in nature. Most of the male victims (63%) preferred firm material, while other types of ligature materials such as bed sheet, woolen muffler or belt were used by the rest of the male victims (5 or 11.35%), similar with observation of Sharma B R et al⁹. In this study, the ligature mark (pattern) was prominent in many cases as seen in 94% of deaths. In the rest of the cases the ligature mark was faint and needed careful examination, but the absence of the ligature mark cannot exclude the use a firm material. Hence presence of ligature mark has positive value but its absence has no negative value, because the imprint of pattern over skin depends on a number of factors like the texture of the material, the design of pattern, the area of contact, the time of suspension, the type of hanging etc. In this study, during the dissection of the neck, pale bands were found under the course of the ligature mark in 56%of cases. Contusions of the platysma were found in 20%, contusions in the strap muscles of the

neck in 11% of the cases and fracture of thyroid and hyoid bone were noticed in 3% of cases^{16,17,18,19,20}.

CONCLUSION

High incidence of suicidal hanging in the middle age group, especially the males impose huge economic burden on the families of the victims. A careful examination of neck in suicidal hanging cases is of great importance in ascertaining the ante-mortem character of lesion and to exclude the possibility of murder. A visit to the scene of offence should be done to corroborate the findings of post-mortem examination. A well designed comprehensive programme is needed to identify the causative factor and for the prevention of suicidal behavior.

ACKNOWLEDGEMENT

I wish to express my deep sense of gratitude to Dr. Dudaiah M.D, Professor and the then Head of the Department of Forensic Medicine and Toxicology, Kakatiya Medical College, Warangal for his guidance and suggestions in carrying out this study. Further, I express my sincere regards to all the staff members of The Department Of Forensic Medicine and Toxicology, Kakatiya Medical College, Warangal for their co-operation and help.

Conflict of Interest: This is to certify that there is no conflict of interest.

Ethical Clearance: Not applicable.

Source of Funding: Own.

REFERENCES

1. Toro K, Krostof I, Keller E. Incomplete decapitation in suicidal hanging- report of a case and review of the literature. *J For Leg Med* 2008; 15(3): 180-184.
2. Brock A, Griffiths C. Trends in Suicide by method in England and Wales, 1979- 2001. *Health Stat Quart* 2003; 20: 7-18.
3. Lalwani S, Sharma GS, Kabra SK, Girdhar S, Dogra TD. Suicide among children and adolescents in South Delhi (1991-2000). *Indian J Pediatrics* 2004; 71:701-3.
4. Mohanty S, Sahu G, Mohanty MK, Patnaik M – ‘Suicide in India: a four year retrospective study’ – *J Forensic Leg Med.* 2007May; 14(4):185-9.
5. Bastia BK, Kar N. – ‘a psychological autopsy study of suicidal hanging from Cuttack, India: focus on stressful life situations’ – *Arch Suicide Res.* 2009; 13(1):100-4.
6. Reddy KSN. *The Essentials of Forensic Medicine & Toxicology.* 29th ed. India: Medical Book Company; 2010. P.296-297.
7. Nandy A. *Principle of Forensic Medicine including Toxicology.* 3rd ed. India: Central Book Agency; 2010. P.517-518.
8. L Buris. *Forensic Medicine,* Springer, Budapest, 1993. p 225.
9. Sharma B R, Harish D, Singh V P. Ligature Mark on neck: How informative? A study paper, *Journal of Indian Academy of Forensic Medicine* (2005). Volume 27(1) pp 10 -15.
10. Sheikh MI and Agarwal SS. Medico-legal implications of hyoid bone fracture- a study paper. *Journal of Indian Academy of Forensic Medicine* 2001. Volume 23. Number 4. pp 61 – 63.
11. G.A. Sunil Kumar Sharma, O.P.Murthy, T.D.Dogra. “Study of ligature marks in asphyxial deaths of hanging and strangulation”. *International Journal of Medical Toxicology and Legal Medicine* 2002; 4(2):21-24.
12. Uzün I, Büyük Y, Gürpınar K. – ‘Suicidal hanging: fatalities in Istanbul retrospective analysis of 761 autopsy cases.’ – *J Forensic Med.* 2007 Oct; 14(7):406-9.
13. Kanchan T, Menezes RG – ‘Suicidal hanging in Manipal, South India - victim profile and gender differences’ – *J Forensic Leg Med.* 2008 Nov; 15(8): 493-6.
14. Green H, James RA, Gilbert JD, Byard RW. – ‘Fractures of the hyoid bone and laryngeal cartilages in suicidal hanging’ – *J ClinForensic Med.* 2000 Sep; 7(3):123-6.
15. Khokhlov VD – ‘Calculation of tension exerted on a ligature in incomplete hanging’ – *Forensic Sci Int.* 2001 Dec 1; 123(2-3):172-7.
16. Nikolic S, Micic J, Atanasijevic T, Djokic V, Djonic D – ‘Analysis of neck injuries in hanging’ – *Journal of Forensic Med Pathology.* 2003Jun; 24(2):179-82’ 2008 Oct; 27(4):259-62.
17. Uzün I, Büyük Y, Gürpınar K. – ‘Suicidal hanging: fatalities in Istanbul retrospective analysis of 761 autopsy cases.’ – *J Forensic Med.* 2007 Oct; 14(7):406-9.
18. Naik SK, Patil DY. Fracture of hyoid bone in cases of asphyxial deaths resulting from constricting forces round the neck. *J Indian Acad Forensic Med* 2005; 27: 971-3.
19. Joshi Rajeev, Chanana Ashok, Rai Hakumal. Incidence and Medico-legal importance of Autopsy study of fracture of Neck structure in hanging and strangulation. *Medico legal update* (2007), volume 7(4) Pp 105-109.
20. Jani CB, Gupta BD. An autopsy study of parameter influencing injury to osteo-cartilaginous structures of neck in hanging. *International Journal of Medical Toxicology and Legal Medicine* (2002). Volume No. 5(1). pp 4 – 7.

A Five Year Retrospective Study of Victims of Sexual Offences in Jaipur Region

Yadav A¹, Meena R L², Pathak D³, Kothari N S⁴

¹Assistant Professor, Department of Forensic Medicine, NIMS Medical College, Jaipur, ²Senior Demonstrator, ³Assistant Professor, Department of Forensic Medicine, SMS Medical College, Jaipur, ⁴Professor, Department of Forensic Medicine, NIMS Medical College, Jaipur

ABSTRACT

This study aims to determine the magnitude and sociodemographic characteristics of victims of sexual offences reported at state tertiary care and referral hospital, Jaipur. The present study was carried out on 229 victims of sexual offences between the periods of 2008-2012. All the cases of sexual offences reported during the study period were cases of natural sexual offences committed on female victims except three cases of unnatural sexual offences, committed on male victims. The ages of victims in our study ranged from three to 40 years. The most affected age group was victims between 11-20 years (53.7%) followed by 21-30 years (25.7%). All the five admitted cases of sexual offences were children belonging to the age group 0-10 years. Majority of the victims were Hindu females (86.0%), unmarried (71.6%) educated up to secondary level (33.6%) and from middle socio economic status (52.8%). The majority of the victims were students (51%) followed by housewives (16.5%) and domestic workers (16.1%). The assailant knew the vast majority of victims (90.4%) and remaining were the strangers.

Keywords: Sexual Offences, Female Victims, Assailant, Sociodemographic Characteristics

INTRODUCTION

Of all the crimes, these crimes are the most barbarous and humiliating.¹ Sexual assault includes all those victimizations involving unwanted sexual contact occurring between the victim and assailant. Sexual assault is one of the offenses most underreported to law enforcement.²⁻⁴ Sexual assault follows the iceberg phenomenon. The amount of it visible to our eyes is much less than the amount beneath the burden of social ethics. Most of the cases of crime related to sex go unannounced due to the social stigma related to such events. Rape is a serious offence, causing tremendous physical, mental and emotional trauma to the victim e.g. HIV infection, STD's, mental depression, social isolation etc. It has both short and long-term effects leading to morbidity in the victims.⁵ According to W.H.O., 1 out of 3 women worldwide has experienced rape or sexual assault.⁶ It

is a global problem contributing towards increase in morbidity in those who are at a higher risk.⁷

Securing evidence after sexual offence is an important task for physicians.⁸ Poor medical evidence is often responsible for low conviction rate.⁹ Thorough and timely medical examination of the victim may provide extraordinary evidence to prove the event and establish evidence against the accused. With the spread of education and professionalism amongst the feminine sector of our society, women are now moving out of the protected environment provided to them earlier making them more prone to such crimes. Therefore, there is a need for us to analyze the present scenario of sex related crimes against women and children in our part of the world to look for ways to check the growing rate of such unlawful events. This study initiates to assess the magnitude of sexual offences in this region and to study the profile of

victims as exact data of recent times for our region is unavailable. The role of a forensic expert in cases of sexual offences can be remarkable to aid the victim in administration of justice.

MATERIAL AND METHOD

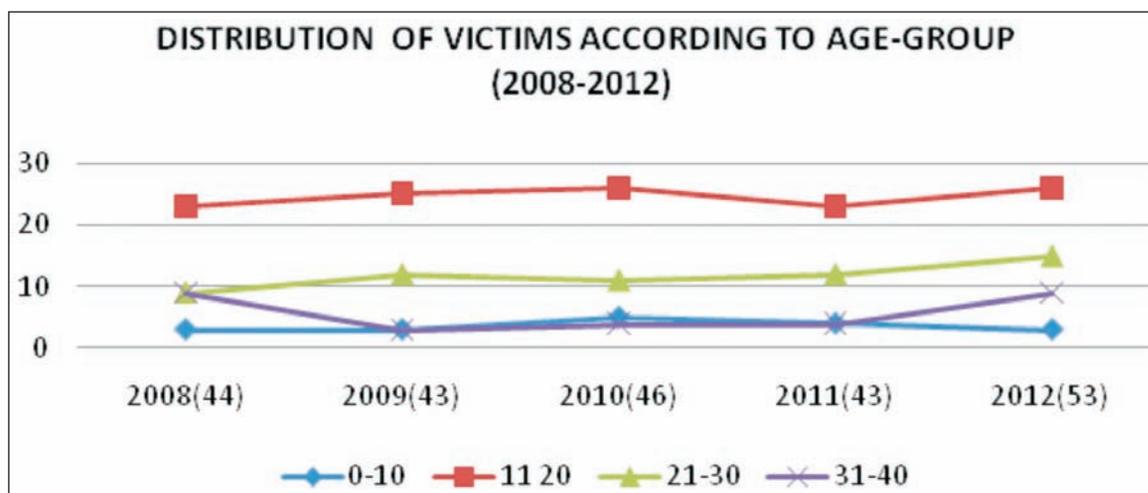
This retrospective study was conducted in the Department of Forensic Medicine and Toxicology of a state tertiary care and referral hospital, Jaipur from January 2008 to December 2012. The inclusion criteria consisted of all cases of alleged history of sexual offences brought to the Department of Forensic Medicine & Toxicology by competent investigation authority and also all the cases with alleged history of sexual offences admitted in state tertiary care and referral hospital. All the cases, who (the victim/ her parent or guardian, when the victim was below 12 years of age) did not consent for medico-legal examination regarding sexual assault were excluded from the study. All the victims of sexual offences who fulfilled the inclusion criteria irrespective of their age were taken for study. For indoor patients, the medico-legal examination of victim was conducted at bedside after taking valid consent of the patient and fulfillment of all legal formalities. A total of 229 victims of sexual offences fulfilled the inclusion criteria and their data was analyzed.

OBSERVATION AND RESULTS

This study was carried out at the Department of Forensic Medicine and Toxicology, state tertiary care and referral hospital, Jaipur over a period of five years from 2008 to 2012. During the study period, 241 victims of sexual offences were considered for medico-legal evaluation. Out of the victims of sexual assault brought at our centre, twelve victims refused to consent for the medical examination for study purpose and hence were not included in the study. A total of 229 cases were included in the study and medico-legal examination carried out for each case as per the standard protocol after taking valid consent and fulfilling the legal formalities. The observations and results for each case noted and the data was analyzed. Out of these victims of sexual offence, three were males and rest were females. All the males were victims of sodomy. The age of victims of study group ranged from 3 year to 40 years. There were 18 (7.8%) victims who were under 10 years of age. Maximum number of victims fell in the range of 11-20 years i.e. the adolescent who just attained majority; including a total of 123 victims (53.7%). 59 (25.7%) victims were between 21-30 years of age and 29 (12.6%) victims were in 31-40 years age group. No victim was more than 40 years of age (Table-1).

Table 1. Age and year wise distribution of victims.

Year Age Group	2008(44)	2009(43)	2010(46)	2011(43)	2012(53)	TOTAL
0-10	3	3	5	4	3	18
11-20	23	25	26	23	26	123
21-30	9	12	11	12	15	59
31-40	9	3	4	4	9	29



Maximum victims i.e. 140 (61.1%) were educated upto primary and secondary levels, 43(18.7%) were educated above secondary level. Surprisingly, only 46

victims (20.0%) out of 229 were illiterate. Majority of victims (86%) were Hindu, unmarried (71.6%) and from a middle socioeconomic status (52.8%) (Table-2)

Table 2. Socio demographic profile of victims of sexual assault

YEAR	2008	2009	2010	2011	2012	TOTAL
Educational Status						
Illiterate	11	8	9	6	12	46
Primary	9	7	12	17	18	63
Secondary	16	17	19	11	14	77
Above secondary	8	11	8	7	9	43
Religion						
Hindu	36	40	39	38	44	197
Muslim	5	4	6	4	7	26
Sikh	1	0	2	1	0	4
Christian	0	0	1	0	1	2
Marital status						
Unmarried	32	34	28	30	40	164
Married	11	10	13	12	15	61
Divorcee	1	0	0	1	2	4
Socio Economic status						
Low	23	18	20	19	16	96
Middle	20	25	26	24	26	121
Higher	1	0	0	0	1	2

Majority of the victims i.e. 117 (51%) were students, 38 (16.5%) were housewives, 37(16.1%) were domestic workers; another twenty one (9.1%) were labourers and sixteen (7%) were employed in private organizations. Among them four victims were sexually assaulted by their employer (Table-3)

Table 3. Distribution of victims according to Occupation.

Occupation	Total (%)
Student	117 (51.0)
Housewife	38(16.5)
Domestic Worker	37(16.1)
Labourer	21(9.1)
Private employee	16(6.9)
Grand Total	229 (100)

In only 22 (9.6%) cases the assailant was a stranger to the victim. In all the rest 207(90.4%) cases, the victim knew the assailant. Out of them, their neighbors sexually assaulted 101 (44.1%) victims. Among the 229 cases, where the victim knew the assailant; there were ten (4.3%) victims of incest (Table-4).

Table 4. Distribution of victims according to Relation to Assailant

Relation to Assailant	Total (%)
Neighbor	101 (44.1)
Acquaintance	59(25.7)
Close friend	37(16.1)
Stranger	22(9.6)
Family members	10(4.36)
Grand Total	229 (100.00)

DISCUSSION

Sexual assault is a neglected public health issue in most of the developing countries. Only 10-50 percent of female victims reports sexual assault.¹⁰It is a well-understood fact that quite a small percentage of sexual assaults are really reported. The underreporting of cases of sexual assault is mainly due to social stigma, prejudice with regard to the chances of marriage, being consider promiscuous and responsible for incident, attendant humiliation and embarrassment caused by appearance and cross-examination in court, publicity impress, risk of losing the love and respect of society, friends and that of her husband if married.¹¹ This study

was carried out on 229 victims of sexual offences who were brought to state tertiary care and referral hospital, Jaipur. Previously studies had been carried out on 38 victims (Sagar et al,1992)¹²; 80 victims (Bhardwaj et al,1995)¹³; 90 victims (Sarkar S C et al 2001-02)¹ and 32 victims (Jain R et al 2006)¹⁴. In our study, only three male victims of sexual offences reported at our hospital during the study period. Though in other studies also, they have reported that majority of the victims were females, still male victims have also been registered. In our study, 98.6% victims were females. The number of female victims among study group population have been reported to be 86% (Grossin et al 2003)¹⁵; 88.9% (Sarkar S C et al), 100% (Jain R et al). All the males reported were victims of sodomy. The incidence of natural sexual offence far exceeds the unnatural sexual offence in our country.¹⁶

The ages of victims in our study ranged from three to 40 years. No age is safe from rape. Cases are on records where the infants or elderly women above 70 years of age have been the victims of rape.¹⁷ This is more or less similar to between six and 25 years (Jain R et al) and a little variable from between 4 and 66 years (Sarkar S C et al). The most affected age group in our study was between 11-20 years (53.7%) followed by 21-30 years age group which had 59 victims (25.7%). This is quite similar to that reported in other studies. Maximum victims had been reported to be in 16-20 years (Sarkar SC et al, 2001-02); 21-25 years (Jain R et al,2006) and 15-20 years (Du Mont et al 2000)¹⁸. From this we can reach to a conclusion the females in the sexually promiscuous age group, i.e. 11 to 30 years are the most prone age group for these crimes. Moreover, the adolescents and the just major females i.e. those between 11 to 20 years are the most vulnerable victims to this category of crime.

In our study, majority i.e. 33.6% victims were those who had finished or were about to finish education upto secondary level. As compared with a study of India we got similarity in the number of illiterate victims being 28.9% (Sarkar S C et al 2001-02). The majority of the victims in our study were students contributing to half of the whole population. The class of students covering the majority of victims in our study indicates towards the changing values of our society, as many of these victims are those who had sexual activities with their acquaintance after absconding together. However, the proportion of domestic workers who became victims of sexual assault is more or less same in the two studies, being 16.1% (our study) and 15.75% (Jain R et al 2006).

However, we again vary in the proportion of housewives who became victims of these assaults, as it is 16.5% in our study being much lower than 43.5% (Jain R et al,2006). Probably this variation is due to difference of rural and urban proportions in the study group of both the studies. In our study, the majority of victims were unmarried being 71.6% which is similar to 81.1% (Sarkar SC et al 2001-02) and a little higher than 65.2% (Dumont et al, 2000).

In our study, in 90.4% cases of sexual assault, the victim knew the assailant and in only 9.6% cases, the assailant was a stranger. This is a little more than 87.5% known assailants (Jain R et al, 2006) and 81% (Sarkar SC et al,2001-02); and quite high as compared to 69.7% acquaintances as assailants and 25.6% strangers (Fimate et al, 1998)¹⁹. Malhotra et al have reported that rape by person acquainted with victim is common for girls less than 10 years of age. Rape or assault by strangers increases significantly with age. In addition, variation may result due to different lifestyle and social customs.

In our study, 90.4% assailants knew the victims, 44.1% were neighbours; 25.7% were acquaintances; 16.1% were close friends, 4.36% were family members (in 7 cases assailant was a blood relative and in 3 cases they were relatives of the in-laws side). This is quite similar to 46.75% neighbours and 15.75% friends (Jain R et al, 2006). However our study differs greatly from 44.1% acquaintances, 18.8% strangers, 30.8% close friend and only 1.8% neighbours (Sarkar SC et al, 2001-02). This variation may have resulted due to the population and time variation of victims due to the difference in the regions of study.

CONCLUSION

Sexual assault is traumatic at the time it occurs, but it also may have long lasting negative effects on physical health.¹⁴ The Indian scenario is even more alarming with reports of sex crimes making headlines almost every day.¹⁵ Majority of the victims were in the age group of 11 to 20 years, Hindu females belonging to urban regions. Most of the victims were unmarried and students who were assaulted, known to their assailants. In a maximum number of cases, the assailant had a friendly relationship with their victim and had sexual activities after absconding together. This study highlights the importance of addressing sexual offences as a public health issue and focuses on the demographic profile of victims in an urban area. Stress should also be laid down on providing sex

education to school students of teenage to increase awareness regarding medical and legal issues related to such events. Probably, spread of education and wisdom among adolescents may provide suppression in vulnerability of these age groups to such torturing events.

ACKNOWLEDGEMENT

The authors are thankful to Dr A.M. Dixit Associate Professor, Community Medicine and Dr. R.K Gahlot PHOD, Forensic Medicine and Toxicology, NIMS Medical College, Jaipur for kindly help to carry out this work.

No Conflicts of Interest.

No Source of Funding.

Ethical Clearance was sought from appropriate authorities before the commencement of this work.

REFERENCES

- Sarkar SC, Lalwani S, Rautji R., Bhardwaj DN, Dogra TD. A study on victims of sexual offences in South Delhi URL: www.medind.nic.in (accessed on 13.01.2013).
- Green, T., Adriana Ramelli and Mavis Mizumoto. 2001. "Patterns Among Sexual Assault Victims Seeking Treatment Services." *Journal of Child Sexual Abuse* 10:89-108.
- Greenfeld, L. *Sex Offenses and Assailants: An Analysis of Data on Rape and Sexual Assault*. BJS report, NCJ 163392, February 1997
- Maguire, K. and Ann L. Pastore, eds. *Sourcebook of Criminal Justice Statistics 2000*. U.S. Department of Justice, Bureau of Justice Statistics. Washington, DC. USGPO, 2001.
- Jewes R, Sen P, Garcia MC. Sexual Violence. In : Krug EG, Dalberg LL, Mercy JA, Zwaaid, Orzano R eds. *World Report on Violence and Health*. Geneva: World Health Organization; 2002. 147-82.
- Statistics of Sexual assault. RAINN calculation based on 2000 National crime Victimization Survey. Bureau of Justice Statistics, U Department of Justice.
- Mukhopadhyay PP, Singh O. Psychiatric assessment of victims of sexual assault: A preliminary study from Burdwan Medical College, Burdwan, West Bengal. *J Indian Acad Forensic Med* 2009; 31(3): 237-42
- Crime in India, National Crime Record Bureau, Ministry of Home Affairs, New Delhi, 2002
- Okonkwo JEN, Ibeh C. Female sexual assault in Nigeria. *Int Journ Gynaecol & Obstet* 2002 Sep; 78 (suppl) 1 : S 105- 10.
- Malhotra N, Sood M. Sexual assault, a neglected public health problem in the developed world, *International Journal of Obstetrics and Gynaecology*, 71; 257-258, 2000.
- Beebe, D.K. Emergency management of the adult female rape victim. *American family physician*, 43:2041-2043; 1991.
- Sagar MS. Sexual offences in South Delhi. *J Forensic Med Toxicol*. 1992; 9: 8-11.
- Bhardwaj DN, Sharma RK, Sagar MS, Murty OP. Study of sexual offences victims in South Delhi. *J Forensic Med Toxicol*. 1995; 12 (3&4): 33-4.
- Jain R, Mathur PN, Kothari NS, Mathur P. Medico-legal evaluation of Sex Assault cases admitted at Sardar Patel Medical College & PBM Hospital, Bikaner, India. *Medico legal update* 2006 Jan-Jun; 8(1).
- Grossin C, Sibille I, Grandmaison GLDI, Banasr A Brion F, Durigon M. Analysis of 418 cases of sexual assault. *Forensic Sci Int*. 2003; 131: 125-30.
- Vij K. *Textbook of Forensic Medicine and Toxicology : Principles and Practice*. 3rd ed. New Delhi (India) : Elsevier; 2005. 460-78.
- Sexual Offences – I, II & III. In: Lyon's *Medical Jurisprudence and Toxicology*. Dogra & Rudra eds. 11th ed. Delhi: Delhi Law House; 2008. p 491-539.
- Du Mont J and Parnis D. Sexual assault and legal resolution; Querying the medical collection of Forensic evidence. *Med Sci Law*. 2000; 19(4): 779-92.
- Fimate L, Devi M. An analytical study of rape in Manipur. *Int Journ Med Toxicol and legal Med*. 1998; 1:1-2.
- Cloutier S, Martin SL, Poole C. Sexual assault among North Carolina women: prevalence and health risk factors *J Epidemiol Community Health* 2002; 56: 265-271.
- Mukhopadhyay PP, Singh O. Psychiatric assessment of victims of sexual assault : A preliminary study from Burdwan Medical College, Burdwan, West Bengal. *J Indian Acad Forensic Med* 2009; 31(3): 237-42.

A Study of Different Position of Mastoid Foramen Related of Skull Bone

Dimple S Patel¹, Rohit C Zariwala², Bharat D Trivedi³

¹Associate Professor, Department of Anatomy, ²Associate Professor, Department of Forensic Medicine, AMC MET Medical College, Ahmedabad, ³Ex. Professor & Head, Department of anatomy, Smt. NHL Municipal Medical College, Ahmedabad

ABSTRACT

The present study analyzed craniofacial bone variations in dried skulls in terms of gender and mastoid foramen (MF) were assessed dried skulls by direct observation and using a Mitutoyo caliper. MF occurrence was higher in right male skulls, and multiple foramina were present in 60% of male skulls (both sides), and in 36.4% of female skulls (both sides). Craniofacial bone variations, considered to be radiological landmarks, have been studied since the beginning of the century using dried skulls and cadavers. These pitfalls are important bone landmarks used in the planning and execution of anesthetic and surgical procedures. The identification and recording of craniofacial variations is important in the preparation of anesthetic blocks in surgical procedures and in the evaluation of regional neurovascular anatomy, to avoid misinterpretations in planning. This study confirms the existence of significant morphological variations in terms of gender and side in a given population. The anatomy of mastoid foramen is clinically important for surgeons¹. In our present study I have found structural variations of the mastoid foramen. This study will provide insight to our knowledge of humanity.

Keywords: Mastoid Foramen (MF), Dried skull, Temporal bone, Occipital bone, Sigmoid sinus

INTRODUCTION

Craniofacial bone variations, considered to be radiological landmarks, have been the object of study since the beginning of the century, using dried skulls and cadavers. They are important in planning and conducting anesthetic and surgical procedures. According to Hanihara and Ishida (2001), discrete cranial characteristics may be the consequence of an adaptation process to different environments and survival patterns that depend on aspects like population size and isolation variables. It is as of surgical planning that surveying and recording these bone variations become important. These efforts may help prevent compromising and injuring neurovascular structures, as in the orbit area, which has connections with the central nervous system, nose, paranasal sinuses, face and structures associated to eye functions (KARAKAS, BOZKIR and OGUZ, 2002). Apart from this, the recording of bone variations in several population groups plays a relevant role in

anthropological and evolutionary studies (BERRY, 1975; AGTHONG, HUANMANOP and CHENTANEZ, 2005).

MASTOID FORAMEN

This is a foramen of variable size and position. Usually it appears near the posterior margin of the bone, but it can occur in the suture between the temporal and occipital bone or within the occipital bone. It can range in size from quite large to very small. Sometimes it is absent. When this foramen is present, it transmits an emissary vein from outside the skull to the sigmoid sinus within the skull. A small branch of the occipital artery also passes through this foramen to vascularize the duramatter.

The mastoid foramen of variable size and position is traversed by a vein from the sigmoid sinus and a small dural branch of the occipital artery, frequently lies near its posterior border². 40% of mastoid foramen is seen on occipital occipito temporal suture.

Etymology: Mastoid comes from the Greek mastos meaning breast. Galen used this name to describe a process of the temporal bone because he thought it resembled a breast in appearance. Foramen is the Latin term designating a hole-like opening. It derives from the Latin forare meaning to bore or perforate.

Latin: Foramen matoideum.

French: Foramen matiodein.

MATERIALS AND METHOD

In total 100 dried skulls were analyzed. Skulls were obtained from the Laboratory of Human Anatomy; AMC MET Medical College, Ahmedabad. Skulls that in one way or another did not afford perfect observation and measurements, due to damage, were excluded. Records were carried out by direct observation and using a Mitutoyo caliper. In foramina, measurements were always carried out starting from the center. Data were analyzed by descriptive statistics, expressed as means ± standard deviation of mean. The Student's t test and the Mann-Whitney test were used to compare measurements of distances. Differences between means were considered significant for $P < 0.05$. The statistical analysis was carried out using the Biostat 5.00™ software.

Location of MF was recorded based on its position in the temporal bone, in the temporo-occipital suture or on the occipital bone, in both sides of each skull. The existence of more than one smaller foramen near MF was recorded as multiple mastoid foramen (mMF), as described in Berge and Bergman (2001).

The present study is carried out on 100 skulls (temporal bones) from the department of Anatomy at AMC MET Medical College, Ahmedabad, Gujarat by examining the mastoid foramen of the right and the left sides of both the sexes.

OBSERVATION AND RESULTS

It was observed that double mastoid foramen was present in 2% of the temporal bones on right side and 16% on the left side. Single mastoid foramen on temporal bone was seen in 26% on the right side and 16% on the left side. In the occipital bones, single mastoid process was seen in 4% of occipitotemporal suture on the right and 14% on the left. Mastoid foramen was also absent in 8% on the right and 10% on the left side of both the temporal as well as the occipital bone. It is presented in table-1.

Table-1 Position of Mastoid Foramen

Serial No	Position of Mastoid Foramen	Side of the Bone	Number of Bones	% age
1	Double mastoid foramen in temporal bone	Right	2	4
		Left	16	32
2	Single foramen on temporal bone	Right	26	52
		Left	16	32
3	Single foramen on occipital bone	Right	2	4
		Left	2	4
4	Foramen on occipitotemporal suture	Right	4	8
		Left	14	28
5	Absence of foramen	Right	8	16
		Left	10	10

The results obtained concerning laterality of MF were similar to those published by Berge and Bergman (2001), as well as the predominance of mMF on the right side³. Keskil, Gözil and Calgüner (2003) observed emissary mastoid foramina in 78% of skulls. Of that percentage, 88.5% were located in the temporo-occipital suture⁴.

DISCUSSION

1. The present study will be a useful guide wherein the dural arteriovenous fistulas can be successfully treated by surgical procedures or embolisation. The goal of embolisation is occlusion of the primary draining vein.

2. Direct transcranial puncture of the meningeal arteries through the parietal or mastoid foramen can be done in cases in which conventional arterial navigation has failed especially when the occipital artery is tortuous in its course. This method allows close access to the arteriovenous venous fistulas. In dural arterio venous fistulas, the arterial anastomosis is enlarged and supplied blood to the entire foramen. Therefore, puncture of the foramen allows access to the artery.
3. A through knowledge of mastoid foramen with different variants is basic and very important to the surgeons and radiologists before and during surgical interventions.
4. Besides surgical importance this study will provide useful information in human anthropometry.

CONCLUSION

The present study demonstrates the existence of significant morphological variations in craniofacial structures. The variations observed were related to laterality and gender, though they also depend on the populational group studied. The identification and recording of craniofacial variations is important in the

preparation of anesthetic blocks in surgical procedures and in the evaluation of regional neurovascular anatomy, to avoid misinterpretations in planning. This study confirms the existence of significant morphological variations in terms of gender and side in a given population.

Acknowledgement: Nil.

Ethical Clearance: Informed consent was taken.

Source of Funding: Self.

Conflict of Interest: Nil.

REFERENCES

1. Standring S: Gray's anatomy. Churchill Livingstone 2005; 39: 468
2. Breathnach A. Frazers anatomy of human skeleton, Churchill Livingstone 1965, 6:197
3. BERGE, JK. and BERGMAN, RA. Variations in size and in symmetry of foramina of the human skull. *Clinical Anatomy*, 2001, vol. 14, n. 6, p. 406-413.
4. KESKIL, S., GÖZIL, R. and CALGÜNER, E. Common surgical pitfalls in the skull. *Surgical Neurology*, 2003, vol. 59, n. 3, p. 228-231.

Postmortem Autolytic Changes in Oral Mucosa: Histological Review

Charan Gowda BK¹, C V Mohan², Hemavathi³

¹Reader, Dept Of Oral Pathology, Sri Siddhartha Dental College, Tumkur, Karnataka, ²Director , Dental care and, Research Center, Bengaluru, Karnataka, ³Former Prof. and HOD, Dept of Oral Pathology, Government Dental College, Bengaluru, Karnataka

ABSTRACT

Following death various changes occur in the human body known as postmortem changes. These postmortem changes begin at molecular level which can be noted microscopically and finally grossly. Postmortem interval (PMI) is the time elapsed since death. Estimation of time since death is still a difficult task even for an experienced forensic pathologist. Gross changes within human body which occur following death during the postmortem interval have been routinely used to estimate the time of death considering different conditions. However, histological changes of skin and oral mucosa which occur during the postmortem interval have occasionally been used to estimate the time of death under different conditions.

Objective: This study is done to study the histological features of decomposition at cellular level in postmortem oral mucosal tissue, skin and its appendages.

Method: Electronic and hard data is searched and studied to understand the postmortem changes of oral mucosal tissue and skin and its appendages. (regarding cases studied number have placed in discussion).

Results: Studies conducted for morphological changes of skin and its appendages showed focal dermal-epidermal separation, eccrine duct necrosis, and dermal degeneration. Oral mucosal different cellular changes like homogenization and eosinophilia, cytoplasmic and nuclear vacuolation, chromatin clumping, pyknosis of nuclei was noted at different time intervals.

Conclusion: PMI determination is essential for narrowing the fields of suspects or possible missing persons. Histological examination of oral mucosa may be helpful in establishing the Postmortem interval more precisely. PMI determination is essential for narrowing the fields of suspects or possible missing persons.

Keywords: Necrosis, Postmortem interval, Pyknosis, Decomposition, Homogenization

INTRODUCTION

Cells are the structural and functional units of all living organisms. They take in nutrients, convert these nutrients into energy, carry out specialized functions,

Corresponding author:

Charan Gowda BK

Reader

Dept of Oral Pathology, Sri Siddhartha Dental College
Tumkur, Karnataka

Email ID drsrinivasreddyp@gmail.com
charangowdabk@yahoo.co.in

and reproduce as necessary. These activities are carried within the cell by instructions that are stored inside the cell itself. Although human body composed of many different cells, certain basic characteristic are alike. They perform their function normally till the availability of proper concentration of oxygen, glucose, different ions, amino acids, fatty substances, and other constituents available in environment.^{1,2} usually cells constantly participate in their environment where they encounter physiologic stresses and also pathologic stimuli. To overcome these cells may undergo adaptation but they preserve their viability and

function. When the stress is harmful it may lead to injury of the cell. To certain extent cell can withstand injury and return to normal functioning. When cell fails to withstand stress or when severity of stress is high cell fails to adapt which result in the cell death/necrosis. Necrosis usually results in degradative action of enzymes within the cell. Series of change occurs following cell death which can be viewed under microscope.

Light microscope which magnifies objects remains to be a basic tool for pathologist for visualization of cell structure. Technical improvements in modern days permit the visualization of fine details of cell.³ Studies that have been conducted showed the changes that occur in cellular level following death progress with time which can be observed under microscope.

Cell death

Necrosis is a Greek word which literally means death or dead body. Necrosis and apoptosis are two different entities which represent two different form of cell death. Apoptosis was the term coined by Kerr et al which was accompanied by several morphological changes in cell.⁴ Various changes that were noted in apoptotic cell includes rounding-up of the cell, retraction of pseudopodes, reduction of cellular volume (pyknosis), chromatin condensation, nuclear fragmentation (karyorrhexis), classically little or no ultrastructural modifications of cytoplasmic organelles, plasma membrane blebbing.⁵ The Nomenclature Committee on Cell Death (NCCD) proposes that in necrotic cell death morphological changes like gain in cell volume, swelling of organelles, plasma membrane rupture and subsequent loss of intracellular contents can be noted.^{4,5} Necrotic cells first show clumping of chromatin and swelling of organelles. This is followed by swelling of the cell, and the rupture of nuclei, mitochondria, and the plasma membrane.^{6,7} Cell death due to lack of oxygen show microscopically eosinophilia, cell may show glassy appearance, vacuolation of cytoplasm. Nucleus may show karyolysis, pyknosis and karyorrhexis.⁵ Electron microscopically the necrosed cell may show discontinuities in plasma and organelle membranes, marked dilation of mitochondria with the appearance of large amorphous densities, disruption of lysosomes, intracytoplasmic myelin figures, and profound nuclear changes culminating in nuclear dissolution.⁵

Postmortem interval

Postmortem interval is the time elapsed between death and corpse discovery. Generally forensic pathologists and forensic entomologist's determine the time since death in cases of shorter postmortem intervals while forensic anthropologist determines time since death in cases with longer postmortem intervals.⁸

Normally a series of changes occur in the human body following death. These changes vary in an orderly fashion along the different time interval. Various internal and external factors may accelerate or retard the decomposition rate. Understanding the postmortem changes and confounding factors may help a forensic pathologist to establish more accurate PMI and limit the time frame of death which may be helpful in the field of forensics. Generally the process of putrefaction and autolysis begins soon following death. Putrefaction is associated with microbes and occurs in moist climate. Presence of green discoloration of the body, gas production with associated bloating, skin slippage and a foul odor can be noted.⁹ Autolysis refers to self digestion, in case of autolysis cell gets destructed due to the action of its own enzyme. Common postmortem changes applied in this days for establishing time of death are rigor mortis, livor mortis, and algor mortis, which progress on a relatively set schedule. Although various factors have to be considered during establishing time of death all bodies decompose to some extent which can be noted microscopically. Various bio-chemical and immunological studies have been carried in modern days to establish more precise PMI.

DISCUSSION

Post mortem interval or the time elapsed from death until discovery and medical examination of the body is one of the important tasks in the field of forensics. Till today unless death has been witnessed establishing the time of death is extremely difficult. Various research studies have been conducted on different tissues to establish the PMI but still accuracy in that particular issue is not possible. It is necessary in the field of forensic to fix the time of death because longer the time interval between the death and examination of body more the chance of losing the reliable data. Various physico-chemical changes occur

in body following death. This changes progress in an orderly fashion at different time interval. Some of the common changes which have been used clinically in establishing time of death are, algor mortis, rigor mortis, livor mortis, putrefaction, adipocere, mummification and maceration.¹⁰

Additionally biochemical markers which includes protein fractions, urea, creatinine, glucose, iron, potassium, calcium, enzymes, immunohistochemical detection of insulin in pancreatic β -cells, the myoalbumin fraction and the level of strontium-90 calcium analogs were conducted none found to be fruitful.¹¹

Morphological changes that a cell undergoes during necrosis can be noted with the help of microscope. Very little research work has been done on the morphological changes of different cells within body. Kovarik C et al¹² conducted study on three individuals for the postmortem gross and histologic changes of the skin. In their study they showed focal dermal-epidermal separation, eccrine duct necrosis, and dermal degeneration. They conclude that study on large scale sample may be useful in estimating the time of death in the early postmortem interval.

Bardale R V et al¹³ studied the histologic changes of the skin and appendages in the early PMI. They showed progressive morphological changes of skin in the early postmortem period. The epidermis and the dermis appeared normal for six hours after death, and after this period, degenerative changes began. Following six hours after death, degeneration began in the dermis, and by the end of eighteen hours, the dermis began to disintegrate. They stress towards the morphological changes in the postmortem period which can be observed under microscope and concludes morphological changes of skin may assist in determining time of death in early postmortem period. sweat Cingolani M et al¹⁴ studied for post-mortem autolytic alterations in the skin at cellular and subcellular levels.

The process of decomposition was noted in the oral mucosal tissue. Gururaj and sivapathsundaram¹⁵ conducted a study on postmortem gingival sample to assess the cytoplasmic and nuclear changes in postmortem gingival sample which was fixed between 10hrs-20hrs. postmortem gingival sample showed nuclear vacuolation along the spinous and superficial

layers. Finally they concludes that cellular decomposition appears within twenty four hours.

Pradeep G et al¹⁶ in their study collected postmortem gingival sample and showed cellular decomposition at different time interval. Their study showed different cellular changes like homogenization and eosinophilia, cytoplasmic and nuclear vacuolation, chromatin clumping, pyknosis of nuclei at different time intervals. They concludes that study on large scale may help to establish time of death by examining the cellular decomposition.

From the histological studies conducted it was noted that various cellular alterations occurs following death. The research work conducted showed a significant association between time intervals and degenerative changes. Within their study they found various cytoplasmic and nuclear changes. Cytoplasmic changes include cytoplasmic vacuolation, homogenization and eosinophilia. Nuclear changes include, pyknosis, nuclear clumping, nuclear vacuolation.

Various research was conducted on various chemical substance within human body for establishing PMI none of them found to be useful in forensics. Morphological changes that were observed among the different cell in the body as a result of autolysis and putrefaction appears to be more promising for establishing PMI. However postmortem histologic changes within the cells of human if analyzed systemically may be helpful in the field of forensics where a pathologist can establish the postmortem interval more accurately.

Establishing time of death or postmortem interval determination is basic requirement in the field of forensics when death has not been witnessed. In death scene investigation it is necessary to establish the cause, manner, and time since death. With progression of time soft tissue decomposition begins and it will be difficult to establish the time of death/ less accurate postmortem interval will be determined. Usually in death investigations, discovery of corpse is often delayed because of intentional disguise by a suspect or death occurring in a remote area to name few. In such cases obtaining tissue preferably oral mucosa tissue and visualizing for autolytic changes of tissue under microscope may become helpful for postmortem interval determination.

Necessary factors that a forensic pathologist to be considered during establishing PMI are,

1. Age and sex of the individual.
2. Temperature and humidity.
3. Cause of death.

CONCLUSION

In death investigations when foul play is suspected or the identification of the unknown person a PMI determination is essential for narrowing the fields of suspects or possible missing persons.

Histological examination of oral mucosa which is more preserved in case of fire, traumatic death where external injuries are severe and in case of death under water where tissue details have been lost may be helpful in establishing the Postmortem interval more precisely. A study on large scale samples considering the temperature, age and sex is necessary for establishing time of death more precisely which may be very helpful in the field of forensics. The forensic pathologist may obtain an approximate indication of the time of death with a simple, rapid and cheap technique.

Conflict of Interest: This study is done to study the histological features of decomposition at cellular level in postmortem oral mucosal tissue, skin and its appendages.

Source of Funding: Self funding

Ethical Clearance: Obtained

Acknowledgement: Dr. Rudramurthy RMO and Senior Consultant in Forensic Department District Government General Hospital Tumkur.

REFERENCES

1. Cooper GM; Hausman RE; The Cell Molecular approach; 5th edition; Sinauer Associates INC; 2-22.
2. Guyton AC; Hall JE; Text book of Medical Physiology; 11th edition; Elsevier Saunders; 3-19.
3. Kumar; Abbas; Fausto; Robbins and Cotran Pathologic Basis of Disease; 7th edition; Elsevier; 2004.

4. Kimberly McCall; Genetic control of necrosis – another type of programmed cell death; Curr Opin Cell Biol; 2010 December ; 22(6): 882–888.
5. Kroemer, G. et al; Classification of cell death: recommendations of the nomenclature committee on cell death; 2005; Cell Death Differ; 12; 1463–1467
6. BowenI, . D et al; Programmed cell death during metamorphosis in the blow-fly *Calliphora vomitoria* Microsc Res Tech; 1996; 34: 202-217.
7. Rochow VBM; Jarvilehto J; Cytological postmortem changes in highly specialized cells subjected to different causes of necrosis; 1997; Cytologia 62: 265-270.
8. Allaire M T; Postmortem interval (pmi) determination at three biogeoclimatic zones in southwest Colorado; A thesis Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College; 1997-2002.
9. Presnell E S; <http://emedicine.medscape.com/article/1680032-overview>.
10. <http://www.dundee.ac.uk/forensicmedicine/notes/timedead.pdf>
11. Kikuchi K et al; HMGB1 A new marker for estimation of postmortem interval; Exp Ther Med. 2010 Jan-Feb; 1(1): 109–111.
12. Kovarik C et al; Gross and Histologic Postmortem Changes of the Skin; The American Journal of Forensic Medicine and Pathology; 2005; 26 (4); 305-308
13. Bardale R V et al; Evaluation of Histologic Changes of the Skin in Postmortem Period; Am J Forensic Med Pathol; Mar 2001; 1-5
14. Cingolani M et al; morphology of sweat gland in determining time of death; Int jour of leg med; 1994; 107; 132-140i
15. Gururaj; Sivapathsundaram B; postmortem findings in gingiva assesses by histology and exfoliative cytology; Journal of oral and maxillofacial pathology; 2004; Vol 8 (1); 18-21.
16. Pradeep GL; Histological assessment of cellular changes in gingival epithelium in ante-mortem and post-mortem specimens; Journal of Forensic Dental Sciences / July-December 2009; Vol 1(2); 60-64.

A Socio-Demographic Profile of Fatal Burn Deaths in Jaipur City, India

Punia R K¹, Yadav A², Meena D K³

¹Professor and Head of the Department, ²Senior Demonstrator, ³Final Year Resident, Department of Forensic Medicine
SMS Medical College, Jaipur

ABSTRACT

Deaths due to burn are some of the most challenging fatalities, both from the investigative and the autopsy aspect. The aim of this study was to record and evaluate the causes and the magnitude of the fatal burn injuries prospectively from 1st July 2012 to 30th June 2013. During this period, a total of 3572 cases were autopsied, of which 425 (11.9%) cases of burn received in the mortuary of SMS Hospital, Jaipur. The majority of deaths (82.3%) occurred between 11 and 40 years of age group with a preponderance of females (60.7%). The Flame burns were seen in 87.7% of the victims, followed by Electrical burns (7.7%). The maximum number of the burn victims 252 (67.5%) died due to flame burns which were caused by kerosene oil. The majority of burn incidents were accidental (78%) in nature followed by suicidal (19%) deaths. The percentages of burns (TBSA) over 40% were observed in most of the cases (90.6%). According to the size 38.8% patients had 61-80% of body surface burns and 27.3% had more than 80% burns. The majority of deaths occurred within a week (53.4%) and most of the victims died from septicaemic shock (55.3%) followed by hypovolumic shock (31.5%).

Keywords: Fatal burn, Flame burns, Electrical burn, Septicaemic shock, TBSA

INTRODUCTION

A burn is an injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals. The injury represents an assault on all aspects of the patient, from the physical to the psychological. It affects all ages, from babies to elderly people, and is a problem in both the developed and developing world. Burn injuries are among the most devastating of all injuries and a major global public health crisis.^{1,2} Burns are the fourth most common type of trauma worldwide, following traffic accidents, falls, and interpersonal violence.^{3,4}

About 45% of the mortality in burns patients is caused by septicaemia.⁵ Burns are a major problem in the developing world. Mortality in the developing world is much higher than in the developed world. Most burns are due to flame injuries. The most infrequent burns are those caused by electrocution and chemical injuries.⁶ Burns and death due to burns continue to remain an important public health and social problem in India. The incidence is particularly high among the "young married females".^{7,8} belonging to lower socio-economic groups.⁹ Hence, this study was done to know the magnitude and the socio-cultural factors of the problem of burns, so that an effective prevention measures could be suggested for reducing the incidence of fatal burns.

Corresponding author:

R K Punia

Professor and HOD

Department of Forensic Medicine, SMS Medical College, Jaipur

Email id: rkpunia86@gmail.com

MATERIAL AND METHOD

The present study is carried out in the department of Forensic Medicine, SMS Medical College & Hospital, Jaipur, from 1 July 2012 till 30 June 2013. 425 burn cases were autopsied in the mortuary of the Forensic

Medicine Department. The various epidemiological characteristics of the cases were obtained and analyzed with respect to the age-gender distribution, marital status, socioeconomic status, place of occurrence, survival period, body surface area, cause of death from panchayatnama papers, autopsy reports, the investigating officers and the relatives of the deceased. The data was recorded, compiled and analyzed statistically. An informed consent was obtained from relatives of each victim prior to his/her inclusion in the study.

OBSERVATION AND RESULTS

A total no of 3572 autopsies were done in the Department of Forensic Medicine during the study period. Out of which 425 (11.9%) burn cases were autopsied. The youngest patient was two and a half year and the oldest was 90 years of age. Maximum victims (62.5%) were in the age group of 21-40 years age group in which females are more affected than males while in 41-60 age group, males are more affected than females. Females (60.7%) were more commonly affected than males (39.3%) (Table-1).

Table 1. Demographic distribution of burn deaths.

Age group(in years)	Male	Female	Total no. of cases.	Percent % (Male : Female)
0-10	5	4	9	55.6:44.4
11-20	14	70	84	16.6:83.4
21-30	66	113	179	36.8:63.2
31-40	39	48	87	44.8:55.2
41-50	20	16	36	55.6:44.4
51-60	16	3	19	84.2:15.8
61-70	6	2	8	75:25
71-80	1	0	1	100:0
81-90	0	2	2	0:100
TOTAL	167	258	425	39.3:60.7

Table 2. Distribution of burn cases according to marital status.

Maximum numbers of burns victims were married (74%). Amongst those, maximum number of burns victims were females i.e. 197 (63%). 112(26%) were unmarried burns victims and amongst those 61 (54.4%) were females (Table-2).

Marital status	Male	Female	Total No.(%)
Married	116	197	313 (74)
Unmarried	51	61	112 (26)

Table 3. Area wise distribution of burn cases.

Out of 425 victims, 67% patients were from rural and 33% from urban dwellings (Table 3) .

SEX	Rural(%)	Urban(%)	Total (%)
Male	111(66.4)	56 (33.6)	167 (100)
Female	175 (67.8)	83 (32.2)	258 (100)
TOTAL	286 (67)	139(33)	425 (100%)

Table No 4. Distribution of patients with respect to manner of burn in relation to sex.

Accidental burning was observed in 78% followed by suicidal (19%) and homicidal burning only in 3% cases. Female preponderance is observed in all manner of burn deaths.

Manner	Male	Female	Total no. (%)
Accidental	134	198	332(78)
Suicidal	32	48	80(19)
Homicidal	1	12	13(3)
Total	167	258	425(100)

Table 5. Distribution of patients in relation to cause of burn.

The most common type of burn were flame burn in 87.8% of cases followed by electric burn in 7.7% cases (table 5). Flame burn was most common in all age groups (Table-5).

Types	No. of cases.(%)
Flame burn	373 (87.8)
Electrocution	33 (7.7)
Chemical burn	12 (2.8)
Scald burn	7 (1.7)
Total	425(100)

Table 6. Distribution of Burn cases in relation to Cause of Death.

The major cause of death was septicæmic shock (55.3%) followed by hypovolemic shock (31.5%), neurogenic shock(5.4%) and toxaemia (5.3%).

Cause of death	No. of cases	Percentage(%)
Septicæmic shock	235	55.3
Hypovolemic shock	134	31.5
Neurogenic shock	23	5.4
Toxaemia	22	5.3
Acute renal failure	11	2.5
Total	425	100

Table No. 7. Distribution of victims according to Socioeconomic status.

Majority of victims (68.5%) belonged to low socioeconomic status in the present study(Table-7).

Socioeconomic status	No. of cases	Percentage (%)
Low	291	68.5
Middle	105	24.7
Higher	29	6.8
Total	425	100

Table 8. Distribution of victims in relation to place of occurrence.

The most common place of burn for female was in –laws home (78.3%) and for male is workplace (64%). (Table-8).

Place of occurrence	Male (%)	Female(%)	Total
In- laws home	1(0.6)	202(78.3)	203(47.7)
Own home	17(10.2)	14(5.4)	31(7.3)
Outdoor	42(25.2)	31 (12)	73(17.2)
Workplace	107(64)	11(4.3)	118(27.8)
Total	167(100)	258(100)	425(100)

Table 9. Distribution of cases according to TBSA and duration of survival

The present study shows that 90.6% of the 425 victims sustained more than 40% of total body surface area (TBSA) burns. Maximum number of deaths (32%) occurs within a week of the incidence of burn, 15.8% of deaths occurred in more than 2 weeks post-burn incidence. There was a positive correlation between the TBSA and Duration of survival (Table-9).

%(Percentage of burn)	Upto 6 h No(%)	7-24 h No(%)	1 week. No.(%)	1-2 week No.(%)	>2 Week No.(%)	Total No. %
0-20	0	0	1	2	1	4(0.9)
21-40	0	1	8	14	7	31(7.3)
41-60	2	11	24	42	25	104(24.5)
61-80	8	21	49	59	34	165(38.8)
81-100	13	35	54	14	0	116(27.3)
Total	23(5.4)	68(16)	136(32)	131(30.8)	67(15.8)	425(100)

DISCUSSION

Severe burn is a major public health issue in developing nations. This makes it the 4th leading cause of injuries after motor vehicle collisions, falls, and violence. This has been attributed partly to overcrowding and an unsafe cooking situation.¹⁰ Overall, nearly 60% of fatal burns occur in Southeast Asia with a rate of 11.6 per 100,000.¹¹

Burn deaths are an important public health problem in a developing country like India. In India, about 700,000 to 800,000 people per year sustain significant burns, though very few are looked after in specialist burn units. Part of this high rate is related to unsafe kitchens and loose-fitting clothing typical to India.¹² It is estimated that one-third of all burns in India are due to clothing catching fire from open flames.¹³ Intentional burns are also a common cause and occur at high rates in young women, secondary to domestic violence and self-harm.¹⁴ Burning of married women in India is a major concern for the Government, law enforcing authorities, the judiciary, the police and forensic experts all over the country.

In our study females 61% were more commonly affected than males 39%. This is in concordance with reports in the literature by other researchers¹⁻⁵⁻¹⁷. S Ramcharan et al¹⁸ in their study had found females 57.1% while as males 42.9%. Ashish K Jaiswal et al¹⁹ in their study had found females 70.3% and males 29.7%, Anuradha Rajput et al²⁰ in their study had found females in 60% and males in 40%. This female sex preponderance could be possibly because of their more domestic involvement as they tend to spend most of time near fire and also dowry deaths.

In our study majority of patients 67% were from rural background while as only 33 from urban dwellings, Ashish K et al in their study had found 67.3% of females and 58% of males from rural background which are consistent with our observations. This may be explained on the basis of poverty, overcrowding and lack of proper safety measures in rural background.

In present study the most common cause of burn was accidental (78%), the second common cause was suicidal (19%) and homicidal (3%). Ashraf F et al²¹ in their study had observed 89.1% of burn injury as unintentional, suicidal (4.3%) and homicidal (2.6%). This

could be attributed to the carelessness of victims while handling fire.

In our study, majority of females (78.3%) suffered burn injuries at their in-law's home. In contrast, 64% males suffered burn at work place. The high incidence of burn in case of females (83.7%) inside the home because of their domestic activities and dowry deaths prevailing in our region. Our findings are consistent with the studies of Ashraf et al who in their study had found home (91.4%) as the most common place of burn, S Ramacharan et al who in their study had observed (62%) of burn occurring at home and Ashish K Jaiswal et al⁶ who also had observed home (85%) as most common place of burn. Other authors reported similar observation-92%²², 86%⁸, 67%²³, 71%²⁴. It also focus on carefulness during their work in kitchen while handling the cooking equipment.

In our study, 373 patients (87.8%) had flame burns, 34 (7.7%) had electric burn, 12 (2.8%) had chemical burn followed by 7 (1.7%) cases of scald burn. Flame burn accounts majority of case which is consistent with reports in literature by Subrahmanyam M, Ashish K Jaiswal et al, Dhiraj buchade et al who had reported the similar findings in their studies. Electrical burns (7.7%) are second most common in our study which had male predominance which is not consistent with the study of Gowri Shankar et al²⁵ where scald burns (9.3%) were the second most common.

Most of the victims (68.5%) in our study belonged to low socioeconomic group. This result is consistent with the Subrahmanyam M and Gupta et al. The incidence of burn injuries decreased with the uplift in the economic status of the individual. This may be due to the use of cheap and unsafe pressure stoves, open fires, adulterated kerosene, financial problems, floor-level cooking. In our study, septicemic shock (55.3%) was major cause of death followed by hypovolemic shock (31.5%). Harish dasari et al²⁶ also reported septicemia (84%) as a major cause of death in their study.

Married females 197 (76.3%) most common victims of present study followed by married males 116 (69.4%) which was consistent with studies of H.M. Mangal et al, Usama b Ghaffar et al²⁷ and Dhiraj buchade et al.²⁸ Kerosene (67.5%) is main inflammable agent among different sources of fire in the present study.

This may be explained on the basis that kerosene is cheap, easily available and widely used as a cooking fuel by people of the low socioeconomic group in India. Similar reports had been reported in studies from India.^{27,29}

In the present study, the majority (90.6%) of the victims had more than 40% of total body surface area (TBSA) burns indicating the incompatibility with life even at a tertiary care centre. In the current study, 53.4% cases died within a week, 30.8% cases between 1-2 week signifying that the burns are rapidly fatal. Similarly Virendra et al³⁰ also reported death from burns within a week in 60.8% victims. Vilasco and Bondurand³¹ in their study reported 40% burn deaths between 3 and 7 days of the incident. These findings highlight that burn injuries are a serious public health problem with alarmingly high mortality and morbidity.

CONCLUSION

Burn profile closely reflects the socioeconomic status of a country. Burn injuries are a major public health concern and are associated with significantly high mortality in India. Majority of the burns were caused by domestic accidents and are therefore preventable by adequate safety measures and health education especially for flame injuries occurring in the home environment.

Acknowledgement: Nil

Conflicts of Interest: None declared.

Source of Funding: Nil

Ethical Clearance: Not required.

REFERENCES

1. Forjuoh SN. Burns in low- and middle-income countries: a review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. *Burns* 2006; 32:529.
2. Peck MD, Kruger GE, van der Merwe AE, et al. Burns and fires from non-electric domestic appliances in low and middle income countries Part I. The scope of the problem. *Burns* 2008; 34:303.
3. World Health Organization. The Global Burden of Disease: 2004 Update. World Health Organization, Geneva, 2008, www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf (Accessed on April 02, 2010).
4. Institute for Health Metrics and Evaluation. The Global Burden of Disease: 2010 Update. IHME, Seattle, 2012 (Accessed on July 01, 2013).
5. Dokter J, Boxma H, Oen IM. The mortality and the causes of death at a burn centre. *Burns* 2008; 34: 1103-07.
6. Shehan Hettiaratchy and Peter Dziewulski, ABC of burns *BMJ* 2004; 328; 1366.
7. Jayaraman V, Ramakrishnan KM, Davies MR. Burns in Madras, India: an analysis of 1368 patients in 1 year. *Burns* 1993; 19: 334-9.
8. Chaurasia AR. Mortality from burns in developing countries. *Burns* 1982; 9: 184.
9. Sharma BR, Harish D, Sharma V. Kitchen accidents viz-a-viz dowry deaths. *Burns* 2002; 28: 250-3.
10. Peck, MD (2011 Nov). "Epidemiology of burns throughout the world. Part I: Distribution and risk factors". *Burns : journal of the International Society for Burn Injuries* 37 (7): 1087-100.
11. Herndon D (ed.). "Chapter 3: Epidemiological, Demographic, and Outcome Characteristics of Burn Injury". *Total burn care* (4th ed.). Edinburgh: Saunders. p. 23.
12. Ahuja, RB; Bhattacharya, S (2004 Aug 21). "Burns in the developing world and burn disasters.". *BMJ (Clinical research ed.)* 329 (7463): 447-9.
13. Gupta (2003). *Textbook of Surgery*. Jaypee Brothers Publishers. p. 42. ISBN 978-81-7179-965-7.
14. Peck, MD (2012 Aug). "Epidemiology of burns throughout the World. Part II: intentional burns in adults.". *Burns : journal of the International Society for Burn Injuries* 38 (5): 630-7.
15. H.M. Mangal, Akhilesh Pathak, J.S.Rathod: The Fire is Both "A Blessing and Scourge to the mankind" *JIAFM*, 2007 October-December-29(4): 75-76.
16. Memchoubi, H.Nabachandra: A study of Burn deaths in Imphal. *JIAFM*, 2007-29(4)131-134.

17. Sharma BR, Sharma V and Harish D: Suicides in Northern India-causes, methods Used and prevention thereof, *Med.Sci.Law*, 2003, 43(3); 221-229.
18. S. Ramcharan, S. Dass, S. Romany, F. Mohammed, T. Ali, M. Ragbir *Epidemiology Of Adult Burns In North Trinidad . The Internet Journal of Third World Medicine* 2003; 1(1).
19. Jaiswal AK, Aggarwal H, Solanki P, Lubana PS, Mathur RK, Odiya S. Epidemiological and socio-cultural study of burn patients in M. Y. Hospital, Indore, India. *Indian Journal of Plastic Surgery*, 2007; 40(2): 158-163.
20. Anuradha Rajput K.P.Singh, Vijay Kumar, Rishi Sexena, R.K.Singh. Antibacterial resistance of aerobic bacteria isolates from burn patients in tertiary care hospital. *Biomedical Research* 2008; 19 (1):1-4.
21. Ashraf F. Attia, Aida A. Sherif, Ahmed M. Mandil, M. Nabil Massoud, Mervat W. Abou-Nazel and Moustafa A. Arafa. Epidemiological and socio-cultural study of burn patients in Alexandria, Egypt. *Eastern Mediterranean Health Journal*, 1997,3(3): 452-461.
22. Subrahmanyam M. Epidemiology of burns in a district hospital in Western India. *Burns*. 1996;22:439-42.
23. Gupta M, Guta OK, Yaduwanshi RK, Upadhyaya J. Burn epidemiology: The pink city scene. *Burns*. 1993;19:47-51.
- 24.. Dhillon K, Shekon HS, Mishra VK. Study of burn deaths in and around Shimla District. *J Punjab Acad Forensic Medicine and Toxicol* 2005;46(2) 105-10.
25. Shankar G, Kalburgi B.E, Hunshikutti S. Analysis of burn injuries admitted in a tertiary care teaching hospital in Bagalkot, Karnataka, India. *Medicolegal Update* 2012, Vol 12 (2):62-65.
26. Dasari H, Kumar A, Sharma BR. Burn Septicaemia- The leading cause of Burn Mortality. *JPAFMAT* 2008; 8(2):10-16.
27. Ghaffar UB, Hussain M and Rizvi SJ: Thermal Burn: An Epidemiological Prospective Study. *J Indian Acad Forensic Med*, 2008,30(1) 10-14.
28. Buchade D, Kukde H, Dere R, Savardekar R: Pattern of burn cases brought to morgue, Sion Hospital Mumbai: A Two Year Study. *J Indian Acad Forensic Med*, 2011,33(4)309-10.
29. Kumar V, Tripathi CB. Fatal accidental burns in married women. *Legal Medicine* 2003; 5: 139-145.
30. Virendra K, Manoj KM, Sarita K. Fatal burns in Manipal area: a 10 year study. *J Forensic Leg Med* 2007;14:3-6.
31. Vilasco B, Bondurand A. Burns in Abidjan Cote D'Ivoire. *Burns* 1995;21:291-6.

Troponin: the Valuable Assay in Post Mortem Investigation of Ischemic Heart Disease

Anita Verma¹, Shaista Saiyad², Pratik Patel³

¹Associate Professor, Dept. of Physiology, ²Asst. Professor Dept. of Physiology, ³Professor and Head Forensic Medicine Dept., Smt NHL Municipal Medical College, Ellisbridge, Ahmedabad Gujarat

ABSTRACT

Sudden, unexplained and unexpected but natural deaths are more common in adults than it can be presumed with no age or sex exemption. It is found more common in younger one. History or circumstances are nonspecific to give cause of death. In such type of incidences meticulous postmortem examination is necessary with various laboratory investigations like histopathology, bacteriology, biochemistry, serology and toxicology. Amongst natural sudden deaths, coronary atherosclerosis and/or its effect(s) is the most common cause. In such cases of sudden death Meticulous & detailed Autopsy is necessary with all above cited laboratory investigations. In cardiac death, Troponin is the best biomarker to detect cardiac damage as there is increase in Troponin in blood after cardiac damage & Troponin levels if raised are highly specific for cardiac damage or injury. In our study, we aimed to find out the role of Troponin assays to establish the cardiac damage at the time of autopsy.

Keywords: Autopsy, Cardiac Injury, Coronary Atherosclerosis, Sudden Death, Troponin

INTRODUCTION

One of the objectives of the postmortem examination is to know the cause of death and its manner, whether natural or unnatural. However in many instances it is too difficult to find out the cause of death particularly in sudden unexpected and unexplained death. Here it requires detailed and meticulous examination involving several disciplines like microbiology-serology, biochemistry, toxicology, histopathology, radiology etc. It also requires analysis and interpretation of all the findings collectively considering gross external as well as internal findings on the dead body during post mortem examination. There are various causes for sudden natural deaths involving different vital system or organ. Amongst these various causes for natural deaths, greater percentage is related to cardiac disease. The coronary

atherosclerosis and its effects play major role in sudden death due to cardiac disease. Myocardial infarction, is myocardial cell death due to cardiac ischemia resulting after the rupture of an atherosclerotic plaque in coronary resulting in platelet aggregation or clotting or emboli, leading to complete blockage. Sometimes there is too small interval between occlusion & death to develop macroscopic or microscopic changes unless alternative cardiac circulation is established with the effective collaterals. Here no evidence of myocardial infarction is found. Conversely, no recent block is seen in coronary in a person suddenly died of stenosis as a result of atherosclerosis. ¹ Even one of the earliest histopathological finding of myocardial infarction due to coronary atherosclerosis i.e. eosinophilia of muscle cytoplasm is clear at about 6 hours of onset of infarction in living. However we can see changes for myocardial ischemic damage on heart only after 24 hours provided the person is alive. So in almost all cases of sudden cardiac death due to coronary block or stenosis / narrowing, it is not possible to get any evidences of myocardial infarction. In such type of cases , particularly in death preceded by complain of chest pain, a rapid assay for cardiac Troponin I [protein released due to damage to cardiac muscle] often serves as a valuable marker to give important useful data

Corresponding author:

Anita Verma

Associate Professor

Dept. of Physiology, 2nd Floor Smt NHL Municipal Medical College, Ellisbridge, Ahmedabad Gujarat-380006

Phone: ((M)9824061850, (R)079-26760202, (O)079-26576275

supportive of the cardiac cause of death in suspected sudden cardiac related deaths. Measurement of this biomarker is useful in the autopsy where we suspect cardiac lesion but that cannot be established by routine means of histopathological study.

There are three isoforms for Troponin I (TnI), out of which, two are present in skeletal muscle and the other is present only in cardiac muscle. The cardiac isoform (cardiac Troponin), with a molecular weight of 24,000 Da, is larger than the other isoforms as it contains an extra 32 amino acid N-terminal peptide. The rest of the protein has greater than 40% dissimilarity in its amino-acid sequence compared with skeletal muscle TnI.²⁻³⁻⁴

European Society of Cardiology and American Society of cardiology acknowledge that cardiac Troponin I and T has supplanted CK-MB as the analytes of choice for diagnosis of cardiac damage.⁵ Troponin C does not have cardiac specificity and is not used in assays for determining cardiac damage.⁶ Since last 5 decades it is known that there is increase in transaminase activity with myocardial infarction. Hence Creatinine, one of the biomarkers for cardiac muscle damage played a major role in such patients till last few years. It has also issued new criteria that elevation in biomarkers are fundamental to the diagnosis of acute myocardial infarction^{2,4} because symptoms are atypical or nonexistent and even ECG changes are either absent or nonspecific^{5,8}. Guideline recommends a level above the 99th percentile in a reference population as the discriminatory value but a new generation of sensitive assays for cardiac Troponin with a 10% coefficient of variation for the levels below the 99th percentile has been introduced in recent past. Again using Troponin I assay, diagnosis of cardiac damage is evident within 3 hours of onset. Cardiac Troponin I is found very low or is undetected in otherwise normal person. However Troponin elevation may help to make an early diagnosis but is not always prognostic⁹⁻¹⁰.

In a case of sudden death or "found dead" person in hospital or autopsy Troponin assay could serve as a laboratory confirmation of myocardial damage without gross naked eye changes of cardiac damage or positive histopathological changes. Cardiac Troponin I, if raised, can't be taken alone for the diagnosis of myocardial infarction as cardiac Troponin elevations suggest cardiac damage but can't be

conclusive of the mechanism, cause or reason.¹² However high sensitivity and speciûcity of this biomarker makes it still valuable.

Various studies have proved the importance of Troponin assay to form evidence of sudden death due to cardiac damage, at postmortem examination as cause of death, without undergoing unnecessary postmortem examination. We aimed our study to determine the level of Troponin I cardiac protein, in suspected cases of cardiac death as compared to control cases. After cardiac injury cardio-Troponin, myofibrillary protein, is released into the blood and is detected in blood even though nothing positive or significant is found of cardiac damage at morphological or microscopic examination at postmortem or in ECG during life time prior to death.

MATERIAL & METHOD

In this study 32 consecutive cases brought to postmortem room for autopsy at Smt NHL municipal medical college, V S. Hospital, Ahmedabad with the history of chest pain, typical of cardiac pain, followed by sudden death were included. 32 other cases, as control, were also studied in database where cause of death was known and was other than cardiac [non-cardiac].

After external examination of dead body was over, about 10 ml of blood was collected from heart during internal examination of thoracic cavity. Blood was immediately placed in airtight bulb and sent to Biochemistry department. Care was taken to avoid freezing and to prevent the haemolysis of blood. In biochemistry department blood was immediately withdrawn from the bulb and blood sample was subjected for cardiac Troponin I test. [AxSYM Troponin-I ADV, Abbott diagnostics: Lower Limit of detection -0.02/ 99th percentile-0.04/10% coefficient of variation=0.16]¹¹. Here we considered a value of 0.04ng/ml in 99th percentile of the population. Value of more than 0.04 ng/ml was taken as diagnostic of cardiac muscle damage. A meticulous postmortem examination was carried out in each with biochemical, radiological, serological, microbiological, histopathological examinations and chemical analysis for poisons. In all cases heart was subjected to radiological examination i.e. coronary angiography by injecting barium sulphate in coronaries to see any coronary narrowing.

Troponin level may be found increased in some conditions though there is no ischemic heart disease. Following cases are the examples in which it may be found to be increased and were not included in the study.

1. Congestive cardiac failure.
2. Trauma to heart.
3. Hypothyroidism.
4. Hypertension.
5. Gross infection.
6. Renal failure.
7. Cardiac surgery.
8. Burns more than one third of body surface area
9. CPR resulting into cardiac contusion.
10. Mitral valve disease.
11. Pericardial effusion.

Cases were designated as cardiac related death (IHD) and control (non-cardiac) cases, from the autopsy finding including ante mortem complain/ history of cardiac pain, histopathological examination (included macro as well as microscopic cardiac study in histopathology department), serological examination, microbiological examination, biochemical examination, toxicology assay and radiological study of coronaries etc.

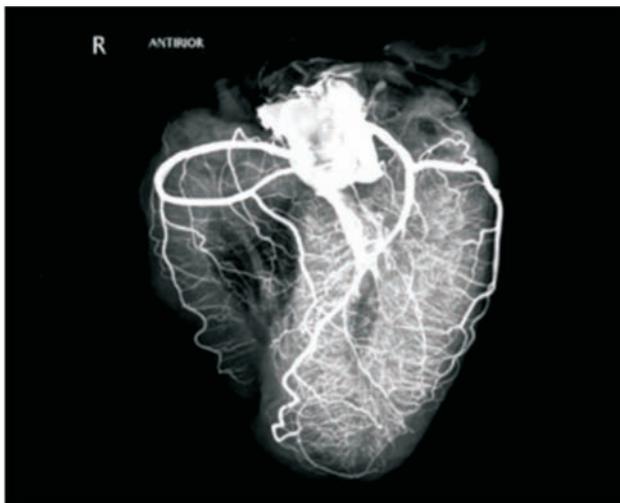


Fig. 1. Patent coronaries at post mortem radiology.

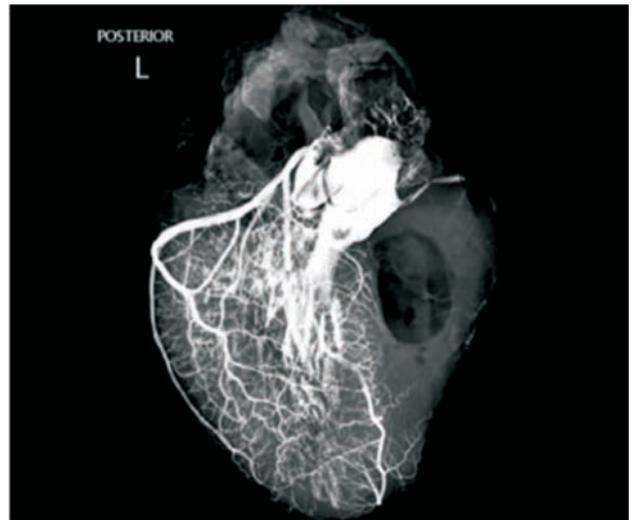


Fig. 2. Complete block of right coronary artery at its origin in radiological study.

RESULTS

Table 1. Cases showing positive assay result [i.e. 0.04ng/ml].

Cardiac related death	Positive result	Non-cardiac cases	Positive result
32	30	32	0

Table 2. Cases showing coronary narrowing in relation to positive Troponin I value, histopathology and chemical analysis reports.

No. of cases with coronary narrowing	No. of cases showing positive Troponin I value	No. of cases with gross histopathology changes in other organs responsible for sudden death	No. of cases showing poison
32	30	00	00

From table no: 1 it is observed that among control cases, where cause of death was known from postmortem findings & investigations, not a single case showed cardiac Troponin I above the upper reference limit. Table no: 2 shows that all 32 cases, where cause of death was cardiac, has obvious coronary narrowing observed during radiological study of heart after infusing barium sulphate in coronaries, macroscopic and microscopic examination of heart and coronaries. Out of all 32 cases with coronary narrowing 30 cases were positive for Troponin I and any of 32 cases showed no gross pathology in any other vital organs or presence of any poison responsible for sudden death. Out of 32 cases, studied of deaths related to cardiac damage, positive results were observed in 30 (93.75%) cases. The results

are more suggestive as significant difference can be seen statistically. [$P < 0.0001$, $\chi^2 = 20.570$]

Table 3. Distribution of cases indicating relation between age group and sex [in cardiac death].

Age group	Sex		Total
	Male	Female	
21-30 yrs	0 (0%)	2 (6.25%)	2 (6.25%)
31-40 yrs	2 (6.25%)	4 (12.5%)	6 (18.75%)
41-50 yrs	4 (12.5%)	4 (12.5%)	8 (25%)
51-60 yrs	4 (12.5%)	0 (0%)	4 (12.5%)
> 61 yrs	10 (31.25%)	2 (6.25%)	12 (37.5%)

Table number 3 shows no significant relation of Troponin I positive test and sex. Negative results for cardiac Troponin found amongst 2 cases of female sex. It could be due to sudden death within minutes before gross cardiac muscle damage could have occurred as it takes time to increase the cardiac Troponin blood level.

Our study showed that with the age Troponin I value was found decreasing. On applying Wilcoxon matched test [4.93] it is observed that person with higher age group had significantly lower Troponin I level ($P < 0.0001$). But the strength of relationship is not significant after Spearman non parametric test ($P > 0.05$). This may be due to reason that Troponin I level starts increasing after cardiac ischemic damage after varying interval in different individuals. Severity of the cardiac damage is also related to sudden death and Troponin level. Troponin I is usually found positive at about 3 hours of the injury. Its value increases gradually with peak value at about 18-24 hours after onset of symptoms. Increase in its level has relation with the extent or severity of the damage to cardiac muscles. All these above cited are the reasons to explain the non-significant relation of Troponin I to age.

DISCUSSION AND CONCLUSION

In our study 32 cases of cardiac related sudden deaths and 32 cases of sudden death due to known cause but non-cardiac death were studied. They were categorized as cardiac and non-cardiac from the history of cardiac pain, gross findings at autopsy with various investigations. The cardiac related deaths with history of chest pain and obvious narrowing of coronary vessels, confirmed at radiological as well as macroscopic study, as a result of atherosclerosis

showed the positive Troponin I value (more than 0.04 ng/ml) suggested cardiac muscle injury, and no other non-cardiac pathology, trauma or poisoning was found in any of these cases which could have caused sudden death. Our study showed no significant relation of cardiac Troponin I, with the age or sex of the deceased. Amongst non-cardiac deaths none of the 32 cases showed the positive cardiac Troponin I value. So when a patient is brought with history of sudden death without clinical findings of cardiac ischemia, an elevated level of Troponin I above cut off value with considerable coronary narrowing due to atherosclerosis, without other non-cardiac disease/pathology, injury and poisoning, the opinion can be given as a cardiac related death.

When the cross sectional area of coronary artery lumen is reduced by more than 75% as a result of diffuse coronary atherosclerotic changes involving the epicardial arteries i.e. the proximal part and narrowing is much more severe, sometimes unexpected sudden death occur with or without the symptoms. In majority of such atherosclerotic narrowing, sudden unexplained death occurs as a result of thrombosis, embolism, spasm or inflammation etc, where mechanism of death is an arrhythmia and the gross morphological changes of myocardial infarction are absent. Though ECG is the one of the best means of diagnosing acute myocardial infarction, it may be normal in about 33 % of cases when recorded early enough. In such cases Troponin I, if used, in correlation with symptoms and gross morphological changes in form of coronary narrowing it is possible to diagnose the cardiac related death due to myocardial ischemic injury. In such types of death, after ruling out other causes for death, increased cardiac Troponin with evidence of marked narrowing of coronaries at autopsy can be considered to give opinion about cardiac death.

Troponin I test can be valuable supportive measure in the emergency department or in the postmortem room where dead body is brought to confirm cardiac death. Study of Troponin I assay helps the diagnosis of myocardial infarction resulting in death as a result of cardiogenic shock.

Acknowledgement: We would like to thank, Dean Smt. NHL Muni. Medical College, Prof & Head, Dept. of Radiology & Prof & Head Dept. of Biochemistry, for their valuable support.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: NA, as we have collected data from Dept. of Forensic Medicine, Smt NHL Muni. medical college

REFERENCES

1. Krishan Vij, Textbook of forensic medicine and toxicology, 5th edition, Elsevier; 100
2. Filatov VL, Katrukha AG, Bulargina TV, et al. Troponin: structure, properties, and mechanism of functioning. *Biochemistry (Moscow)* 1999; 64:1155–1174.
3. Schreier T, Kedes L, Gahlmann R. Cloning, structural analysis, and expression of the human slow twitch skeletal muscle/cardiac Troponin C gene. *J Biol Chem.* 1990; 265(212):47–53.
4. Goldmann BU, Christenson RH, Hamm CW, et al. Implications of Troponin testing in clinical medicine. *Curr Control Trials Cardiovascular Med* 2001; 2:75–84
5. Luciano Babuin, Allan S. Jaffe, Troponin: the biomarker of choice for the detection of cardiac injury, *CMAJ*, November 8; 2005, 173(10), 1191
6. Schreier T, Keded L, Gahlmann, Cloning, structural analysis and expression of the human slow twitch skeletal muscle/cardiac Troponin C gene. *J Biol Chem.* 1990; 265:21247-53
7. Alpert JS, Thygesen K, Antaman E, et al. Myocardial infarction redefined- a consensus document of the joint European Society of Cardiology/American College of Cardiology Committee for the redefinition of Myocardial Infarction. *J Am Coll Cardio* 2000; 36; 959-69
8. Lee TH, Rouan GW, Weisberg MC et al. Sensivity of routine clinical criteria for diagnosing myocardial infarction within 24 hours of hospitalization. *Ann Intern Med* 1987; 106:181-6
9. Wiviott SD, Cannon CP, Morrow DA et al. differential expression of cardiac biomarkers by gender in patients with unstable angina/non ST elevation myocardial infarction: a TACTIS-TIMI I8, *Circulation* 2004;109;580-6
10. Venge P, Johnston N, Lagerqvist B et al. Clinical and analytical performance of the liaison cardiac Troponin I assay in unstable coronary artery disease, and the impact of age on the definition of reference limits. A FRISC-II study, *clin chem* 2003; 49; 880-6
11. Luciano Babuin, Allan S. Jaffe, Troponin: the biomarker of choice for the detection of cardiac injury, *CMAJ*, November 8; 2005, 173(10), 1191
12. Scott M. Wells, DVM, DACVECC and Meg Sleeper, VMD, DACVIM (Cardiology): cardiac Troponin, *Journal of Veterinary Emergency and Critical Care* 18(3) 2008, pp 235–245

An Insight into Additional Factors in Drug Abuse

Seema S Sutay¹, Nishat Ahmed Sheikh²

¹Associate Professor of Forensic Medicine, RD Gardi Medical College, Surasa, Ujjain, MP, ²Associate Professor of Forensic Medicine, Kamineni Institute of Medical Sciences, Narketpally District Nalgonda, Andhra Pradesh

ABSTRACT

Drug abuse is a serious public health issue that is trending upward and shows no signs of slowing. The war on drugs is no longer confined to those "illegal" substances such as cocaine, heroin, and ecstasy, but now includes legal prescription medications. The abuse of prescription drugs is a serious public health issue and the increasing diversion of prescription drugs for illegal use is causing concern among government officials. Doctor shopping is a term generated by the addiction and reliance on prescription medications as patients actively seeks doctors who will prescribe certain types of medications, usually opiates, depressants, and stimulants. Prescription monitoring programs shall prove to be an effective system in identifying and preventing the diversion and abuse of prescription drugs at both the pharmacy and patient levels.

Keywords: Drug Abuse, Over the Counter Drugs, Prescription Monitoring Programme

INTRODUCTION

Over the counter medication in India is not a new problem, but has been a concern since antibiotic resistance and other health complications are noticed. Patient approach pharmacies without prescription to get these medications, is known as Pharmacy shopping. Over the counter drugs means drugs legally allowed to be sold over the counter by pharmacist i.e. without prescription of Registered Medical Practitioner. Prescription only drugs are those medicines that are listed in schedules H & X of the drugs and cosmetic rules. Drugs listed in schedule G (Mostly antihistamines) do not need prescription to purchase but require the following mandatory text on the label "caution: it's dangerous to take this preparation except under medical supervision." Currently non-drug licensed stores (E.G Non-pharmacists) can sell a few medicines classified as 'Household Remedies' listed in schedule K of D & C rules in villages whose population is below 1000 subject to certain other condition⁸.

'Ayurvedic Medicines' are also regulated by Drug control Authority and Drugs and Cosmetic Rules. They are manufactured under Ayurvedic State Licensing Authority, but do not require license for sale. OTC brands in India are Vicks, Amrutanjan, Zandu, Halls, Dabur, Calcium Sandoz, etc.

The Drugs and Magic Remedies (Objectionable Advertisement) Act 1954 and Rules 1955, this Act Controls the advertisements for certain category of drugs with a view to prevent people from self medication under the influence of misleading and exaggerated advertisements. There are 54 ailments covered under this section of which fever is one of them⁸.

Today's man is more informed, use more gadgets lead a fast life and thereby face higher stress changing lifestyles, less exercise, junk food, polluted environment and consuming addictive substances to remain alert at work and night. These negligent attitude towards health leads to psychosomatic disorders e.g. frequent headache, allergy, common cold, constipation, backache, acidity, fatigue, etc. which leads them to over the counter drugs to manage problems. With the help of available knowledge from gadgets, pharmacists, etc., they medicate themselves. Because of Increase in defensive practice of doctors, people have lost of confidence in them and are

Corresponding author:

Nishat Ahmed Sheikh

Associate Professor of Forensic Medicine
Kamineni Institute of Medical Sciences, Narketpally,
District Nalgonda, State Andhra Pradesh
Email ID: drnishatsheikh@gmail.com
Contact No: + 91 009390058109

dependent on Ayurvedic or other alternative medicines for common ailments. They go to pharmacist and take symptomatic medicines which actually don't treat the disease. Misdiagnosis, wrong doses may sometimes worsen the condition¹⁰.

Popular drugs in India are- Diphenhydramine, Dimenhydrinate, Antispasmodic-oxybutynin/ glycopyrolate, anticholinergic like Amantadine. Explosion of illegal drugs hit the ground quietly and many of us didn't realize its dangers its devastating effects- it would take on India. Most common Drugs of abuse are – cannabis/ Merijuana, Heroine/ Brown Sugar, Tobacco. The worrisome fact is that we know

the drugs of abuse in addicted persons whom we call drug addicts. But the persons who by virtue of buying over the counter drugs on large account, have become addicts, go on missing. The states like US, UK, Australia, etc. have drug monitoring program and certain legal provisions enacted and some provisions under approval to reduce prescription abuse, misuse and overuse²⁹. In India it's under development.

A study of pharmacist show following trend of providing over the counter drugs without prescription based on their knowledge¹¹ in all age groups especially 20-30 years

Table No: 1 showing issue of drugs by pharmacist without prescription.

Sr No.	Ailment									
1	Back and joint pain	Acetofenac	Diclofenac	Nimesulide	Ibuprofen	Indomethacin	Acetaminophen +Acetofenac	Prednisolone		
2	Runny nose	Cetirizine,	Chlorphenaramine	Diphenhydramine	Levocitrizine	Fexofenadine	Ebastine			
3	Headache	Acetaminophen	Ibuprofen	aspirin	Naproxen	Mefanamic acid				
4	Cough	Amoxicillin	Ciprofloxacin	Doxycyclin	Dipheny-dramine	Ampicillin	Roxithromycin	Ofloxacin	Cefpodoxime	Ambroxol, Dextromethorphan, Codein Phosphate
5	Fever	Acetaminophen	Ibuprofen	Ketoprofen	Naproxen	Mefenamic acid				
6	Wound care	Ciprofloxacin	Amoxicillin	ofloxacin	Penicillin	Chloramphenicol	Ampicillin	Amoxicillin		
7	Throat infection/ sorethroat	Erythromycin	Roxithromycin	Azithromycin	Clarithromycin	Tetracyclin				
8	Diarrhoea	Loperamide	Tinidazole	Diphenoxylate	Metronidazole +Norfloxazine	Bismuth Subsalicylate	Attapulgit	Ciprofloxacin		
9	Vomitting	Domperidone	Ondansetron	Doxylamine succinate	Promethazine	Metochlorpramide	Chropromazine			
10	Mouth ulcers	Ciprofloxacin	Ofloxacin	Erythromycin	Thiamine hydrochloride	Niacinamide	Clotrimazole gel	Chlohexidine gluconate mouthwash		

This revealed irrational use of antibiotics in most of the ailments which in turn spreads to people who asks for some drugs over the counter again when they have similar complaints¹¹. Recommendations to curb on Antibiotics have been given in bill listed- waiting to be approved¹². Contribution of advertising is much on over the counter. Emphasis is always given on emotions rather than usefulness, as perceptual process differs from reality, we feel deceived in the sense of consumer's right to information. e.g. Complexion creams, Antidandruff, Weight loss, etc. Also we find advertisers exploit naïve and gullible attitude of children in case of food and nutritional supplements¹³.

We have reviewed literature on abuse of these drugs which show worrisome facts to think about.

Steroids

Steroids are on top of the list among irrational user after Antibiotics study released at Dermacon2012 revealed that 15 lakh people are suffering from Topical Steroid Damaged Face (TSDf). Patient had used ointments like Betnovate C &N, Tenovate, Lobate or Quadriderm without prescription over the counter. These medicines have a high steroid content that may turn the skin thinner, give rise to steroid dependence and enhance pimples or rashes on skin. Other complications Hirsutism, Perioral dermatitis or rosacea can also prop up¹⁵. Burning Skin syndrome is another problem due to overuse of topical corticosteroids¹⁷. Over the counter topical steroid are prohibited internationally but not in India.

Another steroid i.e. anabolic steroids which convert to Testosterone e.g. ANDRO used amongst youths and athletes, are available at Gyms. The risks associated with these are clotting disorders, liver damage, premature heart attacks, stroke, weakened tendons, and increased LDL, Decreased HDL levels, Gynaecomastia. These bottles are not labeled as steroids, but sold as muscle activators¹⁶.

Another side effects of these steroids are Sexual dysfunction, depression, anxiety, hallucination, uncontrollable feelings, sleep disturbances, stunted growth, oily skin, acne, hair loss and insomnia, addiction, kidney damage, edema, dysuria etc¹⁹.

Currently Assay that detect the presence of Testosterone, DHE and other anabolic agents do not universally test for all possible forms of doping, making it difficult to detect steroid abuse among athletes. Efforts to thwart steroid abuse in sport are further hindered by the continual development of so called "designer drugs", which are anabolic agents that quickly break down in blood or during testing procedure and therefore more difficult to detect²⁰ hence total ban on availability could be the solution.

Many Australians who want steroids go to Thailand and get these anabolic steroids what they call as steroid vacations because these are strictly prohibited in Australia and hence not at all available for use¹⁸.

Ophthalmic drugs

Study at Mangalore observed that people use; 96% Antibiotics, 55% steroids, 65% Decongestants, and 16% of them use Lubricants over the counter without prescription, with pharmacist recommendations. Antibiotics used are ofloxacin, moxifloxacin, Gatifloxacin²¹. Steroidal eye drops on long term use may cause ocular- conjunctival and corneal toxicity, Steroid induced glaucoma leading to loss of vision, herpetic Keratitis, amoeboid ulcers & Blindness. Over the counter lubricants on long term use may produce corneal epithelial toxicity due to preservative present in the drops e.g. Polysorbate and benzalkonium are highly cytotoxic. Decongestant may induce conjunctivitis. Deeper diseases of eyes may go undiagnosed / misdiagnosed by pharmacist²¹.

Cough and cold

Codein containing cough syrups were banned and were replaced with DXM (Dextrometharphan) over the counter in 1970 by FDA due to abuse potential of

codeine. But today DXM is also abused by parents for their children and also by teenager's reason being easily available over the counter²². Overuse of DXM may cause gastrointestinal disturbances, Confusion, dizziness, blurred vision, rapid heartbeat, and drowsiness; in large quantity it can cause similar effects to those of Ketamine and Phencyclidine²³. Diphenhydramine; another antihistamine used in cough syrup and also used to tackle urticaria has a powerful Hypnotic effects and euphoria like action for which it is abused²⁴.

Analgesics

Though opioid drugs are banned over the counter; severe pain is managed by Dihydrocodein (e.g DF118), Oxycodon (e.g. Oxyconin), Methadone and Buprenorphine²⁵.

Psychotropic substances

Stimulants like Amphetamines, Methylphenidate and DXM. Depressants like Benzodiazepines e.g. Diazepam, Non-diazepam drugs like Zolpidem, Antipsychotics e.g. Clozapine, Risperidon, etc., Imipramine, Fluxetine, Setraline. These drugs are obtained by abusing prescription^{26,27}.

Abortifacient

Drugs like Mifepristone, Misoprostol are available over the counter after MTP act 1971 to stop unsafe Illegal abortion. Now a day's drugs like I-pill contraceptive are available without prescription. It's risky without blood transfusion facility and Operation Theater to tackle complications like incomplete abortion. It may cause congenital anomaly or other birth defects as a study conducted at Ludhiana the failure rate is 34%. In this study they observed incomplete abortions in 75%, Severe anaemia requiring blood transfusion 33%, ruptured fallopian tube, hemoperitonium, Shock 16% and previous LSCS rupture 8.3% of the patients who took medications without prescription either by own, husband or with help of internet²⁸.

DISCUSSION

Doctor Shopping

'Doctor-shopping' refers to a pattern of behavior whereby a patient fraudulently presents symptoms to multiple doctors in order to obtain prescription medication beyond his or her actual medical need, it

is also being referred as 'prescription shoppers', identified on the basis that they have attended on six or more registered Medical Practitioner prescribers in a three month period².

Doctor-shopping is one of the most common and easiest methods for the diversion of prescription medication for non-medical use. The misuse of prescription medication arises when an individual administers medications in a manner or in dosages unintended by their prescriber, for instance to achieve an intoxicated state.

Patients who are unable to obtain a prescription from one physician will seek out another physician in an effort to obtain the amount and type of medications they want. Doctor shopping ranges anywhere from the very aggressive shopper, who frequents many different doctors, to the casual shopper, who visits different doctors but does so infrequently, once patients receive drugs, they will seek out other physicians to prescribe the same pills, often exaggerating their symptoms or even inventing new ailments. The goal in doctor shopping is to obtain the maximum amount of pills without the medical community becoming wise to the scheme. In order for the system to work, the addict must frequent different pharmacies because pharmacists are made to keep records of the controlled substances they dispense.

Doctors and pharmacies to get medications are at greater risk of dying from a prescription drug overdose¹. Prescription abuse; CDC found that in 2010 alone, there were enough painkillers prescribed to supply every adult with one month supply².

Commonly abused prescription drugs are: Sedatives e.g. Zolpidem (ambient), Alprazolam, Diazepam or opioid painkiller e.g. Oxycodone (Percocet/oxycotin) Hydrocodone (vicodin), Hydromorphone (palladone), Oxymorphone. Less powerful opioid e.g. codein, propoxyphen and tramadol and newer analgesic like fentanyl¹ (Duragesic Patch).

Rochelle Clark one of the person netting accepted that he takes 5 prescriptions a week acquiring more than 2800 tablets of hydrocodone alone³. Those people are very good actors, they give history of pain in some area and may be pressed upon and thus receive painkiller prescription from doctor.

Prescription drug monitoring programme have been designed in US to collect prescription data on medications classified as federal substances. The information is stored in central database and can be accessed by authorized users.

Centre for disease control and prevention found 40 Americans die per day from overdose of painkillers such as vicodin and oxycotin².

The study examined information from west Virginia, controlled substance monitoring programme (WVCSMP) and drug related death data compiled by forensic drug data database from July 2005 to Dec. 2007 in which 17.5% of diseased were pharmacy shoppers and 20% were doctor shoppers. The ways of tackling the problem at a broader level might be to hold periodic joint meetings of both local physician and local pharmacy organization to discuss strategies to reduce the problem⁶. 49 states have laws establishing prescription drug monitoring programme and 43 of them have running that involve a database of patient who have been prescribed certain controlled substances. Despite these efforts prescription abuse continues⁴. Another debatable issue is; is database monitoring not invading privacy of patient. But it's for the benefit of patient and thus society at large, therefore legally should be acceptable.

Suggestion

India needs to create prescription monitoring programs and make it statutorily illegal to engage in the practice of doctor shopping. Prescription monitoring programs shall prove to be an effective system in identifying and preventing the diversion and abuse of prescription drugs at both the pharmacy and patient levels. There is a disturbing trend in India; drug users are attracted to doctors and pharmacy shopping because they provide greater availability of drugs, easy access, and convenience. Traditionally, addicts rely upon doctor shopping to obtain prescription drugs. Present laws are not designed to address the specifics of doctors and pharmacy shopping and are ineffective at curbing the problems raised by them.

Acknowledgement: The authors would like to express sincere thanks to Dr. T. Venkat Ramanaiah Prof & HOD of Forensic Medicine KIMS Narketpally.

Source of Funding: Nil

Ethical Clearance: Institutional Ethical clearance and Project Approval, No ethical involvement and no Interventional procedure.

Conflicts of Interest: Nil.

REFERENCES

1. Doctor shopping, http://en.wikipedia.org/w/doctor_shopping
2. Kim carollo, Deaths from painkiller overdose on the rise, say CDC, Nov1, 2011.
3. New law puts heat on doctor shoppers, American medical News.com, Sunday, March 18, 2012.
4. Pamela Lewis Dolan, More states make doctors consult database before prescribing; Amend News staff- June 28, 2012.
5. Pierce G.L., Smith MJ, Abate MA, Halversan J; 'Doctor and Pharmacy shopping for controlled substances' med care: 2012 Jun;50(6): 494-500.
6. WVU study finds doctor and pharmacy shopping are linked to prescription drug overdose deaths; Morgan Town, Health News: 09/06/12.
7. Your pharmacy records and Doctor shopping; Ron Chapman, Justice Florida.com, March12, 2010.
8. Organization of Pharmaceutical producers of India; www.indiaoppi.com.
9. Most popular drugs in India: Introduction. De-addiction staff Sept 1, 2012.
10. Ajit Paninchukunnath, OTC drug marketing- Global trends and Indian Experiences; Health care & marketing- Part V.
11. C. Moothi, Rachael Paul, Rajesh Grandhi, Gundapalli, Dhananjay Rao; Irrational use of OTC drugs: A Pilot study at community pharmacies, International Journal of Pharmacy and Pharmaceutical Sciences, Vol.4, issue1, 2012.
12. Kounteya Sinha, TNN Sep 4, 2012, 12.30 AmIST. Curb on Over the Counter sale of 92 Antibiotic soon.
13. Legal and Ethical aspect of Advertising- Dr Sheetal Kapoor
14. <http://www.medicareaustralia.gov.au/prescriber/pbs/prescription-shopping/index.jsp#N1002A>
15. Yogesh Kant; without prescription- steroids are a bane, beware, Aug 12, 2012; 17.48pmIST
1. www.nida.nih.gov/drug_pages/steroids.html.
17. Betsy Bates, Steroid overuse may ignite burning skin syndrome. Internal Medicine News, Jan1. 2003.
18. Tim Sharky Steroid vacation, <http://www.smh.com.au/national/health/steroidvacation-20120526>.
19. Steve Richards, Negative effects of anabolic steroids, steroid abuse and side effects; Winstrol & Winstrol abuse, april 8, 2012.
20. Position statement-Steroid abuse. The Endocrine society; June 2008,
21. Rajani kadri, Sudhir Hegde, Ajay Kudva, 'Over the counter Ophthalmic drug Misuse, are we aware? Online journal of Health and Allied Sciences. Volm 9, issue2, April-june2010.
22. Steven Dowshen, cough and Cold Abuse, Oct 2010.
23. Romanelli F & smith KM, Dextrometharphan abuse- Clinical Effects & Management. Journal of Pharmacist association 2009:49: 20-27.
24. Feldman MD & Behar M. A Case of Massive, Diphenhydramine Abuse withdrawal from use of drugs. JAMA, 255, 3119-3120.
25. Dasgupta N, bailey, EJ, Cicero T, Inciardi J, Arrino M, Rosenblum A, Dart R. Post marketing surveillance of methadone and Buprenosrphine in United States. Pain Medicine, 2010: 11,1078-1091.
26. Owens DGC, A Guide to Extra pyramidal side-effects of antipsychotics drugs. Cambridge Univ Pess1999.
27. Brenda Goodman, Study of Newer Antipsychotic drug overuse. WEBMD Health News. Jna 7, 2011.
28. Seema Grover, Kumkum Awasthi, Kanupriya Jain, over the counter sale of MTP Pills- Endangering lives of women. The Indian Practitioner, vol 65, No9, Sept 2012.
29. Prevention of prescription drug abuse. National Conference of State Legislature, updated Sept2012

Hidden Facts of Peri-Operative Deaths in ASA-Class I and ASA- Class II Patients - A Cross-Sectional Study

N Vijayakumari¹, K Meiyazhagan²

¹Assistant Professor, ²Prof. and HOD, Department of Forensic Medicine, Annapoorana Medical College and Hospitals, Salem, Tamilnadu, India

ABSTRACT

This study was aimed to determine the various factors contributing to peri-operative deaths in ASA-Class I and ASA-Class II patients. Using confidential structured questionnaire, data was collected from 100 anaesthesiologists practicing in Tamilnadu. Among the 48 deaths, 32 patients (66.7%) were adults, 16 patients (33.3%) were OBG cases, followed by general surgery cases 15 patients (31.3%), 30 cases (62.5%) had underwent surgery under General Anaesthesia, 32 cases (66.7%) were emergency surgeries, 25 deaths (52.08%) were encountered during post-operative period, 17 cases (35.41%) was due to patient factors and 16 cases (33.34%) was anaesthesia related. Deficiency of equipments, drugs and lack of trained technicians to manage emergency situations especially in post-operative ward was seen in 17 cases (39.5%). We conclude that, these findings can be used to improve the quality of peri-operative care, prepare strategies and protocol to prevent such deaths.

Keywords: Peri-operative, Mortality, Anaesthesia, Developing Countries

INTRODUCTION

Peri-operative mortality studies, with adequate confidentiality can provide valuable information on the standards of health care and contribute to an improvement in the standards of surgical outcome.¹ The knowledge obtained from these studies help us to identify our shortcomings in the management of a surgical case, avoiding mistakes which may have occurred in the past, identify the areas needing improvements and developing strategies to prevent such deaths.²

Peri-operative deaths in ASA-Class I and ASA-Class II patients have always remained controversial, as they are healthy patients coming to the hospital only for surgical problem. As death of such a patient is unexpected it leads to various legal and social problems. The cause of death in such cases is always thought to be either due to negligence by the anaesthesiologists or surgeon by the public. The real fact may not be clear unless an autopsy is conducted by competent persons, death audit is conducted or a case is filed in the court of law. In India, there are limited studies done on this particular topic. Most of the studies are done by collecting data from the

hospital records.^{1,2,3,4,5} Though the hospital records are a good source of patient information, certain information regarding inadequate facility, insufficient man power, equipment failure, human error, etc., may not be available. To get the real facts, reviewing anaesthesiologists who came across such deaths will be one of the valuable method of study. Hence the present study is planned to collect information covering all such factors by giving a confidential structured questionnaire to the Anaesthesiologists.

MATERIAL AND METHOD

After obtaining approval from the hospital ethics committee, data was collected using a structured questionnaire during the period of 2012-13. Questionnaire was given to 100 anaesthesiologists practicing in Tamilnadu either by personal contact or through post or by e-mail. Adequate confidentiality is maintained regarding the identity of the anaesthesiologists and the hospital in which they are working. Data is obtained regarding .

1. Pre-op condition & pre-op preparation of the patient- Age, ASA grading, type of the surgery, severity of surgical condition, co-morbidities, were

the co-morbidities adequately managed prior to the surgery, was sufficient time available for pre-op preparation of the case, etc,

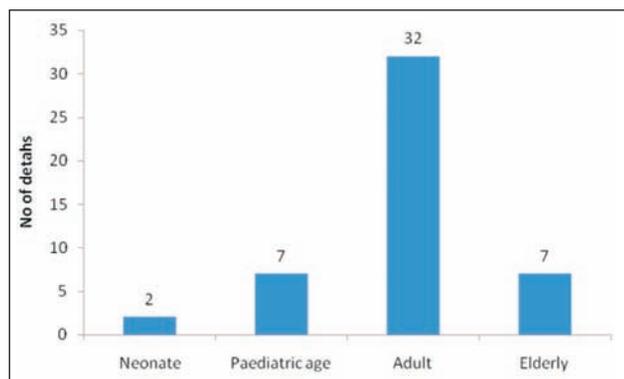
2. Per-operative information- Type of anaesthesia, difficult airway, equipment malfunction, inadequate facilities like equipment, personnel, drugs, etc, and details about the complications occurred during anaesthetic management or surgery
3. Postoperative complications (during first 48hrs) and the probable cause of death.

At the end of the study, data was compiled and analyzed using suitable statistical methods.

RESULTS

In the present study, the response rate was 87% and among those 49.4% of the respondents had been in practice for more than five years. 48 respondents (55.2%) had experienced atleast one death of ASA Class I or ASA Class II patients during their practice. Among the 48 deaths, 32 patients (66.7%) were adults and 9 patients (18.8%) were paediatric patients (Table 1)

Table 1. Age group of patients



Regarding the type of surgery majority were OBG cases 16 patients (33.3%) followed by general surgery cases 15 patients (31.3%) (Table 2)

Table 2. Nature of Surgery

Nature of surgery	Frequency	Percent
OBG	16	33.3
General surgery	15	31.3
No Answer	11	22.9
ENT	2	4.2
Ortho	2	4.2
Plastic surgery	1	2.1
Urology	1	2.1
Total	48	100.0

Most of the deaths, 30 cases (62.5%) were seen in patients who underwent surgery under General Anaesthesia and 32 cases (66.7%) were emergency cases.

In the present study, higher mortality was reported in patients with no pre-existing systemic involvement 32 cases (66.7%). In 10 cases (45.45%) the co-morbid condition was diagnosed during the administration of anaesthesia or in post-op condition. (Table.3)

Table 3. Co-morbid conditions

Co-morbidity	Frequency	Percent
None	32	66.7
Hypertension	2	4.2
Bronchial asthma	1	2.1
Mild respiratory diseases	6	12.5
Endocrinal disease	2	4.2
Others	5	10.4
Total	48	100.0

In 23 cases (47.92%) sufficient time was not available for pre-operative management of the cases. Most of the deaths 25 cases (52.08%) were encountered during post-operative period. The commonest cause of death as per the respondents opinion is patient factors in 17 cases (35.41) followed by anaesthesia related factors in 16 cases (33.34) and in 6 cases (12.50%) was due to surgical complications. The most common factor was airway or ventilatory problems 42 cases followed by cardiac causes 26 cases, technical problems in 3 cases and drug related in 4 cases. More than one factor was involved in most of the cases. Deficiency or malfunctioning of equipments, drugs and lack of trained technicians to manage emergency situations especially in post-operative ward was seen in 17 cases (39.5%).

DISCUSSION

Anaesthesia is considered as high risk activity as it has the potential to induce physiological changes which may lead to morbidity and mortality. Peri-operative mortality is the one of the feared complication of any surgery and it has remained a controversial issue. Preoperative assessment of risk status is done by ASA grading as proposed by American Society of Anesthesiology based on the physical status of the patient. ⁶ The ASA score is a subjective assessment of a patient's overall health that is based on five classes (I to V).

- I. Patient is a completely healthy fit patient.
- II. Patient has mild systemic disease.
- III. Patient has severe systemic disease that is not incapacitating.
- IV. Patient has incapacitating disease that is a constant threat to life.
- V. A moribund patient who is not expected to live 24 hours with or without surgery.
- E. Emergency surgery, E is placed after the Roman numeral.

The rate of postoperative complications and mortality was found to be closely related to the ASA class. The mortality rate of ASA class I and ASA class II is less than 0.2% and it increases with emergency surgeries.⁷ Unexpected death of healthy patients with low risk factors, i.e., ASA class I and ASA class II patients is always been one of the major public health problems as it creates lots of social, legal and financial problems. Anaesthesia has been implicated as the main contributory factor in these deaths.

In the present study, out of 87 respondents 49.4% of the respondents had been in practice for more than five years and 48 respondents (55.2%) had experienced at least one death of ASA class I or ASA class II cases during their practice. We found a significant correlation between mortality and the experience level of the anaesthesiologists (p-value <0.0001). Among the 48 deaths, the death of adult patients was higher 32 patients (66.7%) when compared to paediatric patients 9 patients (18.8%). This is because; paediatric patients are associated with minimal co-morbid conditions. Whereas other studies have reported increased mortality in paediatric patients.^{8,9} In the present study, there has been higher mortality reporting in patients who underwent emergency surgeries 32 cases (66.7%) when compared to elective surgeries 16 cases (33.3%). Similar findings have been reported in other studies,^{8,9,10}

With respect to type of surgery, OBG patients were found to be more vulnerable 16 cases (33.3%) followed by general surgery 15 cases (31.3%). Most of the deaths 30 cases (62.5%) were seen in patients who underwent surgeries under General Anaesthesia when compared to spinal anaesthesia 17 cases (35.4%). Similar findings have been reported by various other studies.^{8,9,11} The

reason for this low mortality in spinal anaesthesia could be due to usage of newer local anaesthetics with fewer side effects, fewer drugs used, minimal physiological changes occurring when compared to general anaesthesia, possibility of better and easy monitoring of these patients.

In the present study, higher mortality was reported in patients with no pre-existing systemic involvement 32 cases (66.7%). Similar findings were reported in other studies.⁸ Mild respiratory problem was present in 7 cases (14.6%) which was optimized before taking up for surgery. The respondents have reported that in 23 cases (47.92%) sufficient time was not available for pre-operative management of the cases. This could be one of the major contributing factors in such deaths.

Intra-operative period has been considered as "incident rich phase"^{12,13} but in the present study the mortality has been reported to be more in post-operative phase 25 cases (52.08%) Deficiency or malfunctioning equipments and monitors, emergency drugs and trained technicians to manage emergency situations especially in post-operative period has been reported in 17 cases (39.5%) which has direct correlation with the high incidence of deaths during postoperative period. This could be attributed to inadequate post-operative management available in a developing country like India. Similar findings were reported in other studies.¹⁴

The commonest cause of death as per the respondents opinion is patient factors in 17 cases (35.41) followed by anaesthesia related factors in 16 cases (33.34), in 6 cases (12.50%) due to surgical complications and in 9 cases (18.75%) the exact cause could not be determined. Similar findings have been reported in other studies.^{8,15,16,17} Airway or ventilatory problem was the major factor involved in the present study 42 cases (87.5%) followed by cardiac problem. Few studies have reported cardiovascular events as the common factor where the majority of cases done were cardiac surgeries.^{4,18}

25 respondents have given suggestions that if improvements are done with respect to equipments (well maintained equipments), adequate monitoring care especially in post-operative period, availability of ICU in every hospital, appointing trained assistants in OT as well as post-op ward, complete pre-operative evaluation and preparation of the patient will prevent most of the peri-operative deaths.

CONCLUSION

Unexpected peri-operative deaths of healthy patients continue to be controversial despite improvements in drugs and equipments. Most of the deaths are preventable if more importance is given to pre-operative evaluation and preparation of the patients, being vigilant, timely intervention, adequate post-operative care, appointing trained assistants and also developing strategies and protocols to avoid error of judgement.

Source of Funding and Conflict of Interest: Nil

REFERENCES

1. Tan, AE. Delilkan. Anaesthetic Contribution to Deaths in the Operating Theatre at the University Hospital Kuala Lumpur -A Retrospective Survey. *Med J Malaysia* (1993); 48 (4): 397-402.
2. Y Kawashima, S Takahashi, M Suzuki, K Morita, K Irita. Anesthesia-related mortality and morbidity over a 5-year period in 2,363,038 patients in Japan. *Acta Anaesthesiologica Scandinavica* (2003); 47 (7): 809-817
3. Lienhart, André, Auroy Yves, et al. Survey of Anesthesia-related Mortality in France. *Anesthesiology* (2006); 105(6):1087-1097
4. M. S. Arbous, J. W. Van Kleef , et al. Mortality associated with anaesthesia: a qualitative analysis to identify risk factors. *Anaesthesia* (2001); 56(12): 1141-1153.
5. Daniel Bainbridge, Janet martin, et al. Perioperative and anaesthetic-related mortality in developed and developing countries: a systematic review and meta-analysis. *The Lancet* (2012);380: 1075-1081
6. Dripps RD. New classification of physical status. *Anesthesiol.* 1963;24:111
7. Turet L, Hatton F, Desmonts JM, Vourc'h G. Prediction of outcome of anaesthesia in patients over 40 years: A multifactorial risk index. *Stat Med.* 1988;7:947-54
8. SunandaGupta, Uditanaithani, SarojKumar Brajesh, VikrantSingh Pathania, ApoorvaGupta. Critical Incident Reporting in Anaesthesia: A Prospective Internal Audit. *Indian Journal of Anaesthesia* 2009; 53 (4):425-433
9. Leandro Gobbo Braz, Danilo Gobbo Braz, and José Reinaldo Cerqueira Braz. Mortality in Anesthesia: A Systematic Review. *Clinics (Sao Paulo)* 2009 october;69(10): 999-1006
10. McKenzie AG. Mortality associated with anaesthesia at Zimbabwean teaching hospitals. *S Afr Med J* 1996; 86: 338-342
11. Clergue F, Auroy Y, Pequignot F, Jouglu E, Lienhart A, Laxenaire MC. French survey of anesthesia in 1996. *Anesthesiology* 1999) 91: 1509-20
12. Khan PA and Hoda MQ. A prospective survey of intra-operative critical incidents in a teaching hospital in a developing country. *Anaesth* 2001;50:171-182
13. Webb RK, Currie M and Morgan CA. The Australian Incident monitoring study: An Analysis of 2000 incident reports. *Anaesth Intens Care* 1993;21:520-528
14. T. Pedersen, K. Eliassen, E. Henriksen. A prospective study of mortality associated with anaesthesia and surgery: risk indicators of mortality in hospital. *Acta Anaesthesiologica Scandinavica.* April 1990; Volume 34, Issue 3, pages 176-182,
15. Irita K, Kawashima Y, Iwao Y, Seo N, Tsuzaki K, Morita K, Obara H. Annual mortality and morbidity in operating rooms during 2002 and summary of morbidity and mortality between 1999 and 2002 in Japan: a brief review. *Masui.* 2004 Mar; 53(3):320-35
16. L. G. Braz1, N. S. P. Mo'dolo1, P. do Nascimento Jr1, B. A. M. Bruschi1, Y. M. M. Castiglia1, E. M. Ganem1, L. R. de Carvalho and J. R. C. Braz1. Perioperative cardiac arrest: a study of 53 718 anaesthetics over 9 yr from a Brazilian teaching hospital. *British Journal of Anaesthesia* 2006; 96 (5): 569-75
17. Ce Ohanaka . Perioperative Deaths in a Nigerian Tertiary Teaching Hospital. *Turk J Med Sci.* 2007; 37 (4): 219-222
18. Juraj Sprung, Randall P. Flick, Stephen J. Gleich, Toby N. Weingarten. Perioperative Cardiac Arrests. Review . *SIGNA VITAE* 2008; 3(2): 8 – 12

Clinical Pattern and Outcome in Patients of Organophosphorus Poisonings in the Rural Area around Talegaon - Dabhade

Maya Pai Dhungat¹, Pradip Pai Dhungat¹, Dilip P Bhoge²

¹Associate Professor, ²Prof & Head, Department of Medicine, M.I.M.E.R. Medical College, Talegaon- Dabhade, Taluka- Maval, District- Pune, Maharashtra, India

ABSTRACT

The aim of this study was to analyse the patterns, clinical profile and the outcome in the patients of organo-phosphorus poisoning in a rural population of Maharashtra.

Introduction: OP compounds are common household insecticides used extensively in agricultural communities all over Maharashtra and Maval Taluka is not an exception for the same. The diagnosis of Organo-Phosphorus Poisoning (OPP) is established by the characteristic constellation of clinical features and depression of cholinesterase activity. There is variability of symptoms and signs depending on the nature of the compound, amount consumed, absorption, time gap between exposure and presentation to the hospital.

Material & Method: We carried out a retrospective analysis of the admissions of the patients of Organo Phosphorus Poisoning for the period from May 2010 to April 2012, at Dr. Bhausaheb Sardesai Talegaon Rural Hospital (BSTRH) and M.I.M.E.R. Medical College Talegaon - Dabhade, Maval, Pune, Maharashtra.

Results: Poisoning cases presenting to the Emergency department of our hospital amount to around 12-15% of the total admissions. Out of 126 patients of poisoning admitted in the time period from May 2010 to April 2012 in BSTRH, 90 patients had Organo-phosphorus poisoning. It was noted that 60 patients (66.67%) were in the age group of 14-30 years with a male preponderance.

Miosis was the most common clinical feature found in 93% of the patients followed by increased lacrimation in 90%, and increased salivation in 84%. Most of the patients had sweating, bronchospasm and vomiting episodes. Intermediate syndrome (IMS) was diagnosed in 8 patients after 48 hours of admission. The overall mortality rate was 14.4%. All our results were similar to most of the other studies.

Conclusion: Despite being a hospital-based study, we believe that these data provide important preliminary information on the pattern of symptoms of poisoning in our area. Most of the poisoning deaths can be and should be prevented or at least reduced by drastic and combined efforts of all concerned.

Keywords: Poisoning, Organo-Phosphorus, Cholinesterase, IMS, Miosis

Corresponding author:

Maya Pai Dhungat

Associate Professor

Department of Medicine, M.I.M.E.R. Medical college.

Talegaon - Dabhade, Maval, Pune, Maharashtra

Email: paimaya@rediffmail.com

Mobile : 9860073364

INTRODUCTION

Deliberate self harm by Poisoning is a major problem throughout the world. Organo Phosphorus (OP) poisoning is a common cause of acute intentional poisoning in India with high mortality(1)The exact incidence of poisoning is not known in India due to

the lack of central registry but approximately account for 12-15% of admissions in the emergency department of Medicine.¹ Suicide is ranked as the third leading cause of death in the age group of 15 to 44 years with an increasing frequency every year.

ORGANOPHOSPHATE poisoning (OPP) from occupational, accidental and intentional exposure continues to be one of the most important causes of poisoning in India. The OP insecticides are of choice as a poisoning agent in the agricultural world as these are easily available in retail market. The mode of exposure and absorption of organophosphates is from dermal, gastrointestinal and inhalational routes.

Organophosphate compounds inhibit Acetylcholine esterase resulting in the accumulation of Acetylcholine and overstimulation of cholinergic receptors. Patients die mostly of the Respiratory failure which can occur due to acute cholinergic crisis, intermediate syndrome (IMS) and central nervous system depression.⁴ The diagnosis of OPP is established by the characteristic constellation of clinical features and depression of cholinesterase activity. A good history, high index of suspicion and detailed clinical examination are essential. The clinical features can be classified into 1. Muscarinic 2. nicotinic and 3. Central nervous system features.⁶ There is variability of symptoms and signs depending on the nature of compound, amount consumed, severity, time gap between exposure and presentation to the hospital. However most of the patients who develop severe toxicity usually have symptoms within 6 hours.

Several studies have focussed on clinical features, treatment and prognostic factors in OPP.⁶⁻¹⁰

The aim

of this study was to analyse the patterns, clinical profile and the outcome in the patients of organophosphorus poisoning

MATERIAL AND METHOD

Dr. BHAUSAHEB SARDESSAI TALEGAON RURAL HOSPITAL (BSTRH) is a tertiary care centre in Maval Taluka catering to the rural poor patients.

We carried out a retrospective analysis of the admissions of the patients with ORGANO PHOSPHORUS POISONING (OPP) for the period from May 2010 to April 2012, at B.S.T.R.H. and

M.I.M.E.R. MEDICAL COLLEGE Talegaon – Dabhade, Maval, Pune, Maharashtra.

Poisoning cases presenting to the Emergency department of our hospital amount to 12-15% of the total admissions. The OP compounds were the most commonly responsible agents in poisoning cases as is seen in the other studies from rural parts of Asia.^{6,7}

Inclusion Criteria : All those patients above 14 years of age with Organo phosphorus poisoning attending our emergency department were included in the study.

Exclusion Criteria : Patients below 14 years of age, those with unknown poisoning and the patients with associated serious comorbidities were excluded from the study.

Outcome measured according to Peradeniya organophosphorous Poisoning (PoP) scale -clinical criteria score.

A score of 0 to 3 is considered as mild poisoning, 4 to 7 as moderate poisoning and 8 to 11 as severe poisoning.¹⁶

Serum Cholinesterase levels were done on the 1st day of admission, for the diagnostic and reference purpose. The test was repeated on 2nd day if the previous reports were normal. All patients included in the study had > 50% reduction of normal S. cholinesterase value.

Descriptive statistics (frequency and percentage) were computed for categorical variable like sex, age group, clinical presentation and outcome.

RESULTS

Out of total 126 poisoning cases admitted in the time period from May 2010 to April 2012 in BSTRH, 90 patients (67.44%) were of organo-phosphorus compound poisoning.

The literacy status revealed that 8 patients were graduates, 13 had studied till 12 standard, 25 upto primary and 44 were illiterate.

Financial problem was a common in married males – 25 cases (46.3%) and Domestic issues were most frequent in married females – 19 cases (52.8 %).

Table 1. Age and sex distribution of the patients

(n=90)			
Age in years	Male	Female	Total
14-30	31	29	60
31-45	19	4	23
>46	4	3	7
Total	54(60%)	36(40%)	90

It was noted that 60 patients (66.67%) were in the age group of 14-30 yrs.

Sex distribution in this study showed a male preponderance. There were 54 (60%) males and 36(40%) females.

About 58% belonged to lower socioeconomic strata. 38% were agriculturist followed by housewives (22%), students (16%), labourers (10%) and others (14%).

About 40% consumed less than 60 ml of poison and 10% consumed more than 120 ml of poison.

The time which elapsed between the poison intake and initiation of therapy, varied from 30 minutes to 16 hours. Majority of the cases i.e.54 (60%), reached the hospital within 6 hours ,25(27.8%) within 6-8 hrs,6(6.67%) within 8-12 hrs whereas 5 (5.56%)presented after 12 hours of consumption of poison to the hospital.

The mean hospital stay was 5.98 days, with a majority of the cases staying for 3 to 9 days in the hospital .

Table 2: Clinical features of organophosphorus poisoning

(n=90)			
Clinical features	No of patients	Clinical features	No of patients
Pulse rate		Salivation	76
45-65	56	Lacrimation	81
66-75	24	↑ Urination	68
>75	10	Sweating	73
Miosis	84	Vomiting	70
Bronchospasm	67	Fasciculations	44
Anxiety /restlessness	73	Fits	2
↓Response to verbal commands	46	coma	5
Respiratory distress	32	Arrhythmia	4

Miosis was the most common clinical feature found in 93% of the patients followed by increased lacrimation in 90% .Out of 90 patients, 84% had increased salivation , 81% of the patients had anxiety

and restlessness ,81% had sweating,74% patients had bronchospasm and 77% had vomiting episodes. In our study, 5.5% of the patients were comatose on arrival to the casualty. We had 8 (8.9%) patients who developed intermediate syndrome during the hospital stay. Delayed CNS manifestations could not be documented as they were beyond the scope of our study.

On presentation to the emergency department ,all patients were evaluated for Airway, Breathing & Circulation (ABC) . A thorough gastric lavage with diluted KMNO₄ solution was carried out till the returning fluid was clear, clothes worn by the patient were removed and a body wash with soap and water was given. All patients were evaluated for requirement of intubation and mechanical ventilation, blood samples were collected for routine investigations and serum cholinesterase levels. Arterial Blood Gases were sent in the patients of severe poisoning . All patients were admitted in the medical I.C.U and monitored continuously for Blood pressure, Heart rate, Pupillary size, Respiratory rate and SpO₂.The standard protocol for treatment of OPP was followed for every patient.

Table 3: The mean age, stay and atropine used

(N=90)			
	Mean	Std. Deviation	Std Error Mean
Age in years	29.9	12.242	1.395
Hospital stay in days	5.9870	2.65317	0.30236
Atropine used in ml	56.2987	80.18664	9.13812

The Peradenya poisoning scale was applied to the clinical signs of the patients at the time of admission and patients were divided into mild, moderate and severe grades.¹⁶

Table 4: Comparison of stay, mechanical ventilation and mortality in the different grades

(n=90)				
Grades	no	stay	ventilation	mortality
Severe	26	7.2± 3.4	16 (61.5%)	10 (38.5%)
Moderate	51	6.3 ± 2.0	7 (13.7%)	3 (5.9%)
Mild	13	4.2± 1.8	0	0

Overall mortality rate was 14.4% (13 out of 90 patients) Among 26 patients who presented with severe symptoms, 16 patients recovered completely and were discharged; however 10 patients expired. Out of 51 patients with moderate severity, 48 patients

survived while 3 patients expired. Patients with mild symptoms had uneventful recovery.

The incidence of respiratory failure in acute OPP is highly variable and various reports have estimated an incidence of 34.95% to 56%. In our study 25.6% (23 out of 90 patients) required ventilation.

DISCUSSION

Organo Phosphorus compounds accounted for 85% of all poisoning cases in our study in comparison to the other studies, where the incidence ranged from 70% - 89.75%.^{2,3} In our study 97% of patients consumed OP compounds with suicidal intent and only 3% were accidental ingestion or occupational exposure. Homicidal poisoning was not reported in our study. Our data revealed that 60% of patients with OP poisoning presented to hospital within 6 hours, 34% between 6-24 hrs and 5.5% after 24 hrs. This trend was similar to the ones shown in some other studies.^{9,10}

Age/sex wise distribution (Table 1) shows a predilection for the group between 14-30 years with male preponderance which is same as in other studies.^{4,5} Regarding marital status, 54(60%) were married and 36 (40%) unmarried. Perhaps the males in this age group have a tendency to take more risks in pursuit of success and in the acts of passion being in the most active period of life. Frustrations and depressions are more common in the personal as well as professional life of this age group.

In 21st century we live in so much of competitive atmosphere which increases the stress day by day. The factors may be related to finance, domestic issues, emotional problem like failure in love or exams phobia. In present study we found that amongst these factors financial problems were common in married males and domestic issues were most frequent in married females. This was similar to other studies.^{8,9}

Miosis was the most common clinical feature found in 93% of the patients followed by increased lacrimation in 90%. Out of 90 patients, 84% had increased salivation, 81% of the patients had anxiety and restlessness, 81% had sweating, 74% patients had bronchospasm and 77% had vomiting episodes.

Overall mortality rate was 14.4% (13 out of 90 patients). Among 26 patients who presented with severe symptoms, 16 patients recovered completely and were discharged; however 10 patients expired.

Delay in hospitalisation, more amount of poison consumed, lack of first aid and severe symptoms on admission seem to be the causative factors. Pattern of poisoning in present study is more or less similar to the pattern found in most of the other studies.^{3,6,9,10} This similarity is there in almost all parameters used in study. Most poisoning is by Pesticide agents.

The clinical course and the outcome was comparable with other studies.^{9,10}

CONCLUSION

Despite being a hospital-based study, we believe that these data provide important preliminary information on the pattern symptomatic poisoning in our area.

Pesticides are the major chemical agents which pose a health threat particularly to young people, depressed and stressed individuals and farm workers. This serious condition needs rapid diagnosis, early and effective treatment so that the morbidity and mortality can be reduced in the affected group. Poison information centres should be set up apart from first aid facilities and manpower provided at PHC level, as immediate treatment can help in saving the lives of many patients. Apart from medical efforts, social support and sincere efforts by N.G.Os and other social groups towards counselling of vulnerable population could be of great help.

The fundamental dictum being "prevention is better than cure", most of the poisoning deaths can be and should be prevented or at least reduced by drastic and combined efforts of all concerned.

Acknowledgement: We acknowledge the assistance of the staff of Medical Records Department of M.I.M.E.R. Medical college.

Ethical Clearance: Taken from M.I.M.E.R. Medical college / BSTRH Hospital ethical committee.

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

1. Falguni Parekh. Changing trends in Poisoning. JAPI Nov 2009; 57 :739
2. Jayaratnam.J. Acute pesticide poisoning: A major global health problem wld. Hlth statistics 1990;43: 139-144

3. Eddleston M., Sheriff MHR, Hawton K. Deliberate self harm in Sri Lanka :an overlooked tragedy in the developing world .BMJ 1998;317:133-35
4. M.A.Chcrian,C roshni, Jvisalaksi , L.Jeyaseelan, AM Cherian .Biochemical and clinical profile after organophosphorus poisoning –a placebo controlled trial using Pralidoxime. JAPI May 2005;53:427-431
5. 7th congress meeting Asia Pacific abstract .journal of medical toxicology sept 2009; 5 (3):165-173
6. S.Shivkumar, KRaghavan, R.M Ishaq, S Geetha. JAPI March 2006; 54:250-251
7. Namba T,Nolte CT,Jackrel J, et al. Poisoning due to organophosphate insecticide. Acute and chronic manifestations. Am J Med 1971;50: 475-92
8. Bawaskar HS,Joshi SR.Organophosphorus poisoning in agricultural India –status in 2005.JAPI 2005 ;53:422-4
9. Pyar Ali,Asma Anwer,Babar Bashir et al.Clinical pattern and outcome of organophosphorus poisoning .JLUMHS.Jan-April 2012;11(01):15-17
10. V.Chand Basha ,S.siraj Mohiyuddin,S.rajesewara Reddy,L.Ananda Kumar.A Retrospective study of organophosphorus compound poisoning in tertiary hospital in Hyderabad region. Indian journal of Forensic Medicine & Toxicology2010; 4:6-8 J Indian Acad Forensic Med. April-June 2011, Vol. 33, No. 2 ISSN 0971-0973
11. Dhaval J. Patel, Pawan R. Tekade. Profile of Organophosphorus Poisoning at Ma harani Hospital, Jagdalpur, Chhattisgarh: A Three Years Study J Indian Acad Forensic Med. April-June 2011; 33(2):102-105 Sociodemographic
12. Kora S.A., Doddamani G.B., Halagali G.R., Vijayamahantesh S.N., Boke Umakanth .Profile of the Organophosphorus Poisoning Cases in Southern India Journal of Clinical and Diagnostic Research. 2011 October, Vol-5(5): 953-956
13. Indranil Bannerjee, Santanu K. Tripathi, A.Sinha Roy. A study on comparative evaluation of add-on Pralidoxime therapy over Atropine in the management of organophosphorus poisoning in a tertiary care hospital .JK Science April-June 2011; 13 No 2 :65-69
14. M. Eddleston ,L.Szinicz,P.Eyer , Buckley N.Buckley .Oximes in acute organophosphorus pesticide poisoning :a systematic review in clinical trials .Q.J.Med 2002;95:275-283
15. S.N.Chugh, Navneet Aggarwal, Surekha Dabla, B Chhabra. Comparative evaluation of “Atropine alone” and “Atropine with Pralidoxime (PAM)” in the management of organophosphorus poisoning. JIACM 2005;6(1):33-7
16. Senanayake N,de silva HJ, Karalliedde L.Scale to assess Severity in organo-phosphate intoxication (POP) scale .Hum Exp Toxicol 1993 July12(4) 297-9

Age Related Changes in Human Kidneys- An Autopsy Study

S R Jagannatha¹, Mouna Subbaramaiah²

¹Associate Professor, ²Assistant Professor, Department of Anatomy, Kempegowda Institute of Medical Sciences, Banashankari II stage, Bangalore

ABSTRACT

Aging is a biological process from which no living being is exempt and a universal effect of aging is the gradual loss of functioning cells from many organs and tissues. Like most other organs kidney also undergoes various structural changes with advancing age. The present study was carried out to assess the ageing process in kidneys belonging to South Indian masses. The study was carried out on 60 human kidneys obtained from post mortem bodies of South Indian people aged from 14 years to 80 years. The collected sample was divided into four age groups. They are as follows, group A (0-20 years), group B (21-40 years) group C (41-60 years) and group D (61-80). Morph metric parameters like weight, length, breadth and thickness were recorded. Results were analyzed statistically. Random slides from each group were studied for histological changes. From the present study it can be concluded that a number of structural changes occur in the kidney with aging. The aging kidney is characterized by loss of renal weight, breadth and thickness associated with arterial sclerosis, an increased number of sclerotic glomeruli, loss of tubules and interstitial fibrosis.

Keywords: Kidneys, Age, Histological Changes, Nephrons

INTRODUCTION

The kidneys are a pair of essential organs, which excretes the final product of metabolic activities and excess water, both of these actions being essential for the control of concentration of various substances in the body fluid.¹ Normal kidney measures about 12 cm in length, 6cm in breadth, 3 cm in thickness and weighs about 130 gm.² The kidney is composed of many tortuous, closely packed uriniferous tubules, bound by a little connective tissue in which run blood vessels, lymphatics and nerves¹. Each tubule consists of two embryologically distinct parts: the secreting

nephron and a collecting tubule.³ The renal corpuscle (or malpighian corpuscle) serves as a passive filter, allowing substances up to a particular molecular weight to pass but preventing substances of a higher molecular weight from passing through and the renal tubules are concerned with selective reabsorption and excretion of substances.⁴ The renal corpuscle represents the beginning of the nephron. These are spheroidal, slightly flattened bodies that occur in large numbers in the cortical labyrinths and their diameter in the adult is about 200 gm.⁵ Each corpuscle consists of : i) Glomerulus - A tuft of capillaries and ii) Bowman's capsule - A double layered epithelial cup which is invaginated by the glomerulus.³ Aging is a biologic process from which no living being is exempt and a universal effect of aging is the gradual loss of functioning cells from many organs and tissues. Kidney loses its functioning cells with age that do not have the ability to divide⁶ and from 4th decade up to 8th decade of life the human kidneys lose approximately a fifth of their weight.⁷ Kidneys with length less than 8 cm are regarded as contraindication for intervention of renal arterial disease.⁸ The kidney

Corresponding author:

S R Jagannatha

Associate Professor

Department of Forensic Medicine, Kempegowda Institute of Medical Sciences, Banashankari II Stage, Bangalore-560070, Karnataka State, India

Phone: (0)91-080-26715790-ext-143

Fax: 91-080-26712798

Mobile Phone No: 0-9886334494

Email: drjagannathasr@gmail.com

cannot regenerate new nephrons. Therefore, with renal injury, disease or normal aging there is gradual decrease in nephron number. After 40 years of age, the number of functioning nephrons usually decreases about 10% every 10 years.⁹ In this study we depend on the data published in textbooks and literatures, which come from the subjects of different races, from the individuals under different geographic and climatic conditions. Hence the present study was undertaken to assess the ageing process in kidneys belonging to South Indian masses.

MATERIALS AND METHOD

The present study was carried out on 60 human kidneys of South Indian people aged from 14 years to 80 years. Among them 48 were from male bodies and 12 from female bodies. The kidneys were collected from apparently fresh dead bodies that underwent medicolegal examination in the Department of Forensic Medicine, KIMS, Bangalore. Written consent was obtained from the victim's relatives for the same. The specimens were washed thoroughly with tap water and gently squeezed to remove the blood clots from the lumina of blood vessels. Associated fat, fascia, nerves and other unwanted tissues were removed. Then the weight of the kidney was measured by means of a electronic balance and results were recorded in grams. The length was measured from upper pole to lower pole. The breadth was measured at the level of the hilum. The thickness was measured at the region of maximum antero-posterior diameter. Length, breadth and thickness were measured with the help of slide calipers. The collected sample was divided into three age groups. They are as follows, group A (0-20 years), group B (21-40 years), group C (41- 60 years) and group D (61-80). Results were analyzed statistically. Five samples from each group were randomly chosen for histological study. Small pieces of tissue measuring about 2cm sq were taken from cortical regions of relatively fresh kidneys. Tissues were processed using an automatic processor and embedded in paraffin blocks. Sections made were processed following standard histological procedure and were stained with Hematoxylin and Eosin stain. One good slide prepared from each tissue block was chosen and histological details were noted.

RESULTS

The present study was done on 60 human kidneys which included 48 males and 12 females of South Indian origin. There were 12 kidneys in group A (0-20

years), 26 in group B (21-40 years), 15 in group C (41-60 years) and 7 in group D (61-80). The mean values of all parameters like weight, length, breadth and thickness in different age groups were tabulated (Table-1). From the present study it is evident that weight of kidneys increased with age up to 50 then started to regress. The length increased proportionately with age up to 50 while breadth and thickness increased up to 40 and then gradually decreased. Most values were significantly higher on the right side except for renal breadth which was higher on the left side (Figure 1 and 2). The values varied considerably when sex was taken into account. Renal weight was higher in females compared to males in younger age group. As age advanced male kidneys weighed more (Figure-3). Renal length in very young and old age females was significantly higher (Figure-4), otherwise it was higher in males. Histologically from the present study it was found that the average number of renal corpuscles per sq. mm area gradually decreased with the increase of age. The size of renal corpuscles increases but glomeruli size appeared to gradually decrease with advancing age. All changes were indicative of arteriolar sclerosis associated with interstitial fibrosis.

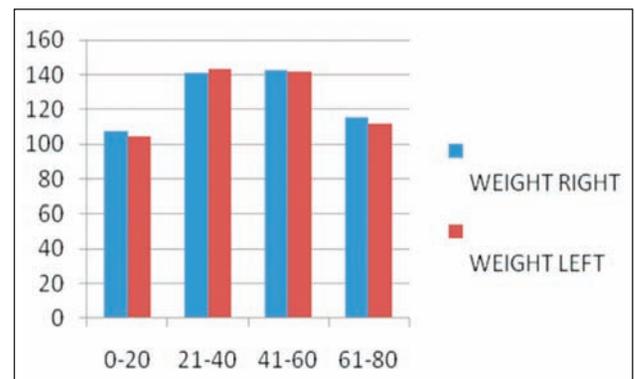


Fig. 1. Graph showing weight changes on right and left sides in different age groups

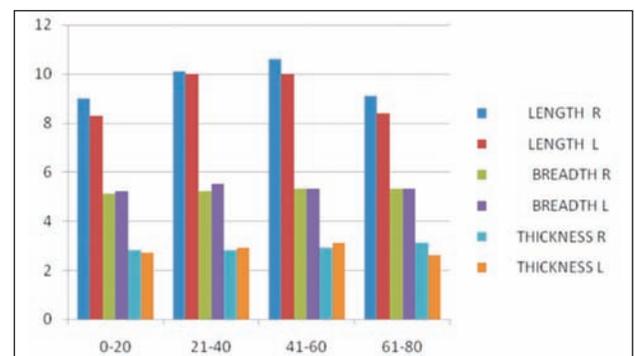


Fig. 2. Showing changes in length, breadth and thickness on right and left sides in different age group

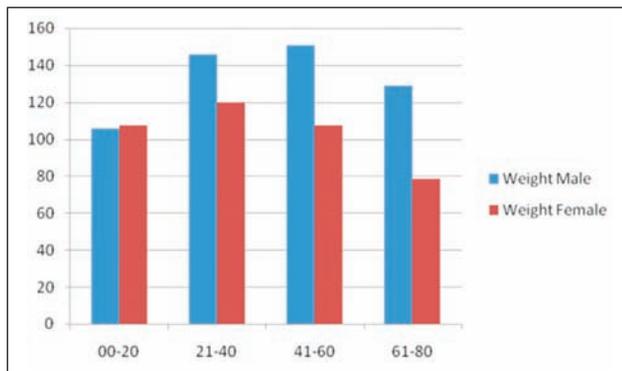


Fig. 3. Graph showing weight changes in males and females of different age groups

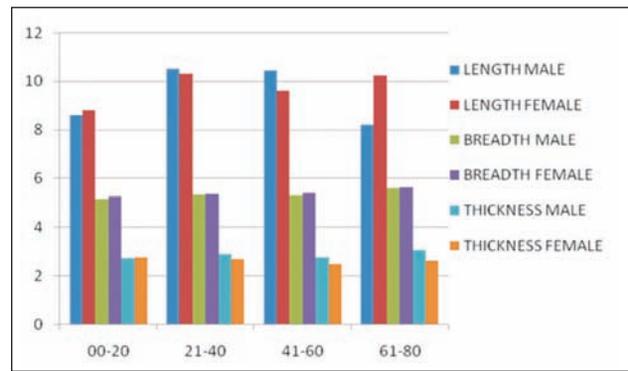


Fig. 4. Showing renal length, breadth and thickness in males and females of different age groups

Table 1: Showing mean values with standard error in different age groups

Age	Weight in grams	Length in cm	Breadth in cm	Thickness in cm
00-20(n=12)	105.83±3.12	08.66±01.90	05.16±0.90	02.77±0.63
21-40(n=26)	141.92±2.67	10.05±00.85	05.36±0.46	02.85±0.58
41-60(n=16)	142.15±2.32	10.25±00.35	05.26±0.98	03.03±0.34
61-80(n=07)	113.92±2.08	08.78±00.91	05.28±0.80	02.80±0.76

DISCUSSION

From the present study it was found that the size of the kidney increases to its maximum level in and around 45-50 years of age. Thereafter it decreases slightly with increasing of age. The study was consistent with other previous studies. Anderson and Brenner reported that renal mass increases from about 60 gm at birth to more than 400 gm during 3rd and 4th decades. By the 9th decade it declines to less than 300 gms.⁶ Mullick worked on 21 pairs of human kidney in Bangladeshi population and found the average weight of the kidneys was 113 gms.¹⁰ It is evident from the present study that the mean weight of the kidneys in South Indian population is slightly variable from other studies. This might be because of their difference in body weight as well as body surface area. Built is the major determinant of kidney weight and nephron size in normal humans. Multivariate, stepwise linear-regression analysis demonstrated that kidney weight was best predicted by body surface area.¹¹ It is obviously clear that the kidneys of South Indian population are shorter, narrower and thinner in comparison with those of western population. Moreover the values might be marginally altered due to formalin fixation.

Renal weight was higher in females compared to males in younger age group. As age advanced male renal values became higher. Studies suggest that the

hormone E2 (Estrogen) is responsible for the resistance of kidneys to the progression of renal disease in women. In men, the progression of chronic renal failure occurs at a faster rate than it does in women indicating that gender can be considered one of the determinants of the progression of the age-related decline in renal function. The sexual dimorphism deeply reflected on renal morphology and physiology is most likely due to specific genes, to the actions of gonadal steroids and to the endocrine paracrine pathways of the kidney. Moreover, it has also been shown that aging exerts different effects on males compared to females.¹²

From the present study it was found that the average number of renal corpuscles per sq. mm area was gradually decreased along with the increase of age. The size of renal corpuscles appeared to increase but glomeruli appeared smaller with advancing age indicating arterial sclerosis. The present study was consistent with most of the previous studies like Moore¹³ and Darmady¹⁴ Anderson and Brenner commented that, aging is a biologic process, the effect of which is the gradual loss of functioning cells from many organs and tissues. So, nephrons as well as nerve and muscle cells are gradually lost during a normal lifetime. The kidney cannot regenerate new nephrons. They suggested that the number of functioning glomeruli declines roughly with the changes in the renal weight with age.⁶

CONCLUSION

A number of structural changes occur in the kidney with aging. The aging kidney is characterized by loss of renal weight, breadth and thickness associated with arterial sclerosis, an increased number of sclerotic glomeruli, loss of tubules and interstitial fibrosis. The pathogenesis of aging-associated structural changes is not completely understood. Both genetic background and hemodynamic factors have been associated with progression of age-related morphological changes. Due to limitation of time all age groups were not covered. Sample size was small and unequal. The results might have been more specific with a larger sample size covering wider age group including fetuses, covering both sexes of same age group. Further studies with more histological details are recommended.

ACKNOWLEDGEMENT

I thank Dr. Ananda, Professor and HOD, Department of Forensic Medicine and Member Secretary, Institutional Ethics Committee, Kempegowda Institute of Medical Sciences, Bangalore for his help to conduct the study.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Obtained

REFERENCES

1. Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE, Ferguson MW. Gray's Anatomy. 39th ed. London: Churchill Livingstone; 2005: 1269-84.
2. Sinнатamby CS. Last's anatomy regional and applied. 10th ed. Edinburg: Churchill Livingstone 1999 : 267-280.
3. Ross MH, Romrell LJ, Kaye GL. Histology: a text and atlas. 4th ed. Baltimore: Williams and Wilkins; 2003: 602-26.
4. Hamilton WJ. The text book of human anatomy 2nd ed. London: Macmillan Publishers Ltd; 1958: 542-67.
5. Junqueira LC, Carneiro J, Kelley RO. Basic Histology. 11th ed. New York: McGraw Hill companies Inc; 2006 : 373-88.
6. Anderson S, Brenner BM. Effect of aging on renal glomerulus. American Journal of Medicine ; 1986 Mar ; 80 (3): 435-42.
7. MacLachlan MSF. The aging kidney. Lancet 1978; 11:143-6.
8. Mikael, Mark. Renal artery intervention – an invasive radiologist's approach. Saudi Journal of kidney diseases and transplantation 2005; 16(2):181-192.
9. Guyton AC, Hall JE. Text book of medical physiology. 11th ed. India: V.B Saunders Company; 2006: 291-401 .
10. Mullick MH. The arterial pattern of human kidney. Journal of Pakistan medical association 1970 ; XX(3):77-83.
11. Kasiske BL, Umen AJ. The influence of age, sex, race, and body habitus on kidney weight in humans. Arch Pathol Lab Med 1986 Jan; 110(1): 55-60.
12. A.L. Gava, F.P.S. Freitas, S.S. Meyrelles, et. al. Gender-dependent effects of aging on the kidney. Braz J Med Biol Res, September 2011, Volume 44(9) 905-913
13. Moore KL, Dalley AF, editors. Clinically oriented anatomy. 4th ed. Philadelphia: Lipincott Williamas and Wilkins; 1999: 279-89.
14. Darmady EM, Offer J and Woodhouse MA. The parameters of the aging kidney. J Path 1973; 109: 195-207.

Morbidity and Mortality among the RTA Casualties Attending in a Tertiary Care Hospital, Belgaum - A Retrospective Study

Bimlesh Kumar Sah¹, Ashwini Narasannavar², M D Mallapur³, Sanjay Kumar Yadav⁴

¹MPH (Master of Public Health), ²BDS, MPH, Department of Public Health, ³MSc, Statistics, Department of Community Medicine, ⁴MPH, Department of Public Health, J.N. Medical College, KLE University, Belgaum, Karnataka

ABSTRACT

Introduction: Accident is an "unpremeditated event resulting in recognizable damage, which usually produces unintended injury, death or property damage". Globally, an estimated 1.2 million people are killed in road crashes each year and as many as 50 million are injured. WHO predicts that in the list of leading public health problems by 2030 Road Traffic injuries (RTIs) will move to 5th position from 9th position. Worldwide everyday as many as 140,000 people are injured on roads. More than 15,000 are disabled and 3,000 died.

Method: This was a Retrospective descriptive study conducted at a tertiary care Hospital of KLE University, Belgaum. All the cases of Road traffic injuries and accidents admitted in this hospital during the period of Jan-Dec 2011 were taken.

Results: Out of 590 cases of road traffic injuries and accidents 453 (76.8%) were male and 137 (23.2%) female casualties. The highest number 247 (41.9%) victims were between 21 to 30 years of age. Most common time of occurrence of accidents was between 12 noon to 6 pm in the evening and a greater number of accident cases were seen in summer season. Majority of them were simple types of injuries 218 (36.9%) followed by Head and lower limb injuries. Two wheelers were the cause of maximum accidents. In types of accidents collision was seen in more than half of the vehicles followed by fall and overturning. Out of all the accidents 465 (78.8%) were cured, 83 (14.1%) died and 42 (7.1%) got disabled.

Conclusion: Most of the victims were of young age groups and out of all the accidents cases 78.8% were cured, 14.1% died and 7.1% got disabled. Maximum accident was seen between 12 noon to 6 pm. Two wheelers were involved in more accidents and head injuries were the most common types of injuries seen.

Keywords: Road Traffic Accidents, Morbidity & Mortality, Tertiary Hospital, Injuries, Belgaum

INTRODUCTION

An accident has been defined as an unexpected, unplanned occurrence which may involve injury. A WHO (World Health Organization) advisory group in 1956 defined accident as an "unpremeditated event resulting in recognizable damage". In the present century accidents represent a major epidemic of non communicable disease and they are no longer considered as accidental, instead are part of the price

we pay for technological progress.¹ According to Worldwide, an estimated 1.2 million people are killed in road crashes each year and as many as 50 million are injured. WHO predicts that in the list of leading public health problems by 2030 Road Traffic injuries (RTIs) will move to 5th position from 9th position.² Every day nearly 140,000 people are injured on the world's roads. Similarly more than 3,000 die and some 15,000 are disabled.³ In India, Road Traffic Injuries (RTIs) are the public health problem where still the society and

decision makers accept the death and disability on a large scale that to among young people.⁴ In India, the total number of vehicles increased from 37 million in 1997 to 73 million in 2004. This represents an annual average growth rate of about 11 percent for cars and motorized two-wheelers and 7 percent for trucks and buses. The total number of fatalities increased at an average rate of about 4 percent per year in the period 1997-2003 and the rate has increased to 8 percent per year since then.⁵ In 2010, an estimated 1, 60,000 persons died due to road crashes in India. Millions were hospitalized and thousands ended up with disabilities. The heterogeneous traffic environment of India poses unique challenges for both mobility and safety. On Indian roads, nearly 30 – 40 types of vehicles of different sizes, shapes and speeds compete for available the space and are in a rush to reach their destination.⁶ Major objectives of the study include the assessment of the quantum of Road Traffic Injuries and deaths and to analyze its morbidity & mortality pattern.

MATERIALS AND METHOD

A Retrospective descriptive study was conducted at KLE’s Dr. Prabhakar Kore Hospital and Research center, Belgaum. All the cases of Road traffic injuries and accidents registered during the period of Jan-Dec 2011 in KLE hospital were taken. Universal sample coverage was followed, i.e. all the cases of RTA registered during the period of 2011 in KLE hospital were taken. Secondary data collection and record review was done using predesigned, pre-tested and structured proforma. Ethical clearance from Institutional Ethics Committee of J.N.M.C, KLE University was obtained for the study. Data analysis was done by using Statistical Package for Social Sciences (16.0 Version) and the results were presented in tables and percentage.

RESULTS

A total of 590 cases of road traffic injuries and accidents were reported at KLE’s Dr. Prabhakar Kore Hospital, Belgaum during the study period. There were 453 (76.8%) male and 137 (23.2%) female casualties. The average age of victims was 31.5 years. The highest number 247 (41.9%) of victims were between 21 to 30 years of age. (Table 1)

Table no. 1: Demographic Characteristics of the participants

(n=590)

Respondents by age (in years)		
Age groups	Frequency	Percent
≤ 10	02	0.3
11-20	83	14.1
21-30	247	41.9
31-40	152	25.8
41-50	76	12.9
51-60	22	3.7
≥ 61	08	1.4
Respondents by Sex		
Gender	Frequency	Percent
Male	453	76.8
Female	137	23.2
Total	590	100.0

A greater number of accident cases 225 (38.13%) were registered in summer season and less cases were seen in winter season whereas maximum accidents occurred between 12 noon to 6 pm in the evening 206 (34.9%) and followed by 6 am to 12 noon 188 (31.9%) and during midnight very few accidents had occurred (Table no.2). Two wheelers 342 (58.0%) were the majority type of vehicles involved in RTA followed by light motor vehicles (car, jeep, van, etc) 130 (22.0%), and heavy motor vehicle (bus, truck, tractor, etc) were 99 (16.80%).

Table No. 2. Distribution of cases according to Season, Time & Types of vehicle involved

Season wise distribution of cases		
Season	No. of accident case	Percent
Rainy (June-Sept)	187	31.69
Winter (Oct-Jan)	178	30.16
Summer (Feb- may)	225	38.13
Time wise distribution of cases		
Time of accident	Frequency	Percent
6 am-12 noon	188	31.9
12 noon-6 pm	206	34.9
6 pm- midnight	185	31.4
Midnight-6 am	11	1.9
Types of vehicle involved in accident		
Types of vehicle	Frequency	Percent
2 wheeler	342	58.00
LMV	130	22.00
HMV	99	16.80
Others	19	3.20

297 (50.3%) of the accidents were due to collision of two vehicles followed by fall 209 (35.4%), overturning of the vehicles 72 (12.2%) where as collision with pedestrian were very few that is 12 (2.0%). Out of all the types of injury occurred majority were simple types 218 (36.9%) followed by head injuries 114 (19.3%), lower limb injuries 97 (16.4%) & upper limb injuries 79 (13.4%).

Table No. 3. Distribution of different Types of accident and Injury

Distribution of different types of accident		
Types of accident	Frequency	Percent
Collision	297	50.3
Fall	209	35.4
Overturning	72	12.2
Collision with pedestrian	12	2.0
Distribution of different types of injury		
Types of injury	Frequency	Percent
Simple injury	218	36.9
Head injury	114	19.3
Lower limb	97	16.4
Upper limb	79	13.4
Abdominal injury	37	6.3
Chest injury	36	6.1
Others	9	1.5

DISCUSSIONS

A total of 590 cases of road traffic injuries and accidents were reported at KLE's Dr. Prabhakar Kore Hospital, Belgaum during one year of period. Our study shows the overwhelming majority of the cases 453 (76.8%) were males and only 137 (23.2%) females. According to a study done in Bhopal, 1047 (82.5%) of the victims were males and 221 (17.5%) females.¹ Another Study from Western Maharashtra showed similar observations.⁷ It is due to greater male exposure on urban streets. The average age of victim was 31.5 years and the highest number 247 (41.9%) victims were between 21 to 30 years of age groups. Similar observations were also made in other study done from eastern Nepal showed that the highest (28.6%) percentage of the cases were in the age group of 20-29 years and less in age groups of 20 and 49 years.⁸ Similar other studies have shown the same results.^{1,7} The present study shows that maximum number of road traffic accidents (38.13%) took place in summer season and more cases (80) in month of May and less winter season. This is in consistent with the findings of study conducted at Faisalabad, Pakistan where maximum number of fatal road traffic accidents (47.05%) took

place in summer season (May to August) and the highest incidence (14.47%) was noted in the month of July.⁹ The higher incidence of RTAs during months of May to August is attributed to the reason that in these days it is very hot outside and everyone is in hurry.⁸ In the present study the peak time for accidents was between 12 noon to 6 pm in the evening 206 (34.9%) followed by 6 am to 12 noon 188 (31.9%) and 185 (31.4%) occurred from evening to midnight. Almost similar peak times for accidents were also reported in Bhopal, Pondicherry, Assam and Western Nepal studies.^{1,10,11,12} But a study conducted in Haryana is in contrast with the present study findings that is the peak time for accident was evening (6 pm-12 midnight) (40.15%), with other time remaining almost similar.¹³ In the types of vehicle involved in accident, Motorized two-wheeler occupants were involved in highest number 342 (58.0%) followed by occupant of light motor vehicles (Car, Jeep, Van) 130 (22.0%) & heavy vehicles 99 (16.80%). A similar results were found in study done by Patil SS, et al, a study from Western Maharashtra in which out of 174 occupants, motorized two-wheeler occupants were highest in number, i.e. 61 (35%) followed by occupants of four wheelers 45 (25.9%), other occupants were truck 27 (15.5%), three wheelers 19 (10.9%), tractors 10 (5.7%) and tempos 4 (2.3%).⁷ In this study it was observed that, out of all the types of accidents cases occurred more than half were due to collision of two vehicles 297 (50.3%) followed by fall 209 (35.4%), overturning of the vehicles 72 (12.2%). Similar results were observed in the Pondicherry study done by Jha N et al, where the common mode of sustaining injury was collision in which 37% of victims were injured followed by being knocked down by a vehicle and fall.¹⁰ Similar results were also observed in Delhi. Falling from a moving vehicle and collision between two vehicles was responsible for 20% and 19% respectively.¹⁵ But this is in contrast to the study done from eastern Nepal by Jha et al where the common (37%) mode of sustaining accidents was by falling down from a moving vehicle.⁸ In this study it was observed that, out of all the types of injury occurred majority were simple types of injury 218 (36.9%) followed by head injuries, lower limb injuries & upper limb injuries. Whereas the study done at Bhopal has almost similar trends of injury regarding the involvement of body parts, head injury being the most common (59.3%) injury among RTA victims followed by fracture of upper limb (21.3%) & lower limb 174(13.7%).¹ Also the similar trend was seen in the study done by Mishra B et al at western part of Nepal where, 156 (43.32%) had head injury followed

by limb injury and others.¹² But this is in contrast to the study done by Singh A et al in Haryana where abdominal injury were maximum with 495 (40.0%) and rest were found similar.¹³

CONCLUSION

The present study revealed that most victims were of young age groups and out of all the accidents cases most of them were cured, few died and got disabled. Maximum accidents were of two wheelers and were seen between 12 noon to 6 pm. Head injuries were the most common types of injuries seen. The study highlights the need of compulsory implementation of helmet wearing for motorcyclist and need for taking urgent steps for establishing ambulance services and provision of pre-hospital care & trauma services. Also a nationwide computerized trauma registry is urgent required to bring out the risk factors, chain of events leading to the accidents and will be extremely helpful in policy making and health management at the national level in India and worldwide.

Conflict of Interest: Nil

ACKNOWLEDGEMENT

We wish to acknowledge the staff of the Department of Public Health, KLE University for their support in conducting the study.

Funding: Nil

REFERENCES

1. Khare N, Gupta S, Varshney A, Athavale A. Epidemiological study of road traffic accident cases attending tertiary care hospital, in Bhopal Madhya Pradesh; National Journal of Community Medicine, July – Sept 2012, 3(3): 395-399.
2. N Mittal. Policies and programs for road safety in developing India: J Emerg Trauma Shock. 2008. Jan-Jun; 1(1): 42-49.
3. Dr. LEE Jong-wook, WHO Director-General. Road Safety Is No Accident: A Brochure for World Health Day 7 April 2004. 1-20. 2004. Geneva, World Health Organization.
4. D. Mohan. The road ahead: Traffic injuries and fatalities in India. Transportation Research and Injury Prevention Programme. Indian Institute of Technology, Delhi. 2004.
5. City Development Plan For Bangalore. Jawaharlal Nehru National Urban Renewal Mission. 2006; Vol 1: Pg 65.
6. G. Gururaj. Road Safety in India: A Framework for Action, National Institute of Mental Health and Neuro Sciences, Bangalore. 2011; Publication no 83.
7. Patil S, Kakade RV, Durgawale PM, Kakade SV. Pattern of Road Traffic Injuries: A Study From Western Maharashtra; Indian Journal of Community Medicine, January 2008 33(1): 56-57.
8. Jha N, Agrawal CS, Epidemiological Study of Road Traffic Accident Cases: A Study from Eastern Nepal. Regional Health Forum WHO South-East Asia Region, 2004; 8(1): 15-22.
9. Sulehri M, Qasim A. Road Traffic accidents; fatalities in Faisalabad; Professional Med J Mar-Apr 2012; 19 (2): 180-186.
10. Jha N, Srinivasa DK, Roy G, Jagdish S. Epidemiological study of road traffic accident cases: a study from south india; Indian Journal of Community Medicine, Jan.-Mar., 2004, 29 (1): 20-24.
11. Singh YN, Bairagi K, Das K. An epidemiological study of road traffic accident victims in medicolegal autopsies; ISSN 0971 -0973, JIAFM, 2005; 27 (3): 166-169.
12. Mishra B, Sinha N, Sukhla SK, Sinha AK. Epidemiological study of road traffic accident cases from Western Nepal; Indian J Community Med, 2010; 35 (1): 15-21.
13. Singh A, Bhardwaj A, Pathak R, Ahluwalia SK. An epidemiological study of road traffic accident cases at a tertiary care hospital in rural Haryana; Indian Journal of Community Health, July - Dec. 2011, 23(2): 53-55.
14. Sharma D, Singh U, Mukherjee S. A study on road traffic accidents in Anand-Gujarat; Healthline ISSN 2229-337X, July-December 2011, 2 (2): 12-15.
15. Kumar A, Lalwani S, Agrawal D, Rautji R, Dogra TD. Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years; Indian Journal of Neurotrauma (IJNT) 2008, 5 (2): 63-67.

The Suicidal Cowdung Powders of Kongunadu

Tarun K George¹, Anugrah Chrispal², Ramya I², Joe Flemming³, Pradeep Kumar⁴, Sneha Anna Joy⁴

¹Post Graduate, ²Assistant Professors, Department of Medicine, ³Professor, Department of Clinical Biochemistry, Christian Medical College, Vellore, ⁴Physicians, Bishop Walsh Memorial hospital, Thadagam Coimbatore

ABSTRACT

Suicide in India is a common cause of death. Common means employed are consumption of pesticides and chemical compounds. Newer compounds are frequently consumed and often the composition is unknown. Here we describe a prevalent 'Cow Dung power' poisoning. It is available in green and yellow variety and can cause gastrointestinal symptoms and sometimes persistent seizures. The compound was analyzed and found to be Malachite green and Auromine O respectively. These compounds and the clinical profile require to be studied in more detail and steps taken to curb its use and availability.

Keywords: Malachite green, Auromine O, Cow dung powder, suicide, poisoning, South India

INTRODUCTION

Suicide rates in India are among the highest in the world and in South India they account for upto 9% of all deaths(1). About half of these are due to ingestion of poisons most of which are pesticides (2). Here we describe an unusual compound consumed as poison which we encountered in our region.

The yellow and green cow dung powders are a frequently consumed for suicidal poisonings

in the region of central Tamil Nadu. These are traditionally inorganic dyes which are used for colouring the courtyards of houses. It is a modern substitute for the fresh cowdung solution (green) and cow dung and turmeric (yellow) solution, that is used for religious, sanitary and aesthetic purposes. These powders are sold in paper covers with no details of contents. There is no literature available on its composition, complications of consumption or management. A high incidence rate of suicidal poisonings at a secondary hospital on the outskirts of Coimbatore, prompted a study of the scenario.

MATERIAL AND METHOD

Aim

To provide a descriptive study of the clinical profile of patients presenting with suicidal yellow and green cow dung poisonings to a secondary level hospital.

Inclusion Criteria

All patients above the age of 18.

Intentional consumption of the yellow or green cowdung powder.

Exclusion Criteria

Failure to give consent.

Suspicious consumption of poison.

Consumption of multiple compounds.

METHODOLOGY

All patients having intentionally consumed a poison were included in the study.

At admission to the emergency services initial stabilization was done. All the patients were treated with Gastric lavage till the lavage fluid was clear. This was followed by a single dose activated charcoal. A careful history was taken to ascertain the symptoms, the quantity of poison consumed and time of consumption of the poison was determined.

Concurrently the signs and symptoms were documented in a Performa. Consent was taken from the relatives. Creatinine and electrolytes were sent for the patients. All patients who had taken the yellow

Cowdung were given Inj. Phenytoin 15mg/Kg prophylactically as to prevent seizures. Since it has been noticed in prior patients that once patients develop seizures it most often progressed to a status epilepticus.

The clinical data during the course of admission was monitored and the outcomes were followed. The data was collected for a six month period.

FINDINGS

Over a period of Six months 20 cases of the cowdung poisonings were encountered.

(12 yellow and 8 green)

The gender distribution was 11 males and 9 females.

Most patients presented within half an hour of consumption of the poison. 2 presented within 1 hour and one 2 hours later.

Among those who consumed green cowdung - 6 were asymptomatic and 2 had symptoms of nausea and abdominal discomfort.

Table 1. Clinical features of Malachite green poisoning

Symptoms	Number of patients	Dose
Asymptomatic	6	< 20g
GI disturbances nausea and vomiting	2	> 30 g



Of those consumed yellow cowdung –nausea, vomiting and abdominal pain were seen in 4 patients, giddiness and drowsiness in 4, incontinence in 2 and seizures in 2. Of the patients who developed seizures one died in within half an hour and the other was referred to a higher centre.

Table 2. Clinical features of Auromine yellow poisoning

Clinical features	Number of patients	Dose
Asymptomatic	4	< 10 grams
Gastrointestinal	6	< 20 grams
CNS (drowsiness)	4	> 20grams
Incontinence	2	> 20grams
Seizures	2	> 20grams

It was observed that chances of developing symptoms were greater with more quantity of powder consumed(>15g) . But few with consumption of small quantity also developed symptoms.

All the asymptomatic patients of the cowdung poisoning recovered steadily and were discharged well after one day

Information on the compound was scarce.

Attempting to detect the toxin we found that on spectrometric analysis :

(Sample sent to reference laboratory at Christian Medical College Vellore Tamil nadu India for analysis.)



Yellow powder - absorbance spectrum consistent with *Auramine O*.

(Using a 0.1mg/ml solution in water, absorbance peaks at 370nm and 430nm).

The green powder - absorbance spectrum consistent with *Malachite green*

(Using a 0.1mg/ml solution in water, absorbance peaks at 620m and 420nm and 320nm).

DISCUSSION

Malachite green is a coloured cation. It has been traditionally used as a dye. The toxidrome of malachite green poisoning was generally benign in our cohort of patients. The outcomes were good and the toxicity was also mild. In our cohort 75% of the patients were asymptomatic and the rest had only mild gastrointestinal symptoms.

Auramine is a part of the Auramine Rhodamine dye used to stain Mycobacterium tuberculosis for rapid diagnosis and also in the dying industry as a cloth dye. The chemical formula is $C_{17}H_{21}N_3HCl$. Auramine O is a basic dye and it can stain skin and nail beds. Auramine is a powerful neurotoxin; it causes CNS depression and irritation of the cerebral hemispheres as evidenced by drowsiness and seizures in our patient when consumed in excess of 20 grams. It is a powerful gastrointestinal irritant also as 50% of our patients admitted had gastrointestinal symptoms.

There have been anecdotal case reports of a rare fatal auramine consumption (3) and methemoglobinemia as a result of accidental malachite green consumption(4).

CONCLUSIONS

From our experience the cowdung powders are common source for deliberate self harm in this region. The lethality is variable, being benign in Malachite green and potentially lethal in Auramine consumption. Steps to educate the public and restriction of distribution of this compound should be carried out. In patients presenting after consumption of the compound we recommend the following protocol.

Our current protocol for management includes

After preliminary assessment and stabilization, nasogastric stomach wash until the contents are clear. Instillation of activated charcoal. Close monitoring of vitals.

In the case of yellow cowdung poisoning, we dilantinize with Phenytoin 15mg/Kg prophylactically. Symptoms of increasing giddiness, drowsiness and incontinence can be signs of an impending seizure. One should be prepared to treat the onset of a status epilepticus.

Considering the high frequency of these poisonings, there is not much data on its toxicity profile. Further research regarding the cellular mechanism of action of these substances, treatment regimes and prevention also needs to be addressed.

Conflict of Interest: Nil

Acknowledgement: Dr K Kuruvilla, PSG College Coimbatore and the staff of Bishop Walsh hospital, Coimbatore.

Source of Funding: Internal.

Ethical Clearance: Cleared by Fellowship in Secondary Hospital Medicine, Course Committee, Christian Medical College, Vellore.

REFERENCES

1. Gajalakshmi V, Peto R. Suicide rates in rural Tamil Nadu, South India: verbal autopsy of 39 000 deaths in 1997-98. *Int J Epidemiol.* 2007 Feb;36(1):203-7.
2. Patel V, Ramasundarahettige C, Vijayakumar L, Thakur JS, Gajalakshmi V, Gururaj G, et al. Suicide mortality in India: a nationally representative survey. *Lancet.* 2012 Jun 23;379(9834):2343-51.
3. Bastia BK, Nagesh KR, Kuruvilla A, Saralaya KM. A Rare Case of Fatality due to Auramine Poisoning. *Journal of the Indian Society of Toxicology.* 2005;1(1):25-7.
4. Spiller H, Rodgers G, Willias D, Bosse G, Sullivan J. Methemoglobinemia due to malachite green ingestion in a child. *Clin Toxicol (Phila).* 2008 Apr;46(4):320-1.

Juvenile Delinquency: Retribution / Reform?=Futuristic Vision VIS a VIS Changing Scenario

Shrikant Asawa¹, Sandeep Bhowate², Pardeep Singh³

¹Professor & Head, ²Assistant Professor, ³Associate Professor PCMS & RC Bhopal

ABSTRACT

The present study attempts to have a insight in to a burning issue which has caused uproar in general public, media , various state governments and central government and judiciary regarding juvenile offences, the age of juvenile and retribution / reforms required to be in pace with the changing scenario. It also attempts to reviews statistical trends of juvenile delinquency in India and around the globe with objective to plan preventive strategies for avoiding such crime. A detailed analysis of reported cases indicates that despite the reduction in total juvenile crimes, the cases involving murder, rapes, robbery, theft , hurt are found to be increasing. The impact of globalization, industrial growth, changing socio economic dynamics, increasing cost of living and expectations, escape routes and short cuts for success , degradation and disintegration of family and cultural values, substance abuse, child psychology and their overall growth as responsible law abiding citizens of the country are thought to be some of the important factors responsible for such crimes. This paper stresses that, inculcation of social and moral values, better living conditions, better job opportunities, fast judicial trials, good rehabilitation programs and a forward looking law to be some solutions to this present and clear danger.

Keywords: Juvenile Delinquency / Offenses, Preventive Strategies

INTRODUCTION

The Juveniles or under-aged are characterized by low level of maturity, in physical and mental capabilities which distinguishes them from adults. Forty-two per cent of our populations in India are children.¹ The Juvenile Justice Act 1986' defines a Juvenile as a male below 16 years of age and female below 18 years of age. The Act provides for adjudication and rehabilitation of Juvenile delinquents. They are highly vulnerable groups to fall prey to temptations, inducement and mechanizations by

vested groups to embark on the path of criminality. Crimes committed by Juveniles may range from petty ones to heinous ones. Now Juvenile Justice (Care and Protection of children) Act, 2000 brought both boys and girls on a par, treating anyone under 18 as juvenile.

Juvenile delinquency, also known as juvenile offending, or youth crime, is participation in illegal behavior by juveniles (individuals younger than the statutory age of majority.² In recent years, the average age for first arrest has dropped significantly, and younger boys and girls are committing crimes. Between 60-80% percent of adolescents, and pre-adolescents engage in some form of juvenile offense.³ These can range from status offenses (such as underage smoking), to property crimes and violent crimes. The percent of teens who offend is so high that it surely seems to be a cause for worry.

Corresponding author:

Shrikant Asawa

Professor & Head

Dept of FMT, PCMS & RC , Bhopal

Email:dr22071968@gmail.com

Contact No. 09921612456

Table No. 1: Incidence of Juvenile Delinquency under IPC in India

Sr.no.	Year	Incidence of		Juvenile Crimes (%) to Total crimes	No. of rapes by juvenile males
		Juvenile Crimes	Total Cognizable Crimes		
1	2001	16509	1769308	0.9	399
2	2002	18560	1780330	1.0	485
3	2003	17819	1716120	1.0	466
4	2004	19229	1832015	1.0	568
5	2005	18939	1822602	1.0	588
6	2006	21088	1878293	1.1	656
7	2007	22865	1989673	1.1	746
8	2008	24535	2093379	1.2	776
9	2009	23926	2121345	1.1	798
10	2010	22740	2224831	1.0	858
11	2011	25125	2325575	1.1	1149

The share of IPC crimes committed by juveniles to total IPC crimes reported in the country during 1999 and 2000 was same at 0.5%. Since the beginning of this century i. e. 21st century there is a constant, steady increase in the Juvenile offences which is reflected in the above table no 1⁴. The considerable increase in 2001 may be partly attributed to increase in age of delinquent boys from 16 to 18 years as per the new definition of juveniles given by Hon. Supreme court of India but one cannot rule out the increasing

incidence of juvenile offences due to changing scenario in the country, over all development, high cost of living, globalization and raised expectations.

Crimes committed by juveniles have risen steadily over a decade. There is rise in juvenile crimes in a decade from 16,509 in 2001 to 25,125 in 2011 i. e. 65.7%. However, arrests haven't gone up proportionally. The figure was 33,628 in 2001 and 33,887 in 2011 i. e. is - 0.77%.⁵

Table No.2 : State-wise Distribution of Juvenile Delinquency (IPC) Under Different Crime Heads (IPC) During 2011 in India

Sr. No.	Crime Head	State								
		MP	MS	CG	AP	Raj	Guj	TN	UP	Bih
1	Murder (Sec.302 IPC)	112	145	57	64	71	15	45	81	46
2	Attempt to commit murder (Sec.307 IPC)	127	135	39	34	65	02	33	24	76
3	Culpable Homicide not amounting to murder (Sec.304,308 IPC)	4	05	0	05	03	42	01	23	01
4	Rape (Sec.376 IPC)	271	125	80	59	79	206	14	146	17
5	Kidnapping and abduction (Sec. 363-369,371-373 IPC)	106	50	14	55	59	343	9	74	51
6	Of woman	105	36	14	25	49	117	8	66	29
7	Of others	01	14	0	30	10	01	1	08	22
8	Dacoity(Sec. 395-398 IPC)	08	48	12	03	01	15	03	03	09
9	Preparation and assembly for dacoity (Sec.399-402 IPC)	04	14	0	0	03	02	0	0	02
10	Robbery (Sec.392-394, 397,398 IPC)	59	176	25	22	46	42	30	32	49
11	Burglary (Sec. 449-452, 454,455,457-460 IPC)	287	571	384	229	205	206	154	51	18
12	Theft (Sec.397-382)	427	1256	311	646	349	343	499	223	109
13	Auto Theft	99	378	55	152	154	118	188	16	37

Table No.2 : State-wise Distribution of Juvenile Delinquency (IPC) Under Different Crime Heads (IPC) During 2011 in India (Contd.)

Sr. No.	Crime Head	State								
		MP	MS	CG	AP	Raj	Guj	TN	UP	Bih
14	Other Theft	328	878	256	494	195	225	311	207	72
15	Riots (Sec. 143-145, 147-151,153, 153A, 153 B, 157,158,160 IPC)	108	442	85	23	18	117	40	23	248
16	Criminal breach of trust (Sec.406-409 IPC)	01	08	01	01	01	01	0	04	0
17	Cheating (Sec.419 ,420 IPC)	04	25	05	16	21	05	08	17	7
18	Counterfeiting (Sec 231-254, 489A-489D IPC)	01	08	02	03	0	0	0	0	0
19	Arson (Sec.435,436,438 IPC)	10	12	12	21	11	04	03	0	06
20	Hurt (Sec. 323-333, 335-338 IPC)	827	1020	524	271	268	278	140	126	133
21	Dowry deaths (Sec.304 B IPC)	51	07	03	03	04	0	0	14	05
22	Molestation (Sec.354 IPC)	168	108	66	68	40	16	12	17	08
23	Sexual Harassment (Sec.509 IPC)	24	28	14	88	0	01	0	0	01
24	Cruelty by Husband & Relatives (Sec.498A IPC)	77	105	10	05	06	58	0	6	02
25	Importation of Girls (Sec.366B IPC)	0	0	0	0	0	0	0	0	0
26	Causing death by Negligence (Sec 304A IPC)	16	29	10	37	16	09	20	01	0
27	Other IPC crimes	2305	458	524	184	570	391	222	94	176
28	Total cognizable crimes under IPC	4997	4775	2178	1837	1836	1618	1233	959	964

It can be observed from the table no 3 that among total crimes committed by juveniles in 2011 i.e. 25125, Madhya Pradesh (4,997), Maharashtra (4,775), Chhattisgarh (2,178), Andhra Pradesh (1,837), Rajasthan (1,836) and Gujarat (1,618) have reported high incidence of juvenile crimes under IPC. These six States taken together have accounted for 69.6% of total juvenile delinquency cases under IPC reported in the country. Maharashtra and Madhya Pradesh reported 145 and 112 cases of Murder respectively during 2011. The highest incidence of the juvenile rape cases in the country was reported from Madhya Pradesh (271)

followed by Uttar Pradesh (146) and Maharashtra (125) which was 24.6%, 13.3% and 11.4% of total juvenile rape cases respectively in the country. The highest incidence of the juvenile theft in the country was reported from Maharashtra (1,256 i.e., 25.0%).⁴

In India Madhya Pradesh is leading in juvenile crime rates which can be attributed to the fact that the literacy rate in Madhya Pradesh is much lower than the other states. Other than this the standard of living, poor socio-economic status, unemployment, health status are much inferior as compared to other states.

Table No.3: Classification of Juveniles Arrested (Under IPC & SLL) By Attributes During 2011 (State Wise)

Sr.No.	State	Education					Family background			
		Illiterate	Primary	Above Primary \ But Below Matric / H. Sec.	Matric / H. Sec. & Above	Total	Living with parents	Living with guardian	Homeless	Total
1	MP	1445	2075	1396	878	5794	4892	606	296	5794
2	MS	691	2861	2215	1003	6770	5818	763	189	6770
3	CG	536	1111	861	184	2692	1893	661	138	2692
4	AP	911	969	402	192	2474	1831	192	451	2474
5	RAJ	432	814	978	318	2542	2392	132	18	2542
6	GUJ	441	1154	676	239	2510	2042	287	181	2510
7	TN	240	1170	617	56	2083	1715	238	130	2083
8	UP	123	353	471	257	1204	1090	96	18	1204
9	BIHAR	234	332	419	141	1126	795	261	70	1126

While taking into account the psychosocial behavior, 30-35% of all juvenile delinquents are psychopaths.⁵ The above Table No 4 clearly shows that in addition to psychological behavior, the education status, family background and other important socio economic factors also play a major role in the occurrence of juvenile offences. Madhya Pradesh is leading state in the illiterate juveniles arrested while Maharashtra leads in juvenile arrested having primary, above primary & below Matric and Matric, H. Sec. & above education under various IPC and SLL crimes. Maharashtra also leads in juveniles arrested living with parents, living with guardians while Andhra Pradesh tops in juveniles arrested under various IPC and SLL crimes.

The issue needs urgent attention and needs to be addressed at the global level seriously. Question is how?

Juvenile Punishments in different countries

France: Up to 10 years:-No criminal charges.10-13 years: Education penalties (placing in a home or specialized centre).13-16 years:-Minor (Will get only half the adult sentence).16-18 years:-Can be remanded and plea of juvenility can be set aside.⁸

United Kingdom : <10 years:- can't be charged with crime (In England and Wales).10-18:-Juveniles tried in youth court without jury.(Youth justice and Criminal Evidence Act, 1999 says children between ages 10 and 18 are capable of committing a crime and will be tried in a separate court for youth.). For serious crimes, like murder or rape, case starts in youth courts but will be passed to adult courts.⁵

United states: Juveniles can be tried as adults in criminal court by being transferred to adult court from juvenile justice system. The age at which this can be done differs from state to state. Once transferred to adult court, juvenile defendants lose status as minor.⁵

Australia : <10 years :- No criminal charges.10-12 years :-Can be criminally prosecuted if proved child understood that what he's done was wrong.16years :- Age of juveniles in Queensland.17 years :- Age of juveniles in most of the states of Australia.⁸

Saudi Arabia : No codified penal law. Judges interpret and apply *Sharia Law* in criminal cases at their discretion.⁵

Nether land : 12-15:-One year of detention.16-18:- Juvenile court may apply adult criminal law. For

heinous crimes 2 years of detention.19-21:-Sometimes accused treated under juvenile law.⁵

India: A person below 16 will be treated as 'juvenile' and if he commits some offence. Trial will be conducted in juvenile court and if convicted, he will be sent to " Borstal school." An youthful offender can be detained in " Borstal School " upto 21 years.

Death Penalty

Since 1990, nine countries have given capital punishment to juvenile offenders-Iran (46) , US (19), Saudi Arabia (5), Pakistan (4), Yemen (2), Sudan (2), China (2), Congo (1), Nigeria (1)

Indian Scenario

The Juvenile Justice Act allows the police not to register an FIR against a juvenile if the punishment for the alleged crime is less than seven years -which would include practically all crimes barring murder, attempted murder and rape. The police refer not to register an FIR in case of petty crimes, emboldening these gangs to commit bigger crimes?⁵

As per recent Hon'ble Supreme Court Judgment, Juvenile law cannot lessen punishment to 'minor' offenders.¹²

The serious question that needs attention not only from Indian point or scenario but globally is can only punitive (suppressive) methods are sufficient to reduce Juvenile Delinquency as it is not the only result of one's psycho- social development but in mass the product of family environment, faulty parenting styles, socio-economic strata, education and peer influence and many factors as clearly indicated and demonstrated by recent gruesome and famous case that occurred in India raising a lot of hue and cry in the general public and protest and demonstrations all over the country. Similar such incidences were also reported all over the globe including Europe and united states of America.

At least 30-35 % juvenile delinquents are psychopaths including those as young as 10 years. They know how to hook an un-suspecting victim .They even lull the counselor into believing that they are reformed as per psychologist.⁵

Is Law the only solution to deal with juvenile delinquency or it is going to require a multi prong attack and strategy at the global level in addition to sincere effort by each Nation. Can it be prevented like

any disease before manifestation .After all they say prevention is better than cure.

Preventing juvenile delinquency

The two largest predictors of juvenile delinquency are, parenting style and peer group association particularly with antisocial peer groups mostly when adolescents are left unsupervised.

Other factors which predominately contribute in Juvenile Delinquency are

Poor socio-economic status, poor school readiness/ performance and / or failure, peer rejection, hyperactivity, or attention deficit disorder (ADHD), some biological factors such as high level of serotonin, giving them a difficult temper and poor self- regulation , and lower resting heart rate which may lead to fearlessness. Individual risk factors such as low intelligence, impulsiveness or the inability to delay gratification ,aggression , empathy , and restlessness.¹³ aggressive or troublesome behavior, language delays or impairments, lack of emotional control (learning to control one's anger), and cruelty to animals.⁹

Family environment and peer influence :- Family factors which may have an influence on offending include: the level of parental supervision, the way parents discipline a child, particularly harsh punishment, parental conflict or separation, criminal parents or siblings, parental abuse or neglect, and the quality of the parent-child relationship including peer rejection.¹⁰

CONCLUSION

It is clearly reflected that purely punitive (or suppressive) efforts are not very effective for youth as majority of crimes are committed by a relative handful of repeat offenders who typically display serious behavioral problems in childhood. Professional development programs , educational programs, recreational and youth developmental activities juvenile delinquency can be prevented while to the orphaned, rehabilitation programs should be instituted.

Prevention services may include activities such as substance abuse education and treatment, family counseling, youth mentoring, parenting education, educational support, and youth sheltering.

Acknowledgement: The authors sincerely acknowledge the help provided by Central Library of Peoples College of Medical Sciences and Research Centre, Bhopal.

Conflict of Interest: This study is insight and review of scenario in India and globally with regards to juvenile delinquency and there is no conflict of interest involved so ever.

Source For Funding: The article does not have any funding issues involved in its generation.

Ethical Clearance: The article do not violate any ethical , moral or legal guidelines pertaining to original scientific work and juvenile rights.

REFERENCES

1. More needs to be done to protect women: PM. The Morung Express [Internet]. 2013 April [cited 2013 May 15; [About 1p.]. Available from: <http://www.morungexpress.com/frontpage/93742.html>
2. Siegel, Larry J., and Brandon Welsh. Juvenile Delinquency: The Core. 4th ed. Belmont, CA: Wadsworth / cengage Learning, 2011.
3. Steinberg, L. (2008). Adolescence, 8th ed. New York, NY: McGraw-Hill
4. New Delhi. National Crime Records Bureau. Ministry of Home Affairs. Government of India. (New Delhi): Crime In India; 2011Statistics
5. Bhavna Vij-Aurora, Amitabh Srivastava. Young and Dangerous. India Today.2013 January 21;15-24
6. Cahall A, Cohall R and Bannister H: 'Adolescents and violent crime', Curr opin Pediatr. 1998 Aug; 10(4): 356-62
7. Park K: 'Preventive medicine in obstetrics, pediatrics and geriatrics', Park's text book of Preventive & Social Medicine, 6th Edition 2000: 397.

8. Tougher penalty for heinous crimes by juveniles? SC agrees to examine. How others deal with juveniles. *Times Of India* 2013 February 5:1 .
9. Bartol, Curt & Bartol, Anne (2009). *Juvenile Delinquency and Antisocial Behavior: A Developmental Perspective*, 3rd ed. Upper Saddle River, NJ: Pearson Prentice Hall.
10. Graham, J. & Bowling, B. (1995). *Young People and Crime*, Home Office Research Study No. 145, London: Home Office.
11. Dishion & McCord (1999). When interventions harm : Peer groups and problem behavior. *American Psychologist*, 54, 755-764
12. Juvenile law cannot lessen punishment to 'minor' terrorists, Supreme Court rules. *Times Of India* 2013 March 22:5
13. Farrington, D.P. (2002). "Developmental criminology and risk-focused prevention" in M. Maguire et al. (eds) *The Oxford Handbook of Criminology* (3rd edn.). Oxford: Oxford University Press

Study of Ossification of Carotido-Clenoid Ligament and Interclenoid Ligament in Skulls of Central India and its Clinical Implications

Rashmi Deopujari¹, Ashutosh S Mangalgi², Dibya Kishore Satpathi³, Lata S Khanzode⁴

¹Associate Professor, People's College of Medical Sciences and RC, Bhopal, ²Professor, Anatomy, Chirayu Medical College & Hospital, Bhopal, ³Professor, Forensic Medicine & Toxicology, L. N. Medical College, Bhopal, ⁴Professor, Anatomy, Chirayu Medical College & Hospital, Bhopal

ABSTRACT

Ligament connecting anterior and middle clenoid processes, carotid-clenoid ligament ossifies to form Carotido clenoid foramen (CCF). Similarly ligament extending between anterior and posterior clenoid process, ossifies to form interclenoid bar. Sellar region of 54 dry human skulls (108 sides) of central India were examined for ossification between anterior, middle and posterior clenoid process. Ossification between clenoid processes were observed in sixteen skulls. Complete Carotido-clenoid foramen was seen in 15.74 % and incomplete in 10.18 %. Complete ossification of interclenoid bar was observed in 4.6 % and incomplete in 5.55 % skulls.

Bilateral carotido-clenoid foramen was observed in 5 skulls (9.2 %) and bilateral presence of osseous interclenoid ligament was seen in single skull only.

Presence of bony CCF may cause compression, tightening or stretching of Internal carotid artery. Surgical procedures involving cavernous sinus, ACP and optic canal become difficult in presence of CCF. Hence anatomical knowledge about the carotidoclenoid foramen and interclenoid bar is important for radiologist and surgeon as well as forensic experts.

Keywords: Anterior clenoid process (ACP), Posterior clenoid process (PCP), Middle clenoid process (MCP), Internal carotid artery, Carotido-clenoid ligament (CCL), Interclenoid bar

INTRODUCTION

The middle cranial fossa is butterfly shaped formed centrally by the body of sphenoid and the wings of sphenoid laterally. The medial end of posterior free border of lesser wing of sphenoid overhangs the middle cranial fossa when traced medially shows a prominent anterior clinoid process (ACP). The ACP provides attachment to the free margin of the tentorium cerebelli and is grooved medially by the internal carotid artery. Sella turcica consists of tuberculum sellae, hypophysial fossa and dorsum sellae. On each side the tuberculum sellae presents a small projection, the middle clenoid process (MCP)¹.

In the middle cranial fossa, fibrous ligaments connect the clenoid processes of sphenoid bone. Ossification spreads along these ligaments to form bony bars. Fibrous ligament connecting anterior and middle clenoid processes, the carotid-clenoid ligament ossifies to form Carotido clenoid foramen. Similarly fibrous ligament extending between anterior and posterior clenoid process, ossifies to form interclenoid bar. The term interclenoid bar is also referred as sella bridge, interclenoid osseous bridge, or interclenoid tinea². Such ossifications of fibrous ligaments in middle cranial fossa may interrupt surgical procedures³. Objective of the present study is to identify ossifications of carotid clenoid ligament and interclenoid ligament and to study their clinical implications.

Corresponding author:

Ashutosh S. Mangalgi

Professor, Anatomy

Chirayu Medical College & Hospital, Bhopal

Email: ashutoshmangalgi@yahoo.co.in

Ph: +91 9993366621

MATERIAL AND METHOD

The study was carried out at Chirayu medical college & hospital and People's college of medical

sciences, Bhopal on fifty four dry human skulls from central India, irrespective of age and sex. Seller region was examined for ossification between anterior clenoid process, middle clenoid process and posterior clenoid process. Presence of carotido clenoid foramen and interclenoid bony bar were noted.

OBSERVATIONS

Out of 54 skulls (108 sides) ossification between clenoid processes were observed in sixteen skulls. Out of this complete Carotido-clenoid foramen was seen on 17 sides (15.74 %), incomplete CCF on 11 sides (10.18 %). Complete ossification of interclenoid bar was seen on 5 sides (4.6 %) and incomplete on 6 sides (5.55 %).

Bilateral carotido-clenoid foramen was observed in 5 skulls (9.2 %) (Figure 1) and bilateral presence of osseous interclenoid ligament was seen in single skull only (1.8 %) (Figure 2).

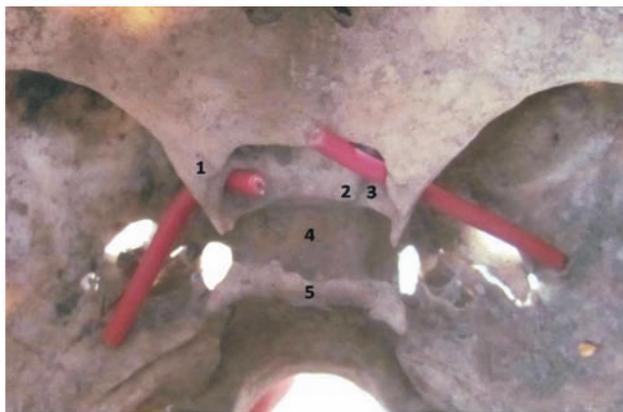


Fig. 1. Illustration showing bilateral carotidoclenoid foramen. 1 – Anterior Clenoid Process (ACP); 2 – Middle Clenoid Process (MCP); 3 – ossified carotidoclenoid ligament; 4 – Hypophyseal fossa; 5 – Dorsum sellae.

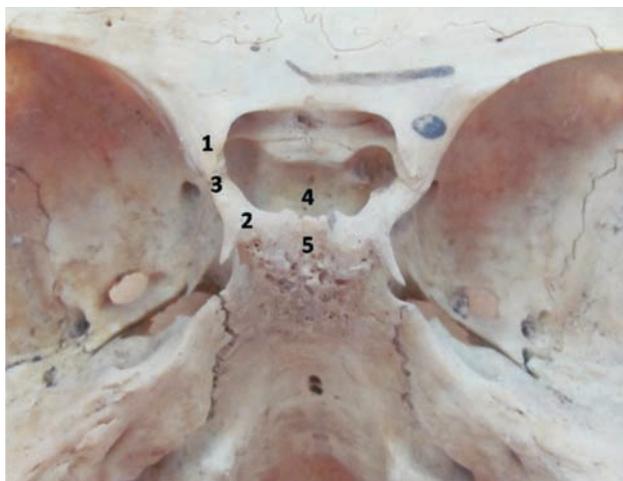


Fig. 2. Illustration showing bilateral Interclenoid Bar. 1 – Anterior Clenoid Process (ACP); 2 – Middle Clenoid Process (MCP); 3 – Interclenoid Bar; 4 – Hypophyseal fossa; 5 – Dorsum sellae.

DISCUSSION

The ACP is joined to the middle clinoid process (MCP) by the carotidoclenoid ligament (CCL). Ossification of the CCL results in the formation of the carotidoclenoid foramen (CCF) which transmits upturned course of internal carotid artery (ICA).

Dorsum sellae presents a posterior clinoid process (PCP) on each side. Fibrous ligament extending between ACP & PCP ossifies to form interclenoid bar.

In present study complete CCF was observed on 17 (15.74%) sides and incomplete on 11 (10.18%) sides. Lee et al⁴ studied seventy three dry adult Korean skulls and observed complete CCF in 4.1% and incomplete CCF in 11.6% skulls.

Ozdogmus et al⁵ studied 50 autopsy cases. On 27 sides carotidoclenoid ligament was completely ossified, on 18 sides it was incompletely ossified. Patnaik et al⁶ also reported two skulls, one with a bilateral CCF and in the other one with incomplete CCF bilaterally along with bilateral interclinoid bars. In present study bilateral carotido-clenoid foramen was observed in 5 skulls (9.2 %)

Erturk et al⁷ studied one hundred nineteen adult dry skulls and 52 adult cadaveric heads and observed CCF in 35.67% of the specimens, unilaterally in 23.98%, and bilaterally in 11.69%. The complete-type carotidoclenoid foramen was observed in 4.09% of the specimens, the contact type in 4.68%, and the incomplete type in 14.91%.

Huynh – La et al⁸ dissected 35 cadavers and the ACP regions were examined in 55 skull sides. CCF was observed in only 8 sides. Das et al⁹ also reported a case of CCF in a Malaysian skull while Freire et al³ reported presence of bilateral CCF in Brazilian skull.

Internal carotid artery grooves anterior clenoid process. Due to ossification of carotidoclenoid ligament this part of internal carotid artery may get compressed⁵ and may also cause change in transverse diameter of ICA⁷. It is difficult to mobilize or retract the artery during cavernous sinus surgery in presence of carotidoclenoid foramen⁴. It is in close proximity to the optic nerve, therefore it is important for neurosurgeon to have detailed knowledge for planning safe and effective surgery^{4,7}

In present study complete ossification of interclenoid bar was seen on 5 sides (4.6 %) and incomplete on 6 sides (5.55 %). Bilateral osseous

interclenoid ligament was seen in single skull only (1.8 %).

Ozdogmus et al¹ reported bilateral presence of ossified interclenoid ligaments in 3 skulls out of 50 autopsy specimens. Suazo et al¹⁰ reported a case of an extensive ossification of sella turcica forming CCF and interclenoid bar in dry skull of 40 year old Brazilian skull. Ossification of sella turcica may be associated with craniofacial developmental abnormalities¹¹ and also in subjects with dental abnormalities¹².

In optic nerve mobilization for aneurysms in dural fold¹³, paraclenoid aneurysms³ requires removal of anterior clenoid process, transsphenoidal approach for tuberculum sellae meningiomas¹⁴ is difficult in presence of ossification of interclenoid ligament. Cavernous sinus is related to important structures like, oculomotor nerve, trochlear nerve, divisions of trigeminal nerve and exposure of these structures require removal of anterior clenoid process³.

CONCLUSION

Surgical procedure on cavernous sinus become difficult in presence of CCF and involves the risk of damage to extraocular nerves. Existence of bony CCF may cause compression, tightening or stretching of ICA. Injury to the Cavernous segment of ICA may lead to bleeding causing fatal cerebral infarction. Hence pre-operative knowledge of status of ossification of caroticoclinoid ligament is required. CCF and its differentiation from the optic canal is clinically important for radiologists and neurosurgeons. Anatomical knowledge about the carotidoclenoid foramen and interclenoid bar may be useful in cases of surgeries involving removal of the ACP and also for neurosurgeons and forensic experts.

Acknowledgements: Nil

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: No ethical issue as study was on dried human skulls.

REFERENCES

1. Standring S. Overview of the Development of the Head and Neck Head: Skull and Mandible. In: Standring S, editor. Gray's anatomy: the anatomical basis of clinical practice. New York:Elsevier; 2005. p. 462-3 & 465-7.
2. Ozdogmus O, Ssaka E, Tulay C, Gürdal E, Uzün I, CavdarS. Ossification of interclenoid ligament and its clinical significance. Neuroanatomy 2003 (B); 2: 25 – 27.
3. FreireAR, RossiAC, PradoFB, CariaPHF, BotacinPB. The caroticoclinoid foramen formation in the human skull and its clinical correlations International Journal of Anatomical Variations 2010; 3: 149-150
4. Lee HY, Chung HI, Choi, Lee KS; Anterior Clinoid process and optic strut in Koreans. Yonsei medical Journal 1997; 38(3):151-154.
5. Ozdogmus O, Saka E, Tulay C, Gürdal E, Uzün I, CavdarS. The anatomy of the carotico-clinoid foramen and its relation with the internal carotid artery. Surg Radiol Anat. 2003(A); 25(3-4):241-6.
6. Patnaik, V.V.G; Rajan S, Bala Sanju K. Bilateral Foramen Clinoido-Caroticum & Interclinoid Bars-A Report of 2 Cases J Anat. Soc. India 2003; 52 (1): 69-70.
7. Erturk M, Kayalioglu G, Govsa F Anatomy of the clinoidal region with special emphasis on the caroticoclinoid foramen and interclinoid osseous bridge in a recent Turkish population Neurosurgical review 2004; 27(1):22-26.
8. Huynh-Le P; Natori Y; Sasaki T Surgical anatomy of the anterior clinoid process J Clin Neurosci. 2004; 11(3):283-7.
9. Das S, Suri R, Kapur V Ossification of caroticoclinoid ligament and its clinical importance in skull-based surgery. Sao Paulo Med J. 2007 Nov 1; 125(6):351-3.
10. Suazo GIC, Zavando MDA, Smith RL. Ossification of the Sella Turcica and clinoid ligaments, case report, morphological study and literature review. International journal of morphology 2008; 26 (4): 799 – 801.
11. Becktor, J. P.; Einersen, S. & Kjær, I. A sella turcica bridge in subjects with severe craniofacial deviations. Eur. J. Orthod. 2000; (22):69-74.
12. Leonardi, R.; Barbato, E.; Vichi, M. & Caltabiano, M. A sella turcica bridge in subjects with dental anomalies. Eur. J. Orthod. 2006; 28:580-5.
13. Inoue T, Rhoton AL Jr, Theele D, Barry ME. Surgical approach to the cavernous sinus: a microsurgical study. Neurosurgery. 1990; 26(6):903-32.
14. Arai H, Sato K, Okuda O, Miyajima M, Hishii M, Nakanishi H, Ishii H. Transcranial transsphenoidal approach for tuberculum sellae meningiomas. Acta Neurochir. 2000; 142: 751 – 757.

Haematemesis and Malaena - Rare Presentations of Methotrexate Toxicity - A Case Report

Aundhakar S C¹, Bhalla G B², Mhaskar D M², Mane M B³, Panpaliya N², Mahajan S K²

¹Professor and Head, ²Resident Doctor, ³Lecturer, Department of Medicine, Krishna Institute of Medical Sciences University, Karad, Maharashtra

ABSTRACT

Methotrexate is a mysterious compound with unknown pharmacokinetics. It is primarily used in many conditions like cancers, psoriasis, rheumatoid arthritis, lupus, Crohn's disease, etc. Many of its adverse effects are known but there are many more adverse effects for which there is no pathophysiological understanding till date. Haematological adverse effects of methotrexate are not uncommon but symptoms of haematemesis and malaena after 20 days of accidental intake of methotrexate is very very uncommon, especially when patient was only on methotrexate and no other drugs like NSAIDs to precipitate the upper GI-bleed. We hereby report such a case of methotrexate induced haematemesis and malaena who came to us for treatment. After immediate administration of essential drugs, there was rapid recovery. The patient was discharged from the hospital symptom free.

Keywords: Methotrexate, Haematemesis, Malaena

INTRODUCTION

Methotrexate is a potentially toxic antimetabolite anticancer drug, which, in low doses, remains an effective and safe therapy for pustular psoriasis & as disease modifying antirheumatic drug (DMARD) in the treatment of rheumatoid arthritis (RA)⁹ if careful monitoring is done according to the recommended guidelines.⁵ Failure to adhere to the guidelines can lead to methotrexate toxicity. In MTX-treated RA patients, the prevalence of haematological toxicity, including leucopenia, thrombocytopenia, megaloblastic anaemia and pancytopenia, is estimated to be 3%.¹⁰ Well-known sign of methotrexate toxicity include bone marrow suppression.⁶ Oral & gastrointestinal ulcerations are very rare complications.¹¹

CASE HISTORY

A 75 yr old male had come with complaints of blood in vomitus and loose motions with difficulty in swallowing since 4 days before admission to our hospital. Patient was alright four days back when he suddenly developed tarry black loose motions, 4-6 episodes a day. He also complained of low grade fever which was intermittent in nature and was not associated with chills/rigors/rash/sweating/burning

micturition. He also had difficulty in swallowing which was more for solids than liquids. Patient was diagnosed by a dermatologist as having psoriasis 20 days back for which he was advised to take tablet methotrexate 5mg once a week but, by mistake, patient consumed it on a daily basis for 20 days. On examination, he was afebrile, Pulse-90/minute, BP-130/80mmHg; pallor was present. Icterus, clubbing, cyanosis and lymphadenopathy were absent. Systemic examination was within normal limits. On local examination, multiple pigmented patches over skin with silvery scaling were present over the ankle and knee joints. On oral examination oral thrush and stomatitis were noted. His investigations were as follows:

Haemoglobin- 9.2G/dl, Total Leukocyte Count- 500/cmm with neutrophils-14, eosinophils-5, lymphocytes-10; platelet count- 75000/cmm. Liver and Renal function testes were within normal limits, HIV-ELISA-negative, Stool culture-sterile, Urine culture-sterile, Blood culture-sterile, Stool routine and microscopic examination - occult blood was present. Peripheral blood smear- normocytic normochromic, leucopenia, thrombocytopaenia, eosinophilia; ESR- 125mm at the end of 1 hour.

Methotrexate was stopped immediately and the patient was put on Inj. Meropenem 1gm IV 8th hrly and Inj. Filgrastin 5 mcg/kg SC (gcsf) & Leucovorin 15 mg 6th hrly for 3 days. Meanwhile, upper GI-scopy was done which showed multiple small ulcers in the antral region. Colonoscopy was done which turned out to be normal. Patient showed rapid clinical improvement. He was soon fit enough to be discharged. His lab reports at the time of discharge were as follows- Hb-9.3G/dl, TLC-9500/cmm with neutrophils 64, eosinophil-0, lymphocytes-36 platelet count-2.4 lac.

DISCUSSION

Methotrexate was originally developed and continues to be used for chemotherapy either alone or in combination with other agents. It is effective for the treatment of a number of cancers. It is also used as a treatment for some autoimmune diseases including rheumatoid arthritis, psoriasis, psoriatic arthritis, lupus and Crohn's disease,¹ to name a few.

Although methotrexate was originally designed as a chemotherapy drug (in high doses), in low doses methotrexate is a generally safe and well tolerated drug in the treatment of certain autoimmune diseases. Because of its effectiveness, low-dose methotrexate is now first-line therapy for the treatment of rheumatoid arthritis.³ Though methotrexate for autoimmune diseases is taken in lower doses than it is for cancer, side effects such as hair loss, nausea, headaches, and skin pigmentation are still common. The most common adverse effects include ulcerative stomatitis, low white blood cell count and thus predisposition to infection, nausea, abdominal pain, fatigue, fever, dizziness & acute pneumonitis.^{1,2,4}

To our knowledge, none of the reported cases have mentioned about dysphagia & GI bleed as the side effect of methotrexate as the incidence of such side effects is very low. Stomatitis usually precedes pancytopenia and should be considered a warning sign. This was the reason for dysphagia in our patient. Patients with mucositis have a 4 fold higher risk of septicaemia than the individuals without mucositis. These ulcers serve as portal of entry for endogenous oral flora to produce infection. Also, the oral flora of neutropenic patients differs from that of the healthy population as it is rich in Gram-negative organisms and typical α -haemolytic streptococci.

Methotrexate is a highly selective competitive inhibitor of the enzyme dihydrofolatereductase and consequently reduces the production of thymidylate and DNA synthesis. Tissues undergoing rapid cellular turnover with a high fraction of the cells in S phase cycle (oral mucosa, gastrointestinal tract, bone marrow cells and testicular tissue) are the most susceptible to its cytotoxic effects. The mucosal cells are more sensitive to methotrexate than the precursor cells in the bone marrow because of greater accumulation and persistence of methotrexate in the intestinal epithelium. Mucositis usually appears 3-7 days after the drug administration and precedes the onset of fall of leucocyte and platelet counts by several days. This was the reason for haematemesis and malaena in our patient. The most common risk factors for methotrexate toxicity are - alteration in methotrexate dosage and the use of non-steroidal anti-inflammatory drugs⁶ along with methotrexate. Other possible contributing factors for methotrexate toxicity are renal insufficiency (because methotrexate is excreted unchanged primarily by the kidneys), infection, pustular flare of psoriasis and older age (55 years or more). The risk of toxicity secondary to methotrexate is even greater if additional methotrexate is administered sooner than the usual scheduled weekly dose, because a new population of dividing cells in the S phase will be targeted.⁷ Rapidly proliferating cells have a greater susceptibility to methotrexate because more cells are in the S phase, where methotrexate exerts its effect.⁸

Treatment of choice for bone marrow suppression secondary to methotrexate toxicity is leucovorin calcium,^{5,6} which is administered orally or intravenously or subcutaneously every 6 hours after an immediate loading dose of 20 mg(10 mg/m²) until plasma methotrexate concentration is 5×10^{-8} or less.⁶ However, leucovorin calcium must be administered within 12-24 hours after the last dose of methotrexate to be effective.⁶

It's gratifying to observe the worldwide interest in methotrexate as there are still many unanswered questions about this compound. So, it is mandatory to follow the strict advice of the treating physician or a dermatologist when a patient is on methotrexate therapy as even a minimal amount of negligence can lead to serious consequences in any form.

Acknowledgement: Nil

Source of Funding: Nil

Conflicting Interest: Nil

Ethical Clearance: Done

REFERENCES

1. Bookstaver PB, Norris L, Rudisill C, DeWitt T, Aziz S, Fant J. *Am J Health Syst Pharm.* 2008 Nov 15;65(22):2117-21.
2. Methotrexate: The American Society of Health-System Pharmacists. <http://www.drugs.com/monograph/methotrexate.html>. Retrieved 3 April 2011.
3. Scheinfeld, N (2006). "Three cases of toxic skin eruptions associated with methotrexate and a compilation of methotrexate-induced skin eruptions". *Dermatology online journal* 12(7):15.
4. Haustein UF, Rytter M. Methotrexate in psoriasis: 26 years' experience with low-dose long-term treatment. *J Eur Acad Dermatol Venereol.* 2000 Sep;14(5):382-8.
5. Dollery C. *Therapeutic drugs.* 2nd ed. Edinburgh: Churchill-Livingstone; 1999. p. M90-6.
6. Roenigk HH Jr, Auerbach R, Maiback HI, Weinstein GD. Methotrexate in psoriasis: Revised guidelines. *J Am Acad Dermatol* 1988;19:145-56.
7. Pearce HP, Wilson BB. Erosion of psoriatic plaques: An early sign of methotrexate toxicity. *J Am Acad Dermatol* 1996;35:835-8.
8. Bleyer WA. Methotrexate: Clinical pharmacology, current status and therapeutic guidelines. *Cancer Treat Rev* 1977;4:87-101.
9. Hoffman TE, Watson W. Methotrexate toxicity in the treatment of generalized pustular psoriasis. *Cutis* 1978;21:68-71.
10. Cronstein BN. Molecular therapeutics. Methotrexate and its mechanism of action. *Arthritis Rheum* 1996;39:1951-60.
11. Weinblatt ME. Toxicity of low dose methotrexate in rheumatoid arthritis. *J Rheumatol* 1985;(Suppl 12):35-9.
12. Haddad LM, Winchester JF. 1990. *Clinical management of poisoning and drug overdose.* 2nd ed. Philadelphia, PA: W.B. Saunders Company.

Psychopathology and other Contributing Stressful Factors in Female Offenders: An Exploratory Study

Pallavi Joshi¹, Sanjay Kukreja², Avinash Desousa³, Nilesh Shah⁴, Amresh Shrivastava⁵

¹Consultant Psychiatrist, Private Practice, Bangalore, India, ²Research Associate, Department of Neurosurgery, ³Research Associate, Department of Psychiatry, ⁴Professor and Head, Department of Psychiatry, Lokmanya Tilak Municipal Medical College, Mumbai, ⁵Department of Psychiatry, University of Western Ontario, Lawson Health Research Institute, London, Canada

ABSTRACT

Background: Psychopathology and stressful factors contributing to the same have been under studied in the Indian context with few studies available in the area. The objective of the present study was to determine the prevalence and type of psychopathology and history of other contributing stressful factors in female offenders in a state run urban prison.

Methodology: The study was carried out in a state run prison located in an urban area with a cross sectional design. A semi structured proforma, DSM-IV TR, and Modified Kuppuswamy's socioeconomic scale was used by a trained psychiatrist to interview the participants and diagnose psychopathology. A total of 50 female offenders participated in the study. All statistics were assessed using relevant tests by a qualified bio-statistician and using appropriate computer software.

Results: The prevalence of psychopathology was found to be 82%. The most common psychopathology was found to be substance related disorder followed by major depressive disorder, adjustment disorder, personality disorder and generalized anxiety disorder. Forty eight percent (n=24) of the participants had dual diagnosis. Family history of psychopathology was found in 12% of the participants, history of child abuse in 36%, history of parental Loss in 22%, history of domestic violence in 40%, history of marital disharmony in 62%, history of inadequate family support in 54%, history of deliberate self-harm in 28% and history of substance abuse was found in 40%.

Conclusions: Thus, the psychiatric morbidity and history of contributing stressful factors in female prisoners is very high. There is an urgent need to recognize these psychopathologies and provide help and treatment to improve the overall quality of life of these female prisoners.

Keywords: Prisoners, Psychopathology, Offenders, DSM-IV TR

INTRODUCTION

It is well known that psychological factors such as frustration, hostility, and feelings of helplessness might be the cause or the consequence of criminal behavior and in some cases, both¹. Researchers argue that mothers in prison face multiple problems in

maintaining relationships with their children and encounter obstacles created both by the correctional system and child welfare agencies. Women who give birth while incarcerated are rarely allowed to spend time with their child after birth. Termination of parental rights also affects prison mothers²⁻³.

Women inmates who are substance abusers are more prone to intense emotional distress, psychosomatic symptoms, and low self-esteem than male inmates⁴. The impact of physical, sexual, and emotional abuse found in the experience of women offenders also creates a significant need for counseling

Corresponding author:

Avinash De Sousa

Carmel, 18, St. Francis Avenue, Off S.V. Road, Santacruz West, Mumbai 400-054.

Tel - 91-22-26460002

E-mail: avinashdes888@gmail.com

and therapy⁵. Several studies have also found that female prisons offered fewer vocational and education program opportunities when compared to those offered in male institutions⁶⁻⁷. Gender bias research has found that women prisoners were cited more frequently and punished more severely than males⁸. Based on the characteristics of women offenders, their pathways to crime, how they differ from male offenders, and how the system responds to them differently, the need for gender-responsive treatment and services seems clear in case of female offenders⁹.

There is a consensus that mental health problems are more common among female prisoners than their male counterparts¹⁰. Studies suggest that women inmates are more likely to be conformists and males are more likely to be antiauthoritarian (rebellious). A study of the tendency to blame others found that both sexes placed the blame for their actions on the others, only that males found blame with peers while females found blame with their families¹⁰.

Studies on female prisoners have confirmed that child abuse (sexual, physical, emotional abuse) and neglect can lead to psychiatric morbidities¹¹⁻¹². Studies have found that the loss of father before the age of 10 years was more highly correlated with signs of depression in women prisoners than was loss of mother although, loss of both parents can lead to depression in women prisoners¹³. Among the stressful life events that affect female offenders, sexual abuse, domestic violence, family and social support are very important and have been studied extensively¹⁴. High prevalence of various psychiatric disorders like major depressive disorder, posttraumatic stress disorder, eating disorders & personality disorder have been reported in female prisoners who are substance abusers¹⁵.

There are very few Indian studies conducted on prisoners to study the psychopathology in female prisoners. To address this knowledge gap, we studied the frequency and type of psychopathology, and history of other stressful factors contributing to psychopathology in female prisoners.

MATERIAL AND METHOD

The study population was composed of female prisoners, aged 18 to 60 years, from a state run urban prison (female inmates section) in Mumbai. Female

prisoners with a major medical/surgical illness or mental retardation were not included in the study. A total of fifty female participants agreed to participate voluntarily in the study.

A semi structured proforma was used to obtain the details about socio-demographic profile, childhood history, family history, marital history, personal history, past history, substance use history, history of psychiatric illness & details pertaining to psychiatric symptoms. The DSM-IV TR criteria were applied to study the psychopathology in female prisoners.

Socioeconomic status (SES) is one of the most important social determinants of health and disease. Usually composite scales are used to measure SES, which has a combination of social and economic variables. The most widely used scale for urban populations is Kuppaswamy's socioeconomic scale, which is a composite score of education and occupation of the head of the family along with monthly income of the family, which yields a score of 3-29. This scale classifies the study populations into high, middle, and low SES¹⁶.

The study protocol was approved by the Institutional Ethical Committee. All the female prisoners (18-60 years of age) from the female inmates section of the state run urban prison were informed about the nature of the study and asked to participate. Participants who could not understand the nature of the study either due to mental retardation or language problem were not included. Participants who had a major medical or surgical illness were also not included in the study. Permission was taken from appropriate authorities including the Deputy Inspector General (DIG) of Police for interviewing the female prisoners in the prison. Each participant was interviewed by a trained psychiatrist to assess patients with psychological disorders. All the participants were interviewed by the same psychiatrist. Each interview was preceded by a written informed consent form, in which participants were explicitly informed of the voluntary and confidential nature of participation in the study. The study participants were interviewed and asked questions about socio-demographic profile, childhood history, family history, marital history, personal history, past history, past history of psychiatric illness & details pertaining to psychiatric symptoms. The diagnosis of psychopathological illnesses was made by the interviewing psychiatrist.

RESULTS

The participants were mainly of Muslim (46%) and Hindu (40%) religion while Christians constituted 14 % of the study participants. Most of the study participants were Indian nationals (84%) while 14 % of them were foreign nationals. More than half of the participants were married (58%), 18% were unmarried, 20% were divorced or separated and 4% were widows. Three fourth of the study participants were unemployed (72%), 14% were skilled workers and 6% were semi skilled professionals. One third of the study participants were illiterate (34%), one third had studied up to primary school (34%) and one third had studied secondary school and above (32%). Majority of the study participants were of lower socioeconomic status (68%).

Most of the study participants were arrested for non-violent crimes (90%) and only 10% for violent crimes. Half of the participants (52%) were in the prison for less than six months, 20% for 6-12 months and 28% for more than a year. Only 6% were sentenced (convicts) and 94% were under-trial.

82% of the participants in our study were found to have some psychopathology on Axis I or Axis II of DSM-IV TR. 40% of the study participants had substance related disorders. 32% of the participants had major depressive disorder. Adjustment disorder was found in 22% of the study participants. 12% of the study participants were found to have personality disorder. Of these most were having borderline personality disorder and antisocial personality disorder. (Table 1).

48% of the participants had dual diagnosis. Among participants with major depressive disorder (32%), 8% had nicotine dependence, 4% had alcohol abuse and

2% had opioid dependence in early full remission. All participants with personality disorder had some substance related disorder also. (Table 1).

One fourth of the participants (24%) were already diagnosed as having some psychiatric illness. the most common history of psychiatric illness was major depressive disorder (12%) followed by psychosis NOS (4%) and borderline personality disorder (12%). One fourth of the participants (24%) were already taking some treatment for their psychiatric problems.

14% of the study participants had a history of significant past medical/surgical illness and 8% had a history of epilepsy while 4% had a history of head injury. 36% of the participants in our study perceived child abuse. 6% reported sexual abuse and an equal number reported emotional abuse and neglect. 16% participants had physical, sexual and emotional abuse.

22% had a history of loss of a parent before the age of 10 years. Only 4% of the participants in our study gave history suggestive of conduct traits in the childhood. 40% of the study participants gave a history of domestic violence prior to imprisonment. 62% of the study participants perceived their marital relationship as disharmonious and only 16% perceived their marital relationship as harmonious. 54% perceived their family support as inadequate. (Table 2).

40% participants in our study had a history of substance abuse or dependence. Nicotine dependence was the most common (16%) substance related disorder in our study participants. 14% had a history of alcohol abuse while 28% gave a history of deliberate self-harm in their life time. Almost all of them had this attempt in impulse, out of frustration and boredom in the prison (Table 2).

Table 1: Frequency and type of psychopathology in the study participants

S.No.	Axis I& Axis Ii Disorders	Number (n)	Percentage (%)
1.	Adjustment Disorder with Anxiety	2	4.0
2.	Adjustment Disorder with Anxiety with Nicotine Dependence	1	2.0
3.	Adjustment Disorder with Depressed Mood	5	10.0
4.	Adjustment Disorder with Depressed Mood with Nicotine Dependence	1	2.0
5.	Adjustment Disorder with Mixed Anxiety & Depressed mood	2	4.0
6.	Alcohol Abuse	3	6.0
7.	Alcohol Abuse with Borderline Personality Disorder	2	4.0
8.	Alcohol Dependence in early full remission with Antisocial Personality Disorder	1	2.0
9.	Alcohol Dependence in early full remission with Borderline Personality Disorder	1	2.0
10.	Generalized Anxiety Disorder	1	2.0
11.	Major Depressive Disorder	9	18.0

Table 1: Frequency and type of psychopathology in the study participants (Contd.)

S.No.	Axis I& Axis II Disorders	Number (n)	Percentage (%)
12.	Major Depressive Disorder with Alcohol Abuse	2	4.0
13.	Major Depressive Disorder with Nicotine Dependence	4	8.0
14.	Major Depressive Disorder with Opioid Dependence in early full remission	1	2.0
15.	Opioid Dependence in early full remission with Borderline Personality Disorder	2	4.0
16.	Psychosis NOS	2	4.0
17.	Somatization Disorder with Nicotine Dependence	2	4.0
	Total	41	82.0

Table 2: History of other stressful factors in the study participants

S.No.		Number (n)	Percentage (%)
1.	History of psychiatric illness	12	24.0
	- MDD	6	12.0
	- Psychosis	2	4.0
	- Borderline PD	2	4.0
	- Antisocial	1	2.0
2.	History of psychiatric treatment	12	24.0
3.	History of medical/surgical illness	7	14.0
	- Epilepsy	4	8.0
	- Head injury	2	4.0
	- Epilepsy as well as Head injury	1	2.0
4.	Family history		
	- MDD in mother	4	8.0
	- Alcoholism in father	2	4.0
5.	History of child abuse	18	36.0
	- Sexual abuse	3	6.0
	- Emotional abuse and neglect	3	6.0
	- Sexual and emotional abuse	1	2.0
	- Physical, sexual and emotional abuse	8	16.0
6.	History of parental Loss (<10yrs of age)	11	22.0
	- Loss of mother	7	14.0
	- Loss of father	3	6.0
	- Both	1	2.0
7.	History of conduct Traits	2	4.0
8.	History of domestic violence	20	40.0
9.	Marital relationship harmony		
	- Disharmonious	31	62.0
	- Harmonious	8	16.0
10.	History of family support		
	- Adequate	23	46.0
	- Inadequate	27	54.0
11.	History of deliberate self-harm	14	28.0
12.	History of substance abuse and dependence	20	40.0
	- Alcohol Abuse	07	14.0
	- Alcohol Dependence in early full remission	02	4.0
	- Nicotine Dependence	08	16.0
	- Opioid Dependence in early full remission	03	6.0

DISCUSSION

In our study, two third (68%) of the participants were either illiterate or had studied up to primary school. This is similar to the observations by a study done on female prisoners from Coimbatore Jail¹⁷, which found that 72% of the female prisoners were either illiterate or had education up to primary school. Majority of the participants in our study were of lower socioeconomic status (68%). Studies of female prisoners in India have reported that 60% of the prisoners belong to lower socioeconomic class¹⁷. Whether deprived individuals, in terms of education and money, are pushed for the crime to fulfill their needs is matter of question. Socioeconomic & educational background plays an important role in the psychopathology of female prisoners. They have negative correlation with each other¹⁸.

Most of our study participants were arrested for non-violent crimes (90%). Literature also suggests that females usually do not commit violent crimes possibly because of their biological differences and differences in their needs. Arrest statistics certainly indicate that women do not engage in assaultive behavior (or at least not arrested for such behavior) as frequently as men¹⁰. It is interesting to note that 94% were under trial. Studies have reported the percentage of convicted women prisoners to be only 16 percent¹⁷. The under trial period being so long in India can have its own toll on the prisoner. As per the report of Committee on empowerment of women¹⁹, over 80% of the women prisoners are under trials who have been in prison for years together. No one knows when the trial will take place or when they will be able to come out of the cold prison walls. Our study also found that almost 70-80 percent was of the female prisoners were unaware about their trial status and many of them had no lawyers to fight for them¹⁷. This prolonged incarceration for under trial patients can be a matter of stress to develop psychopathology.

82% in our study were found to have some psychopathology on Axis I or Axis II of DSM-IV TR. Studies have reported the prevalence of overall psychopathology in female prisoners to be between 70-85 percent²⁰⁻²³. Various studies have reported the prevalence of Major Depressive disorder in female prisoners to be 10-15 percent and that of personality disorder to be 18-65 percent²⁴. Dual diagnosis has been reported to be very common in female prisoners²¹.

We required a lot of effort to make the participants answer questions in detail (voluntarily) during the interview. We believe the stigma associated with psychiatric illness could be a reason for hiding their illnesses from regular prison psychiatrists. 36% of the participants in our study perceived child abuse (sexual abuse, physical abuse, emotional abuse and neglect). According to the National Child Abuse Statistics of America, thirty-six percent of all women in prison were abused as children²⁵. History of child abuse not only increases the chances of incarceration but also is a predictor of psychiatric morbidity in female prisoners¹¹⁻¹². Studies on female prisoners have reported that child abuse (sexual, physical, emotional abuse) & neglect can lead to various psychiatric morbidities like depression, suicidal behavior, substance related disorders and anxiety disorders¹¹.

Various studies have reported that 23-90% of female prisoners have experienced domestic violence²⁶⁻²⁷. One study reported correlation between the victims of domestic violence & psychopathologies like post traumatic stress disorder (PTSD) & depression among female inmates²⁸. The prevalence of drug abuse and dependence in female prisoners is reported to be 30-60% across studies²⁹⁻³⁰. Various studies worldwide have reported the prevalence of deliberate self-harm at some point in life in female prisoners to be 25-45%³¹⁻³². Psychological disorders also appear to be related to an increased risk of self-injury and suicide³³⁻³⁵.

The psychiatric morbidity in female prisoners is very high. There is an urgent need to recognize these psychopathologies and provide help and treatment to improve the overall quality of life of these female prisoners & society at large. The limitations of our study include small sample size and no informant was available to countercheck the information provided by the female participants. We also used pure clinical judgment to diagnose via DSM criteria rather than using a structured interview tool. It is recommended that future research in this area should include large sample size from multiple prisons across the country to note the psychopathology and status of female prisoners across India.

Acknowledgment: None

Financial Disclosures: Nil

Conflict of Interest: Nil

REFERENCES

1. Khurana, A, Dhar P. Effect of Vipassana Meditation on Quality of life, Subjective well-being, and Criminal Propensity among inmates of Tihar jail, Delhi. Retrieved from <http://www.vridhamma.org/Research-on-inmates-of-Tihar-Jail-Delhi>, 2000.
2. Bloom B, Chesney-Lind M. Women in Prison: Vengeful Equity. In Muraskin (Ed.), *It's a Crime: Women and Criminal Justice*. (pp. 183–204). New York: Prentice Hall ; 2000.
3. Bloom B, Steinhart D. Why punish the children?: a reappraisal of the children of incarcerated mothers in America. San Francisco: National Council on Crime and Delinquency ; 1993.
4. Wellisch J, Anglin MD, Prendergast M. Treatment strategies for drug-abusing women offenders. In J. Inciardi (Ed.), *Drug Treatment and the Criminal Justice System* (pp. 5–25). California: Sage Publications ; 1994.
5. Pollock JM. *Women, Prison, & Crime*. Belmont, CA: Wadsworth Thomson Learning ; 2002.
6. Morash M, Bynum TS, Koons-Witt B. *Women Offenders: Programming Needs and Promising Approaches*. U.S. Department of Justice: Office of Justice Programs, National Institute of Justice ; 1998.
7. Pollock JM. *Counseling Women in Prison*. Thousand Oaks, CA: Sage Publications ; 2002.
8. McClellan DS, Farabee D, Crouch BM. Early Victimization, Drug Use, and Criminality A Comparison of Male and Female Prisoners. *Crim Justice Behav* 1997; 24(4): 455–76.
9. Covington S, Bloom B. *Gender Specific Programming for Female Offenders: What is it and why is it Important ? Report of the American Society of Criminology* ; 1998.
10. Macdonald M. Women prisoners, mental health, violence and abuse. *Int J Law Psychiatry* 2013; 36(3-4): 293–303.
11. MacMillan HL, Fleming JE, Streiner DL, Lin E, Boyle MH, Jamieson E, Beardslee WR. Childhood abuse and lifetime psychopathology in a community sample. *Am J Psychiatry* 2001; 158(11): 1878–83.
12. Goyal SK, Singh P, Gargi PD, Goyal S, Garg A. Psychiatric morbidity in prisoners. *Indian J Psychiatry* 2011; 53(3): 253–7.
13. Climent CE, Plutchik R, Ervin FR, Rollins A. Parental loss, depression and violence. III. Epidemiological studies of female prisoners. *Acta Psych Scand* 1977; 55(4): 261–8.
14. Wright B, Duffy DM, Curtin K, Linehan SA, Monks S, Kennedy HG. Psychiatric morbidity among women prisoners newly committed. *Irish J Psychol Med* 2006; 23(2): 47–53.
15. Zlotnick C, Clarke JG, Friedmann PD, Roberts MB, Sacks S, Melnick G. Gender differences in comorbid disorders among offenders in prison substance abuse treatment programs. *Behav Sci Law* 2008; 26(4): 403–12.
16. Kumar N, Shekhar C, Kumar P, Kundu AS. Kuppuswamy's socioeconomic status scale-updating for 2007. *Indian J Pediatr* 2007; 74(12): 1131–3.
17. Kumari MN. Socio-economic Profile of Women Prisoners. Report on A Minor Research Project under University Grants Commission ; 2009. Downloaded from www.languageinindia.com/feb2009/nageshkumari.pdf
18. Kennealy PJ, Hicks BM, Patrick CJ. Validity of Factors of the Psychopathy Checklist-Revised in Female Prisoners. *Assessment* 2007; 14(4): 323–40.
19. Committee on empowerment of women. (Thirteenth Lok Sabha) *Women in Detention*. Eleventh Report. 2002-2003. Retrieved from <http://164.100.24.208/ls/committeeR/Empowerment/3rd/ANNEXUREII.html>
20. Birmingham L. Mental disorder and prisons. *Psychiatr Bull* 2004; 28(11): 393–7.
21. Edwards D. Mental Health Diagnoses in the Prison Population. North Carolina Department of Public Safety ; 2007. Retrieved from <https://www.ncdps.gov/div/RP/Aug2007StatsMemo.pdf>
22. Maden T, Swinton M, Gunn J. Psychiatric disorder in women serving a prison sentence. *Br J Psychiatry* 1994; 164(1): 44–54.
23. Von Schönfeld CE, Schneider F, Schröder T, Widmann B, Botthof U, Driessen M. [Prevalence of psychiatric disorders, psychopathology, and the need for treatment in female and male prisoners]. *Der Nervenarzt* 2006; 77(7): 830–41.
24. Fazel S, Danesh J. Serious mental disorder in 23000 prisoners: a systematic review of 62 surveys. *Lancet* 2002; 359(9306): 545–50.
25. National Child Abuse Statistics - 2007. Retrieved from www.childhelp.org/resources/learning-center/statistics.

26. Browne A, Miller B, Maguin E. Prevalence and severity of lifetime physical and sexual victimization among incarcerated women. *Int J Law Psychiatry* 1999; 22(3-4): 301–22.
27. Acoca L. Defusing the Time Bomb: Understanding and Meeting the Growing Health Care Needs of Incarcerated Women in America. *Crime Delinquency* 1998; 44(1): 49–69.
28. Lang AJ, Stein MB, Kennedy CM, Foy DW. Adult psychopathology and intimate partner violence among survivors of childhood maltreatment. *J Interpers Viol* 2004; 19(10): 1102–18.
29. Abram KM, Teplin LA, McClelland GM. Comorbidity of severe psychiatric disorders and substance use disorders among women in jail. *Am J Psychiatry* 2003; 160(5): 1007–10.
30. Hartwell SW. Comparison of offenders with mental illness only and offenders with dual diagnoses. *Psychiatr Serv* 2004; 55(2): 145–50.
31. Singleton N, Meltzer H, Gatward R, Coid J, Deasy D. Psychiatric morbidity among prisoners. Summary report. UK: Government Statistical Service; 2007. Retrieved from <http://www.google.co.in/www.ons.gov.uk>.
32. Völlm BA, Dolan MC. Self-harm among UK female prisoners: a cross-sectional study. *J For Psychiatr Psychol* 2009; 20(5): 741–51.
33. Liebling A. *Suicides in Prison*. Routledge ; 1992.
34. Liebling A. Vulnerability and Prison Suicide. *Br J Criminology* 1995; 35(2): 173–87.
35. Liebling A, Krarup H. *Suicide Attempts and Self-Injury in Male Prisons*. UK: Home Office London; 1993.

Stature and Percutaneous Tibial Length - A Correlational and Comparative Study in Sex of Gujarat

Dimple S Patel¹, Rohit C Zariwala², Bharat D Trivedi³

¹Associate Professor, Department of Anatomy, ²Associate Professor, Department of Forensic Medicine, AMC MET Medical College, Ahmedabad, ³Ex. Professor & Head, Department of anatomy, Smt. NHL Municipal Medical College, Ahmedabad

ABSTRACT

One of the primary characteristic for the identification of a person is the stature of the person. After the age of 21 - 25 years, the dimensions of the skeleton remain unchanged and the ratio in size. Of different parts to one another is also considerably variable in different individuals. In case of dismembered body parts, stature can be estimated on the basis of ratio of the different parts. In this paper, attempts are made for the estimation of the stature of native of Gujarat state at AMC MET Medical College, Ahmedabad using "Percutaneous tibial length" in year 2009-10. Tibial length was taken from medial condyle to the tip of medial malleolus with the knee semi flexed and foot partly inverted.

Keywords: Stature, PCTL

INTRODUCTION

Stature is one of the various parameters of identification of the individuality of a person. It is well known that there is a definite relationship between the height of the person and various parts of the body like head, trunk and lengths of the upper and lower limbs. Assessing the height of an individual, from measurements of different parts has always been of immense interest to the anatomists, anthropologists and forensic medicine expert.

Identification is an individual's birth right. As per standard dictionary, "Stature" is defined as the height of a person in a natural standing position. Estimation of stature of an individual by any means is a part of science called Anthropology is a Greek word where "anthropos" means human being and "logos" means knowledge. It is a field of science that deals with the study of humans from their earliest beginnings on earth up to the present time. Forensic anthropology is the application of this anthropological knowledge and techniques in a legal context. This involves details

knowledge of osteology to aid in the identification, to establish cause of death and time since death etc¹. From the skeletal remains reconstruction of stature from human skeletal remains continues to be important aspects of forensic science⁵. Although a variety of bones have been used to estimate stature, the most reliable results are based on long bone lengths and particularly the bones of the lower limbs.

One purpose of this study was to evaluate the accuracy of equations reported in the literature in the stature estimations for people in Gujarat region.

When estimating stature, the examiner must first choose the appropriate formula for the calculation. Thus for our tibia, there is the prospect that the stature estimate may be off by as many as 3...7 cm, or 1.3 inches taller or 1.3 inches shorter. This is called the Standard Error and the values are different for the other long bones of the human skeleton. Stature estimation is an important part of the job of the forensic anthropologist to make personal identification of human skeletal remains.

Further attempts were made to review the new techniques from time to time.

The American Journal of Physical Anthropology set aside a section of the journal for publishing articles concerning anthropometric techniques. In 1950 Viking Fund organized a seminar of a group of physical anthropologists under the direction of Washburn to learn about the technical innovations in physical anthropology. They divided them into three sections.

- (1) Those concerning historical or evolutionary problems.
- (2) Those dealing with the collection and standardization of material on the living and
- (3) Those dealing with analysis of the data.

It was suggested that statistics should be adopted for the specific problems. The utility of making use of computers and other statistical machines was also discussed and emphasized.

The estimation of height of an individual is of more compelling concern to forensic and anthropology experts. The orthodox method for stature estimation is correlation between living stature and lengths of long bones.

Applications of Anthropometry

The measurement on the human body or its parts is practiced for various purposes like

- (1) Industrial Purpose.
- (2) Military Selection and Sports.
- (3) Medical, Surgical and Dental Purposes.
- (4) Criminal and other Identification.
- (5) Scientific Investigations.

Estimation of Stature

Stature is an important factor that complements other data such as age, population affinity and sex in the identification of an individual from skeletal remains.

Three different methods have been suggested and used for the estimation of stature. These are

- (1) The anatomical method.
- (2) The mathematical method.

- (3) The femur/tibia stature ratio. (Sjovold, 2000)

Aims and Objectives

- To assess & to evaluate any relation between percutaneous tibial length & Stature of an individual for medico-legal importance.
- To predict the stature of an individual by percutaneous tibial length using regression analysis.
- To analyze the effect of age and sex on human morphological variation represented by tibial length.
- To review & compare the findings of study in light of available literature.

Review of Literature

- (1) The anatomical method - estimated the total skeletal height and was initially introduced by Dwight in 1894.
- (2) The mathematical method; makes use of one or more bone lengths to estimate stature of the individual. This method employs the bone length and stature tables and regression formula to estimate total skeletal height or the living stature. Karl Pearson developed the first formal stature regression formula. To use mathematical method the bone length is substituted into regression equation (Hens ET. al., 1998; Konigsberg ET. Al. 1998).

The Mathematical method may be used in following ways

- (1) By formulating prediction equation.
- (2) By computing multiplication factors.

Of these two methods, the prediction equations provide a more reliable estimate of stature as compared to the one obtained using multiplication factor.

Work done by various authors can be summarized as follows.

Stevenson (1929), Telkka (1950), Trotter and Gleser (1952), Athawale (1963), Arch. Dis. Childh (1968), Gentry Steele (1970), Snow and Williams (1971), Musgrave and Harneja (1978), DP Bhatnagar (1984),

Lundy (1988), Byers et. al. (1989), Sciulli et al. (1990), Sjovold (1990), Simmons et. at. (1990), Prabha Badkur (1990), Jantsz (1992), Holland (1992), Ousley (1995), D R Jason (1995), Holland (1995), J. Kozak (1996), V Formicola (1996), Giuseppe Vercellotti (1196), Chiba and Terazawa (1998), Rajendra Prasad (1998), N. K. Mohanty (1998), Munzo Ji (2001), J. Piontek, et. al (2001), Dr. Gunnel (2001), Zipfel (2003), Pelin IC (2003), Duyar and Pelin (2003), HR Jadhav (2004) O. P. Jasuja (2004), Dr. Sunil (2005), Can Pelin (2005), Hause et al. (2005), O Celbis (2005), Mubarak Bidmos (2005), Kamla-Raj (2006), Sagir M (2006), Keal Krishna (2007), Bhavna and Surinder Nath (2007), L. E. Ebite (2007), SM Patel (2007), SL Smith (2007), AL Agmohotri (2007), BRNO (2008), B. Danborn et. al. (2008), A. G. Karaman (2008), Krishan (2008), Shalini Kalia (2008), Manisha R. Dayal (2008), Bhavna S. Nath (2009), H. Maijanen (2009), Syeda Zamila Hasan Laila January (2009), Vercellotti et al (2009), Blessing C. (2010), Ashok Sagar (2010), CL Kieffer (2010), SK Chavan (2010), Amit Kumar (2010), Ilayperuma (2010), TD Holland (2010), K. R. Nagesh (2011), Seema et.al (2011), Vercellotti et al. (2011), Vijay Kumar (2011), Amal Hayati Zainal Abidin (2011), Mukta Rani (2011), A. Egwu (2012), Kaore Ashita (2012), Malay Kumar Mondal (2012), Savita Gadekar (2012), Swati Ramakant Pandhare (2012), Kaweesakl Chittawatanarat (2012), Kanchankumar P. Wankheda (2012), DI Mansur (2012), BB Mohanty (2012), Duski Bjelica (2012), Satpute Charulata Annaji (2012), Bikramjeet Singh (2013), Manpreet Kaur (2013), N. Laxmi (2013), Bansal Hansi (2013), Maheswar Chawla (2013).

MATERIAL AND METHOD

Source

The study is conducted on the medical students of AMC Medical College, Maninagar, belonging to Gujarat state aged 21 years or above are included in the study. Age above 21 years is chosen for the reason that, by this age three is completion of skeletal growth by ossification of long bones.

Sample Size

100 subjects (50 males and 50 females) of above 21 years of age belonging to Gujarat state are included in the study.

Data Collected

Stature (Standing height of an individual in cm)
Percutaneous Tibial length (from medical condyle to medical malleolus of tibia in cm)

Methodology

By Regression Equation: It is a statistical measure of average relationship between two variables one independent (tibial length; (x) and other dependent height of an individual (y) in this study).

In a study on 100 young and healthy students in the age group of 21-30 years (50 male and 50 female) percutaneous length of tibia was measured and regression equation were formulated. Direct relationship was observed between stature and percutaneous length of tibia and height of the individual could be estimated with fair accuracy by using equations derived.

Instruments to be used

In above methods all the measurements will be done using following materials

- Baseboard of a standard metric height measuring stand.
- Metric Tape.

Data Analysis

Data thus collected will be reloaded on a pre-designed Performa on MS Excel spreadsheet & is statistically tested by using the computer software named as Med Calc version 12.7, SPS (Smith's Package of Statics) and Microsoft Excel.

Inclusion Criteria

- The medical students of A.M.C. Medical College, Maninagar, Ahmedabad, born and brought up in Gujarat State origin from this region are the target population.
- Age group of students ranged from 21 to 29 years.
- Measurements were taken at fixed time b/w. 12 to 2 p.m. To eliminate the discrepancies due to diurnal variation.
- Similar socio-economic status.

Exclusion Criteria

- Age above 30 years and below 20 years is excluded.
- Cases of Dwarfism, where skeletal growth is abnormally stunted.
- Cases of Gigantism, where skeletal growth is abnormally enhance.

- Subjects with skeletal anomaly especially of spine and long bones.
- Time other than b/w. 12 to 2 p.m. excluded.

Measurement of percutaneous tibial length

It is measured with the help of metric tape in centimeters, by measuring the distance between the most prominent palpable portion of the medical condyle of the tibia and tip of the medical malleolus. For this, the subject is asked to sit with knee placed in the semi flexed position and the foot partly inverted to relax the soft tissues and render bony landmarks prominent. Then, the prominent landmarks are measured with the help of metric tape on right side. These measurements are taken in both males and females separately.

RESULT

Table 1: Age distribution

Age in years	Number (n=100)	Male (n=50)	Female (n=50)
21	11	03	08
22	15	08	07
23	13	08	05
24	13	07	06
25	10	06	04
26	09	04	05
27	09	04	05
28	09	03	06
29	11	07	04

Table-1 shows age distribution of the candidates participated in the study. The candidates included in the study are of age above 20 and below 30 years. Maximum number of candidates belongs to age of 22 years. Minimum number of candidates is of age 26, 27 and 28 years. Maximum number of male candidates belongs to age of 22 and 23 years. Maximum number of female candidates belongs to age of 21 years.

Table 2: Comparison of Stature parameters between male and female.

Results presented in Mean (+) (-) SD (Min-Max)

StudyParameters	MaleN=50	FemaleN=50	P Value
Range (cm)	159.00 - 187.50	147.70 - 170	p<0.0001
Body height (cm) Mean	174.91	157.53	p<0.0001
Standard deviation	6.57	4.77	p<0.0001
Variance	43.17	22.81	p<0.0001
95% of CI for mean	173.04 to 176.77	155.80 to 159.07	p<0.0001
SE of mean	0.92	0.67	p<0.0001

Table 2 shows that range of mean of Stature in males is from 159.00 to 187.50 and the resulted mean is 174.91. However, the range of stature in females is from 147.70 to 170 and the resulted mean are 157.53.

Table-3: Showing PCTL parameters between male and female.

Results are presented in Mean (+) (-) SD (Min-Max)

Study Parameters	Male N=50	Female N=50	Difference	P Value
Range	35.50 - 46.00	32.50 - 43.50	-	p<0.0001
Mean PCTL (cm)	40.90	38.09	2.81	p<0.0001
SD	2.48	2.39	0.09	p<0.0001
Variance	6.18	5.74	0.44	p<0.0001
95% of CI for mean	39.50 to 42.50	37.41 to 38.77	-	p<0.0001
SE of mean	0.35	0.33	0.02	p<0.0001

Table-3 shows that range of mean of PCTL in males is from 35.50 - 46.00 and the resulted mean is 40.90. However, the range of PCTL in females is from 32.50

- 43.50 and the resulted mean is 38.0

Table-4: Showing Stature parameters in different age groups of males.

Parameters	Age groups		
	21-23	24-26	27-29
Parameters	21-23	24-26	27-29
n	19	17	14
Range	164.50 - 187.50	166.50 - 186.00	159.00 - 187.50
Mean	175.64	174.08	174.92
SD	6.85	5.64	7.53
Variance	47.05	31.84	56.72
95% of CI for mean	172.33 to 178.94	171.18 to 176.98	170.57 to 179.27
SE of mean	1.57	1.36	2.01

Table-4 shows the comparison of stature parameters in different age groups in male population. Maximum numbers of subjects are of age group 21-23 years. The men of status is highest in age group of 21-23 years.

DISCUSSION

Estimation of stature is affected by the age, race, sex and many other unknown variables. Population variations in anthropometric dimensions do exist and are attributed to genetic, dietary habits and factors. Gujarat's population has many genetic trait common to the population of West-Asia.

It is quite problem to establish the height from the length of long limb bones, since the proportional relationship of the length of a long limb bone to the body height is variable from individual to individual. So in the study of biological data one is forced to take into account, a mean height and a mean bone length in the present work the mean PCTL for the type of work. The maximum stature in males in this study is 180.50 cm and in females is 170 cm whereas in a study conducted by Momonchand. A, Meera Devi T, it is 176.5 cm and 166.5 cm respectively. Siddiqui and Shah² in their study conducted in Punjabi population using long bones in 1944 also observed - mean stature in cm is 163.6 with range was 148.7 to 168.7 in cm. Pan N³ in their study conducted in Hindus in 1924 observed - mean stature in cm was 162.0 Stature of male is higher than females in all studies.

CONCLUSION

With respect to age, sex and racial groups, dimensions and body proportions are widely variable. The present study has shown the usefulness of PCTL measurement in the estimation of stature amongst medical students of age between 20-30 years belonging to Gujarat. Regression formulae for stature estimation from PCTL measurements were derived in both males and females.

The following conclusions are drawn from the present study of stature estimation from PCTL

- (1) Stature forms an important aspect of individual's physiognomy and can be used as a tool for partial identification of an individual.
- (2) In the present study, the regression equation developed for stature estimation from the PCTL by regression equation formulae $Y = 69.9514 + 2.5902 X$ in males and $Y = 85.1460 + 1.9005 X$ in females can be useful in estimating stature of the population of Gujarat.
- (3) Correlation coefficient of PCTL & height is 0.9806 in males and 0.9535 in females.

For PCTL & Stature : Males : $Y = 68.9514 + 2.5902 X$
 Females: $Y = 85.1460 + 1.9005 X$

Where Y = Total height and X = PCTL.

In either case, if one of the measurements is known, the other can be calculated.

This fact will be of practical use in medico legal investigations and in anthropometry.

This is comparable to other studies conducted in Eastern and Northern India⁶, Germany⁷, Mauritius⁹, Turkey⁸ and Korea⁶. Mohanty et.al (1998) found a correlation coefficient (0.952 in males and 0.939 in females, similarly Ozaslan et.al. (2003) derived correlation coefficient (0.740 in males and 0.790 in females). The highest correlations were observed between stature and tibial length, which explains that the weight bearing bones are better indicators of the stature.

Acknowledgement: Nil.

Ethical Clearance: Informed consent was taken.

Source of Funding: Self.

Conflict of Interest: Nil.

REFERENCES

1. Nath B. S. Estimation of stature from long bones in Indians of the United Provinces; a medico-legal inquiry in anthropometry. Indian J Med Res 1931; 18: 1245-1263.
2. Siddique M A H & Shah M A. Estimation of stature from long bones of Punjabis, Indian J Med Res 1944; 31: 105-108.
3. Pan N. Lengths of long bones and their proportions to body height in Hindus. J Anat 1924; 58: 374-378.
4. Telkka A. On the prediction of human stature from long bones. Acta Anatomica 1950; 9, 103-107.
5. Journal of Forensic Sciences 1995 Jan; 40(1): 59-62.
6. Choi BY, Chae YM, Chung IH, Kang HS. Correlation between the postmortem stature and dried limb-bone lengths of Korean adult males. Yonsei Med J, 1997; 38: 79-85.
7. De Mendonça MC. Estimation of height from the length of long bones in a Portuguese adult population. Am. J. Phys. Anthropol, 2000; 112, 39-48.
8. Pelin IC and Duyar I. Estimation of stature from tibia length: a comparison of methods. Journal of Forensic Sciences 2003 Jul; 48(4):708-12.
9. Patel SM, Shah GV, Patel SV. Estimation of height from measurements of foot length in Gujarat region. J Anat Soc India, 2007: 56:25.

Study of Origin of Left Vertebral Artery from the Arch of Aorta in Central India and its Clinical Relevance

Ashutosh S Mangalgi¹, Akash Deep Suri², Dibya Kishore Satpathi³, Lata S Khanzode⁴

¹Professor, Anatomy, ²Assistant Professor, Medicine, Chirayu Medical College & Hospital, Bhopal, ³Professor, Forensic Medicine & Toxicology, L. N. Medical College, Bhopal, ⁴Professor, Anatomy, Chirayu Medical College & Hospital, Bhopal

ABSTRACT

Vertebral artery is a branch from first part of subclavian artery. On left side it may take origin from the arch of aorta. In present study on twenty cadavers and two fetuses, vertebral artery on left side was arising from the arch of aorta in three cases (13.63%). Condition may be presented with dizziness. Anomalous presentation may interfere with haemodynamics of circulation of brain and also interfere with catheterization, surgery and mislead radiologically. Therefore this anomaly should be kept in mind by physician, surgeon and also forensic experts in establishing cause of death.

Keywords: Vertebral Artery, Arch of Aorta, Anomaly, Variations, Branches

INTRODUCTION

Aortic arch gives 3 branches brachiocephalic artery, left common carotid artery and left subclavian artery. The vertebral artery arises as first branch from the supero-posterior aspect of the subclavian artery. Vertebral artery may originate from common carotid artery¹ or from arch of aorta². Variability in origin may be unilateral either on left side³ or on right side⁴ or bilateral⁵. Vertebral artery usually originates as a single branch but some time origin may be bifid as reported by Eisenberg et al⁶.

Due to variation in the origin and course vertebral artery is liable to complicate the surgery. Therefore is important for surgeon and forensic expert to know the cause of death due to rupture of anomalous route of vertebral artery. The artery supplies the cervical part of the spinal cord, spinal cord, spinal ganglions, meninges and dura mater of the posterior cranial

fossa⁴. Compression of artery may cause haemodynamic changes in the cerebral vasculature leading to insufficient blood supply this fact should be kept in mind by physician and neurologist.

MATERIAL AND METHOD

The study was conducted in the department of anatomy Chirayu Medical College & Hospital Bhopal. Twenty cadavers and two fetuses were dissected. Standard steps for dissection of thoracic cavity were followed as per the Cunningham's Dissection manual. The structures in superior mediastinum were dissected. All the branches arising from arch of aorta were observed.

OBSERVATION

Out of 20 cadavers and two fetuses anomalous origin of left vertebral artery from arch of aorta was seen in two cadavers (Figure 1,2) and in one fetus (Figure 3) i. e. in 3 cases (13.63%). Left vertebral artery branches off from the aortic arch between left common carotid artery and left subclavian artery in all three cases (Figure 1,2,3). Right vertebral artery was arising from the right subclavian artery. Variation in origin was unilateral and on left side only.

Corresponding author:

Ashutosh S Mangalgi

Professor

Dept. of Anatomy, Chirayu Medical College & Hospital, Bhopal

Email: ashutoshmangalgi@yahoo.co.in

Ph: +91 - 9993366621



Fig. 1. Illustration showing left vertebral artery originating from arch of aorta (Marked by an arrow).

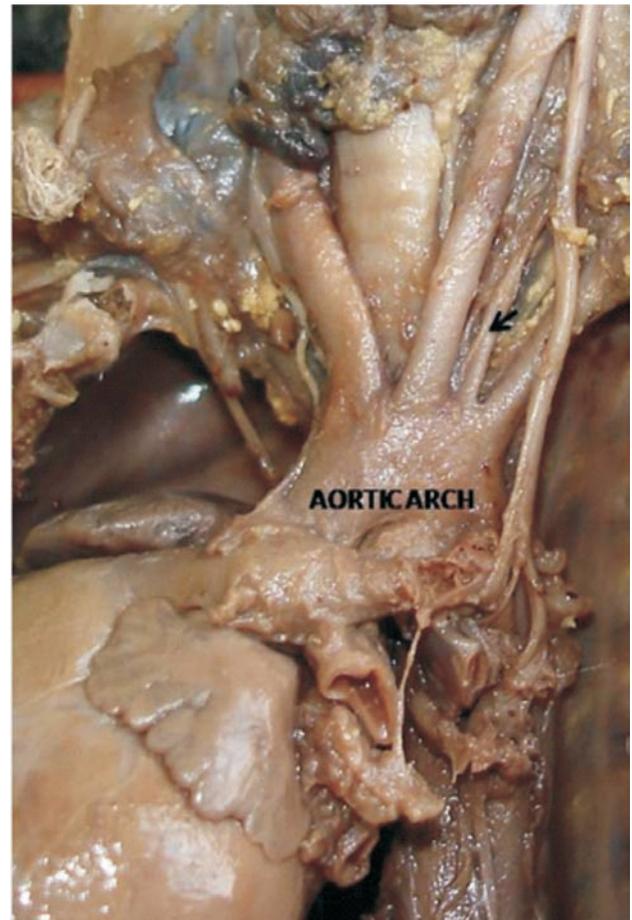


Fig. 3. Illustration showing left vertebral artery originating from arch of aorta (Marked by an arrow).

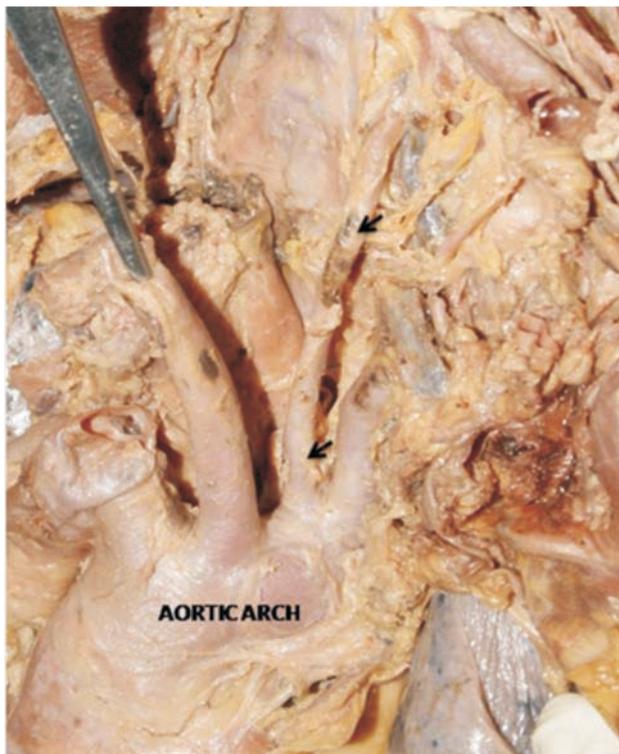


Fig. 2. Illustration showing left vertebral artery originating from arch of aorta (Marked by arrows).

DISCUSSION

Commonly three branches arise from the arch of aorta namely brachiocephalic trunk, left common carotid artery and left subclavian artery. Other than these three common branches, sometimes a fourth branch i.e. left vertebral artery may arise between left common carotid artery and left subclavian artery. The left vertebral artery arising from the aortic arch is the third most common branching pattern of the aortic arch. Incidence of origin of left vertebral artery from aortic arch is variable starting from 0.79% cases⁷. Dasler and Anson⁸ reported incidence between 1-3% and 2.4 to 5.8% reported by Ligege & Scholtz⁹. Present study reported the incidence anomalous origin of vertebral artery from arch of aorta in 13.63% cases. Koenigsberg et al¹⁰ reported left vertebral artery from arch of Aorta in 6% of the population. Frequency of origin of left vertebral artery from aortic arch was found to be 5.6% in the Japanese study¹¹.

Glunèiæ and Marušiæ¹² reported association of left vertebral artery from aorta with the right retroesophageal subclavian artery. Natsis et al⁷ reported left vertebral artery from aortic arch with abnormal origin of inferior thyroid artery as a branch of left vertebral artery.

Vertebral artery develops in four parts. The first part of vertebral artery develops from the dorsal ramus of seventh cervical intersegmental artery, second part is derived from longitudinal communications of the post costal anastomosis, third part from the spinal branch of first cervical intersegmental artery and the fourth part develops from pre neural division of the spinal branch. Persistence of the left sixth dorsal intersegmental artery presents as the left vertebral artery is arising from arch of aorta².

Karcaaltincaba et al¹³ reported a risk of operating aortic aneurysm in cases of anomalous vertebral artery. This variation plays an important role for vascular surgeons, neurosurgeons and thorax surgeons because vertebral artery injury is a known complication of the extended lateral decompression during anterior cervical spine surgery, which can result in exsanguinations and permanent neurologic deficits¹⁴.

Knowledge of these variations is crucial in diagnostic interventions before vascular surgeries of supra-aortic arteries and for planning aortic arch surgeries and endovascular interventions¹⁵. Ligege & Scholtz⁹ reported difficulty in catheterization of supra-aortic vessels in anomalous vertebral artery during four-vessel digital subtraction angiography. The existence of these anomalies also accounts for the policy in many practices of routinely performing an angiogram of aortic arch before attempting selective catheterization of the carotid and vertebral arteries.

Vertebral artery may be wrongly considered to be occluded or diseased, either by eluding catheterization during angiography or by lying outside the region of interest during noninvasive studies such as CT angiography, MR angiography or Doppler sonography^{6,16}.

Abnormal origin of vertebral artery may favour cerebral disorders due to alterations in cerebral hemodynamics. Usually it remains asymptomatic but sometimes it may present with dizziness and may predispose atherosclerosis¹⁷. Knowledge of anomalous vertebral artery is essential for physician, surgeon and also for forensic experts in establishing the cause of death during autopsy.

Acknowledgement: Nil

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: No ethical issue as study was on dried human skulls.

REFERENCES

1. Chen C, Wang L, Wong Y. Abnormal origin of vertebral artery from the common carotid artery. *AJNR Am J Neuroradiol* 1998; 19: 1414-1416.
2. Panicker, HK, Tarnekar A, Dhawane V, Ghosh SK. Anomalous Origin of Left Vertebral Artery — Embryological Basis and Applied Aspects – A Case Report. *J Anat. Soc. India* 2002; 51(2): 234-235.
3. Patasi B, Yeung A, Goodwin S, Jalali A. Anatomical variation of the origin of the left vertebral artery. *International Journal of Anatomical Variations* 2009; 2: 83–85.
4. Kubikova E, Osvaldova M, Mizerakova P, El Falougy H, Benuska J. A variable origin of the vertebral artery. *Bratisl Lek Listy*. 2008;109:28–30.
5. Sikka A, Jain A. Bilateral variation in the origin and course of the vertebral artery. *Anatomy Research International*. Volume 2012 (2012), Article ID 580765, 3 pages <http://dx.doi.org/10.1155/2012/580765>.
6. Eisenberg R, Vines F, Taylor S: Bifid origin of the left vertebral artery. *Radiology* 1986, 159:429-430.
7. Natsis KI, Tsitouridis IA, Didagelos MV, Fillipidis AA, Vlasis KG, Tsikaras PD: Anatomical variations in the branches of the human aortic arch in 633 angiographies: clinical significance and literature review. *SurgRadiolAnat* 2009; 31: 319-323.
8. Dasler EH and Anson BJ: Surgical anatomy of the subclavian artery and its branches. *Surgery Gynecology Obstetrics* 1959;108: 149-174.
9. Ligege P, Scholtz L. Rare variation in the origin of the right vertebral artery. *SA journal of Radiology*, 2004:34-35.
10. Koenigsberg RA, Pereira L, Nair B, McCormick D, Schwartzman R. Unusual vertebral artery origins: examples and related pathology. *Catheter Cardiovasc Interv*. 2003;59:244–250.
11. Yamaki K, Saga T, Hirata T, Sakaino M, Nohno M, Kobayashi S, Hirao T. Anatomical study of the vertebral artery in Japanese adults. *Anat Sci Int*. 2006;81:100–106.

12. Glunèiæ V and Marušiæ A. Association of the truncus bicaroticus, common trunk of the left subclavian and vertebral arteries, and retroesophageal right subclavian artery. Case report. *Annals of Anatomy – Anatomischer Anzeiger* 2000;182(3):281-283
13. Karcaaltincaba M, Haliloglu M, Ozkan E, Kocak M, Akinci D, Ariyurek M. Non-invasive imaging of aberrant right subclavian artery pathologies and aberrant right vertebral artery. *Br J Radiol* 2009;82:73–9.
14. Lu J, Ebraheim NA. The vertebral artery: surgical anatomy. *Orthopedics*1999; 22: 1081-1085.
15. References and further reading may be available for this article. To view references and further reading you must purchase this article. Lemke AJ, Benndorf G, Liebig T, Felix R. Anomalous origin of the right vertebral artery: review of the literature and case report of the right vertebral artery origin distal to the left subclavian artery. *AJNR Am J Neuroradiol* 1999;20: 1318–21.
16. Goray VB, Joshi AR, Garg A, Merchant S, Yadav B, Maheshwari P. Aortic arch variation: a unique case with anomalous origin of both vertebral arteries as additional branches of the aortic arch distal to left subclavian artery. *AJNR Am J Neuroradiol.* 2005; 26: 93–95
17. Vicko G, Goran I, Damjan M, Sanja P. Anomalous origin of both vertebral arteries. *Clin anat* 1999;12:281-284.

An Analytical Study of 818 Poisoning Cases Autopsied at Osmania Medical College, Hyderabad, Andhra Pradesh

Sanjay Punuri¹, Seetharamaiah Mynedi², VP Kumar Sriperumbuduru¹

¹Assistant Professor, ²Associate professor, Department of forensic medicine, ASRAM medical college, Eluru, West Godavari, Andhra Pradesh

ABSTRACT

Poisoning has become a major health hazard with advent of so many industrial, agro chemicals often resulting in fatalities in this present study we have analysed 818 cases of poisoning related deaths autopsies in various parameters.

Keywords: Deaths Due To Poisoning, Autopsy Findings in Death Due to Poisoning, Manner of Death Due to Poisoning, Motive for Poisoning Deaths

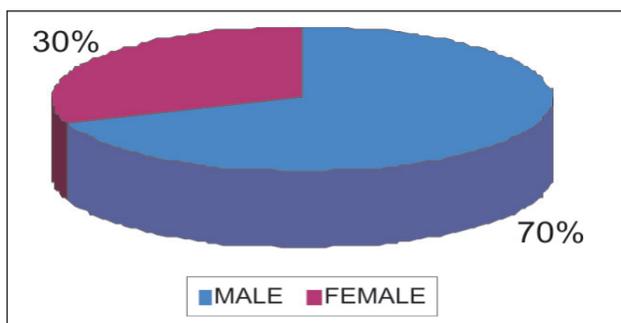
INTRODUCTION

Almost anything is a poison and there is really no boundary between a medicine and poison. It is estimated that some form of poison is directly or indirectly responsible for more than 1 million illnesses worldwide. Poison being invariably medico legal in nature among fatal cases, Postmortem examination is done to establish the exact cause and manner of death. The incidence of poisoning is increasing day by day because of its low cost, easy availability.

OBJECTIVES OF STUDY

To study the commonly used poisons, to study the incidence of poisoning in all aspects and to correlate postmortem findings with the type of poison detected by Chemical Analysis.

Distribution of Study population according to Sex



MATERIALS AND METHOD

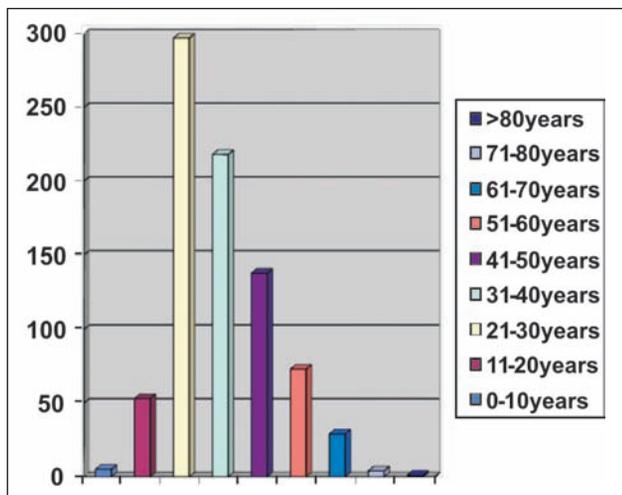
The present study has been carried out in the Department of forensic medicine; Osmania Medical College and hospital Hyderabad, during the period June 2007 to June 2009. A sum total of 818 cases were selected for this prospective study. Detailed information of the deceased pertaining to the cases were collected from the concerned police and relatives of the deceased by a questionnaire, hospital records, post mortem findings were analyzed with the chemical analysis reports.

OBSERVATION AND DISCUSSION

Various parameters like age, sex, marital status, Locality, family pattern, time of consumption of poison, motive of ingestion of poison, odour of mucosal contents, changes in the stomach mucosa were observed and recorded in the tables and graphs.

Distribution of Study population according to Sex is in total cases males were 569 (70%), and females 249 (30%). Males outnumbered the females in the study population. It is correlating with other study which showed male predominance.¹⁴

Distribution of the study population according to age



It is observed from the above table that the maximum number of poisoning in the study population are seen in the age group of 21 to 30 years (36.3%) followed by 31-40years (26.6%). Least number was noticed in the age groups of 0-10 years and > 80 years. This is in correlation with highest incidence in a 25 year study.¹²

Distribution of Study population according to Family Pattern

According to the study, incidence of poisoning in the Nuclear family is 82% as compared to the Non-Nuclear families is 18% in the present study population.

Distribution of Study population according to Locality

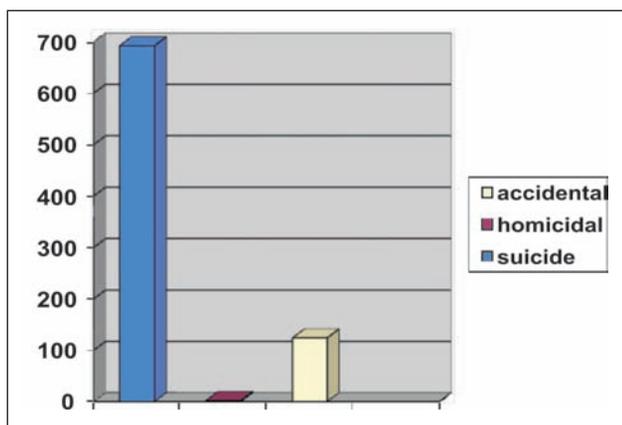
In the study population, it is observed that poisoning cases were predominantly seen in urban

areas (57%) as compared to rural areas (43%). It is not in accordance with other study which showed rural preponderance¹. Increase in stress associated with urbanization can be considered as reason for urban preponderance.

Distribution of Study population according to Socio-economic status

The maximum number of cases were noticed among Upper lower class (46%), followed by middle class (35%). Least is seen among the upper class group.

Distribution of Study population according to Manner of death



In the present study it is observed that, in (83.8%), of the victims the manner of death were concluded as Suicidal, (16%) Accidental and only 2% there were allegations of homicide. Suicidal manner is more common as shown in other studies.⁴

Distribution of Study population according to Mode of consumption of Poison

According to this study the incidence of poisoning is more with the consumption by Oral route (94.37%). Because easy way of consumption, availability is the major reason for higher incidence by Oral route.

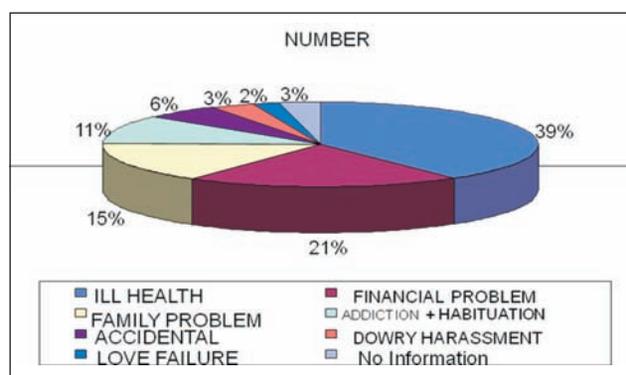
Distribution of Study population according to Occupation

In the present study, it is observed that the incidence of poisoning were seen more amongst the people engaged in Casual labor (34.84%) and agriculture (22%), followed by Office (11.9%), House wife (11.73%), unemployment (8.19%), students (8.06%), others (1.4%).

Distribution of Study population according to Motive

It is seen from the above table that ill health (39.48%), followed by Financial constraints, Addiction, Family problems, Dowry harassment, Accidental, Love failure.

Among the ill health, in majority of cases evidence of chronic illness like gastrointestinal disorders, bronchial Asthma, Tuberculosis, Diabetes, Hypertension and gynecological problem as procured through the history and hospital records, on autopsy finding.



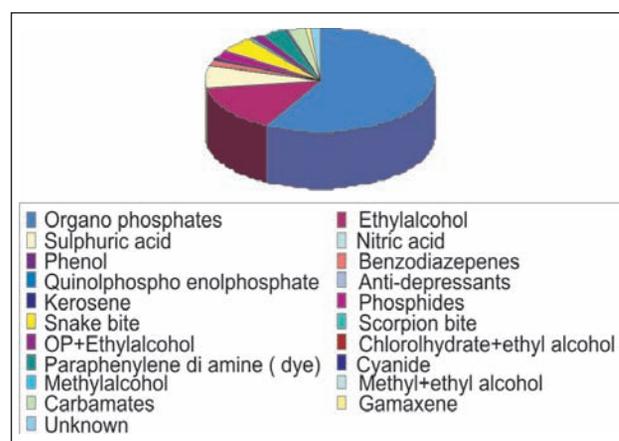
Distribution of Study population according to Mucosa of the Stomach

On postmortem examination it is seen that in 722 cases (88.26% cases) of orally ingested poison, the mucosa of the stomach is congested due to the fact that more number of victims received treatment causing the degradation of the poison. In 3.66% the mucosa of the stomach is Hemorrhagic and in 1.34%

cases it was eroded and in 1.01% cases it was eroded and perforated.

Distribution of Study population according to Type of Poison

After the cases were detected by chemical analysis, 57.82% were positive for organophosphorus, 14.79% ethyl alcohol, 6.60% for Sulphuric acid, 4.76% Snake bite, 3.42% para phenyl diamine (Dye), 2.93% phosphides, 1.46% unknown, 2.56% carbamates, 0.9% benzodiazepines, 0.48% anti-depressants, 0.48% Gamaxene, 0.48% kerosene, 0.36% phenol, 0.24% Nitric acid, 0.12% of methyl alcohol, 0.12% of methyl and ethyl alcohol.



Distribution of Study population according to odour of the stomach contents

In the present study, it is seen that in 263 cases (32.15%) the odour of stomach contents were pungent, peculiar in 250 cases (30.56%), non-specific 119 cases (14.54%), alcoholic 110 cases (13.44%), kerosene 57 cases (6.96%), and Garlic odour in 19 cases (2.32%).

SUMMARY AND CONCLUSION

- A Study on the fatal cases of poisoning autopsied at Osmania General Hospital, Hyderabad between June 2007 to June 2009 was taken. The aim of this study was to study the type of poisons, incidence of poisoning amongst the age and the sex distribution, correlation of the post mortem findings with the type of poison detected by chemical analysis. Among all the postmortem examination done during June 2007 to June 2009, all poisoning cases (818 cases) were selected for this study.

- Incidence of poisoning cases was seen in the age group of 21-30 years (297 cases), 36.3% in both sexes and was more in males 27.13% as compared to females 9.16%. Married males outnumbered the un-married in Rural and urban community in both sexes. Poisoning was more in urban community as compared to rural community and among nuclear families. Majority of the victims were of low socioeconomic group i.e., upper lower class (380 cases) 46%. Home was the ideal place to consume poison (527 cases) 64.42%.
- Among 818 cases it is seen that Organophosphorus compound comprises of (473 cases) 57.82%, followed by Alcohol (121 cases) 14.79%. The odour of the stomach contents were, pungent smell (263 cases) 32.15%, peculiar (250 cases) 30.56%, Garlic smell (19 cases) 2.32%, kerosene smell (57 cases) 6.96%, alcoholic smell (110 cases) 13.44% followed by no specific smell (119 cases) 14.54%.
- The total orally ingested cases of poisoning are 772, in which stomach mucosa is congested in 722 cases, 30 cases hemorrhagic, 11 cases eroded and 9 cases eroded and perforated. These findings were suggestive of a poisoning but the type of poison was known only after the perusal of chemical analysis report.
- The motive behind consumption of poisoning was Ill health 323 cases (39.48%), followed by financial problems i.e., 168 cases (20.53%). Majority of cases were spot dead 182 cases (22.2%) followed by deaths occurred after taking treatment 175 cases (21.3%).
- The manner of death is mostly suicidal in nature 692 cases (83.8%) followed by accidental poisoning. In majority of cases, the route of administration of poison is through mouth.

Conflict of Interest Statement: We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Source of Funding: Self

Ethical Clearance: No identifying details are reported here and all the data related to patient are collected with prior permission from the ethical committee.

Acknowledgement: Dr. J. Srinivas, Assistant Professor, Forensic Medicine, Bhaskara Medical College, Hyderabad.

REFERENCES

1. Adarsh kumar, Krishan vij. "Trends of poisoning in Chandigarh-A Six Year Autopsy Study." *Journal of Forensic Medicine and Toxicology*, 2001; 18(1):8-11.
2. Dalbir Singh, Seema, j, Tyagi. I. "Changing Trends in Acute poisoning in Chandigarh zone". *The American Journal Of Forensic Medicine and pathology*, 1999; 20(2); 203-210.
3. Gargi. J, Hakumat Rai, Ashok Chanana, Gurumanjit Rai, Bagga. I. J. S. "Current Trends of Poisoning -A Hospital Profile". *Journal of Punjab Forensic medicine And Toxicology*, 2003; 3:41-45.
4. Murari Atul, Sharma G. K. "A Comparative Study Of Poisoning cases Autopsied In LHMC, New Delhi and JIPMER, Pondicherry". *Journal Of Forensic Medicine and Toxicology*, 2002; 19(1); 18-20.
5. Chan T. Y, Chan A. Y, Pang C W: "Epidemiology of poisoning in the new territories sound of Hong Kong"; *Hum Exop Toxicol*, 1997 April; Vol 16 (4); 204-207.
6. Dhatarwal S K, Harnam singh: "profile of deaths due to poisoning in Rhotak, Haryana". *Journal of Forensic Medicine & Toxicology* 2001; 18(2): 28-29.

Myositis due to Consumption of Swarmer Termites: A Case Report

Agrawal A¹, Venkatrathamma P N², Srinivas S V³

¹Post Graduate, Dept. of Medicine, ²Professor, Dept. of Medicine, ³Assistant Professor, Dept of Medicine, Sri Devraj Urs Medical College, Kolar, Karnataka

ABSTRACT

The practice of insect consumption, Entomophagy, is widely encountered in India due to significant nutritional and economic benefits to rural community. Local allergic reactions and systemic responses like bronchospasm, angioedema, anaphylaxis, and rarely seizures have been reported. We report the first case of generalised Skeletal and ocular muscles involvement, with no involvement of respiratory and gut muscles due to termite consumption with a favourable outcome.

Keywords: Entomophagy, Swarmer Termites, Skeletal and Ocular muscles involvement

INTRODUCTION

In spite of change in eating habits and preferences, the practice of insect consumption, Entomophagy, is widely encountered in India. The traditional use of insect as food provides significant nutritional and economic benefits to rural community. Local allergic responses to various insects are well known and systemic reactions such as anaphylaxis, laryngeal edema, bronchospasm, serum sickness, and Seizures have been rarely reported.

In Karnataka, the winged termite is known as *Eechalu hula*. It's mentioned by Fobres¹ in 1813 that, termites are eaten by local tribes of Mysore and Carnatic region. We hereby report of case of consumption of fried Swarmed Termites belonging to family Isoptera Termitidae, leading to generalised myositis like picture along with ocular muscle involvement.

CASE REPORT

A 40 year old lady housewife from remote rural of Kolar presented to emergency department with complains of difficulty in swallowing, difficulty in breathing, generalized body aches, pain in face, neck and scalp. Patient gave history of, consumption of salted, Fried Swarmer Termites on previous night. There was no history of severe exertional work previous day, no history of trauma, exposure to pesticide, and concomitant insect sting or bite, there was no history of fever, rash, diarrhoea, pain abdomen, cough, hematuria, no ill habit of alcohol intake, was not on drugs for cardiac and other illness. There was no history of recent weight loss. Though other family members also consumed the Fried Swarmer Termites none of them developed similar symptoms. Previous year also though she had consumed Swarmer Termites there was no allergic response. Family history was insignificant otherwise.

On examination she was conscious, pulse: 86b/min, regular, Blood pressure: 120/80mmHg, respiratory rate: 18cycles/min, there was no rash, no angioedema, and no respiratory distress. Cardiovascular, respiratory system and abdomen examination was insignificant. Nervous system examination revealed normal voice, normal cognition, there was bilateral drooping of eyelids, external ocular muscle

Corresponding author:

Ashish Agrawal

Post Graduate, Dept. of Medicine
R.L. Jalappa Hospital and Research Centre,
Sri Devraj Urs Medical College, Tamaka
Kolar, Karnataka, India-563101
E-mail: ashishagin@hotmail.com
Contact No. +91990028012

movements were restricted in all directions, pupil was spared, all the facial and jaw muscles were tender to touch and movements were restricted significantly (raising eyebrows, frowning, whistling, filling air, pouting lips, showing teeth, clenching teeth and tongue protrusion), limb muscles were tender to touch, movements were restricted and reflexes were intact. Sensory system was normal. Laboratory investigations: haemogram, creatinine, creatine phosphokinase, ALT, LDH, APT, rheumatoid factor, ANA, thyroid function, urine examination, Chest X-ray and ECG were normal. HIV was negative



Fig. 1. Drooping of both eyelids



Fig. 2. Sparing of pupil



Fig. 3. Involvement of facial muscles



Fig. 4. Swarmer Termite Isoptera Reticulitermes

Patient was admitted in Medical Intensive Unit started on steroids, antihistamines, antioxidants, small dose of opioid based analgesic, and intra muscular injections were avoided. 14 hours later patient noticed significant relief from body pains, was able to swallow without much pain, Urine output was adequate. There was no delayed renal failure. Drooping of eye lids improved on third day and resolved by more than 75 % on fifth day. She was able to walk without discomfort and was discharged.

DISCUSSION

Termites of Family Isoptera are valuable source of protein fat and essential amino acids in diet of both primates and modern human ². After the first showers

of the rainy season, the winged adult sexual forms of termites attracted by the lights hover around the lights, lose their wings, drop to the floor, they are swept up, cleaned, fried and eaten in Tamilnadu, Mysore and Carnatic region³. It's also prevalent in places like Orissa, Jharkhand, Arunachal Pradesh, Manipur⁴. It is estimated in few studies that termites are good source of protein, carbohydrate, essential and non essential amino acids². They are better source of Iron, Magnesium, Zinc and Selenium than conventional food item like Turnip, cauliflower, Bitter Gourd, green gram etc². It's also used as supplement for increasing lactation and against Asthma, in some south Indian tribes⁵.

Local allergic responses to Entomophagy are well known and systemic reactions such as anaphylaxis, laryngeal edema, bronchospasm, serum sickness, seizures and Rhabdomyolysis have been rarely reported⁷. Similar case with angio edema in paediatrics age was reported by V. Nandha Kumar⁶ due Red Fire Ants consumption of order hymenoptera.

We Report above case as it is a rare presentation and may be the first report due to consumption of termite of order Isoptera, *Reticulitermes* species. Reactions to Insect of order hymenoptera are documented. It is attributed to formic acid and various peptide and protein components, which are capable of inducing vaso-reactive substances found in there venom^{7,8}. But there is no literature suggesting extensive involvement of skeletal and ocular muscles after swarmed termite consumption.

We present above case to sensitize the physicians about atypical side effects of Entomophagy which is prevalent in large scale in India.

CONCLUSION

We report above case as the first case of generalised Skeletal and ocular muscles involvement, with no involvement of respiratory and gut muscles due to termite consumption with a favourable outcome. The case report emphasises and creates awareness about atypical manifestations of Entomophagy, which are manageable with careful monitoring and symptomatic therapy.

Conflict of Interest: None.

Ethical Clearance: Obtained/Yes.

Statement of Informed Consent - Obtained/Yes.

Acknowledgement: None.

REFERENCES

1. Forbes J, Oriental Memoirs : A Narrative of seventeen years residence in India, London: Richard Bentley I, 2 Vol. 1813, pp 305
2. D Paul, Sudipta Dey, Nutrient content of sexual and worker form of Subterranean Termite *Reticulitermes* sp, Indian Journal of Traditional Knowledge Vol 10 (3), July 2011, pp 505-507.
3. Ranjan, BKC, Tiny wild fauna and food *Isoptera*, (*Family Uncertain*), *My Forrest* 23(3)(1987)177-180.
4. T. Shantibala, R.K. Lokeshwari, H. Debraj Sharma, Entomophagy practices among the ethnic communities of Manipur, north-east India, *Int. J. Int sci. Inn. Tech. Sec. A, Dec. 2012, Vol. 1, Iss 5, pg 13-20.*
5. V Wilsanand, Utilization of termite, *Odontotermes Formosanus* by tribes of south India in medicine and food, Vol 4 (2) Mar-Apr 2005.
6. Angioedema following ingestion of fried flying red fire ants. *Indian Pediatr.* 2013 Apr 8;50(4):423-4.
7. Rhabdomyolysis and Acute Renal Failure After Fire Ant Bites, *J Gen Intern Med.* 2007 January; 22(1): 145-147. Published online 2007 January 5. doi: 10.1007
8. DeShaze RD, Butcher BT, Banks WA. Reactions to the stings of imported fire ant. *N Engl J Med.* 1990;323:462-6

Histopathological Spectrum in Lung Autopsies- A 50 Case Study

Kanwardeep Kaur Tiwana¹, Sarita Nibhoria¹, Manvi Gupta², Ashish Yadav³

¹Associate Professor, Department of Pathology, G.G.S. Medical College & Hospital BFUHS, Faridkot, Punjab,

²Senior Resident, Department of Transfusion Medicine Dayanand Medical College & Hospital, Ludhiana,

³Junior Resident Department of Pathology, GGS Medical College & Hospital BFHUS, Faridkot, Punjab

ABSTRACT

The lungs are one of the most vital organs of the body. They are affected by primary diseases ranging from inflammatory to neoplastic as well as are secondarily involved in almost all terminal diseases. Histopathological examination of lungs is vital in diagnostic work up of all lung diseases. The present study was conducted in year 2012-2013 in which 50 cases were analyzed. Pulmonary congestion and edema was found as the most common diagnosis followed by pneumonia and tuberculosis.

Keywords: Pulmonary Congestion, Pneumonia, Histopathological Examination

INTRODUCTION

An autopsy is study of dead body which is carried out for clinical as well as medicolegal purposes.¹ Histopathological examination of viscera is very important in ascertaining the cause of death but also as a learning tool enriching the medical knowledge.² The present study on lung autopsies was conducted to evaluate the cause and mode of death and to acknowledge the present scenario of pulmonary diseases. The lungs are involved in various kinds of inflammatory, neoplastic diseases and also they are secondarily involved in almost all form of terminal diseases so that some degree of pulmonary edema, atelectasis or bronchopneumonia is seen in almost every dying patient.³

MATERIALS AND METHOD

The present study is a prospective study done between period of 2012-2013 in which 50 cases received in the department of pathology were analyzed with reference to light microscopic changes. In each case clinical findings were obtained for post mortem papers send along with viscera. The lungs were received in 10% formalin solution and then after tissue processing routine staining using haematoxylin and eosin dyes was done. Ancillary aids like special stain e.g. PAS (Periodic Acid Schiff) were used according to need of cases. Gross and histopathological findings were recorded in all cases.

RESULT

The present study is conducted in the Department of Pathology between period of 2012-2013 in which 50 lung specimens received in autopsies were studied. A wide histopathological spectrum of pulmonary disease were diagnosed in the study consisting of maximum cases of pulmonary edema and congestion (30%) followed by pneumonia (14%), tuberculosis (10%), congestion (10%), carcinoma lung (4%), interstitial lung disease (2%) along with rare diagnosis of pulmonary candidiasis (2%) (table No. 1).

Age wise distribution showed highest incidence in 4th -5th decade with mean age of presentation being 49.5±2.0 year. Lungs of newborns were also considered in the study as they were vital to rule out intrauterine death in still born babies. Male preponderance was noted with male to female ratio of 7:1.

Pulmonary edema and congestion was the most common diagnosis and it was made on histopathological examination of lungs. This finding was considered as terminal event or changes due to cardiovascular causes. Also similar findings were noted in ARDS (Acute respiratory distress syndrome) (Fig.-1).

Second most common diagnosis was pneumonia in which grossly lungs were consolidated and heavy but confirmation again was done on microscopy (Fig.-2). Tuberculosis was the next common diagnosis

and in all cases the findings were incidental with no prior history. In one case miliary tuberculosis was noted while one case had presentation of acute abscess.

Carcinoma lung was seen in 4% of cases with one case having metastasis in liver. In second case clinical diagnosis of lung abscess was made but on autopsy foci of adenocarcinoma was found microscopically (Fig.-3). Rare diagnosis of pulmonary candidiasis (2%) was made in young female and it was incidental diagnosis which was confirmed using PAS (Fig.-4).

18% of cases had lungs exhibiting no pathology and 8% of cases showed autolytic changes and the cause was lack of use of proper fixative.

Table 1. Distribution of cases according to histopathological diagnosis

S.No.	Diagnosis	No. of cases	Percentage of cases
1.	Pulmonary Congestion & edema	15	30%
2.	Pneumonia	7	14%
3.	Tuberculosis	5	10%
4.	Congestion	5	10%
5.	Carcinoma	2	4%
6.	Interstitial Lung Disease	1	2%
7.	Pulmonary Candidiasis	1	2%
8.	Allergic Bronchitis	1	2%
9.	Normal Lungs	4	8%
10.	Autolysed	9	18%
		50	100

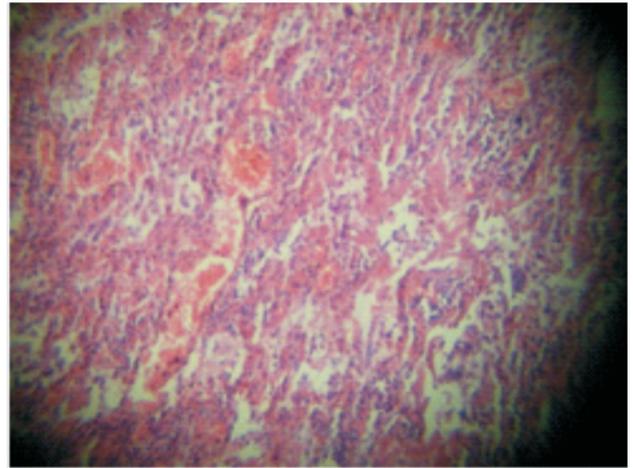


Fig. 2. Sections show red hepatization stage of pneumonia (H&E X100)

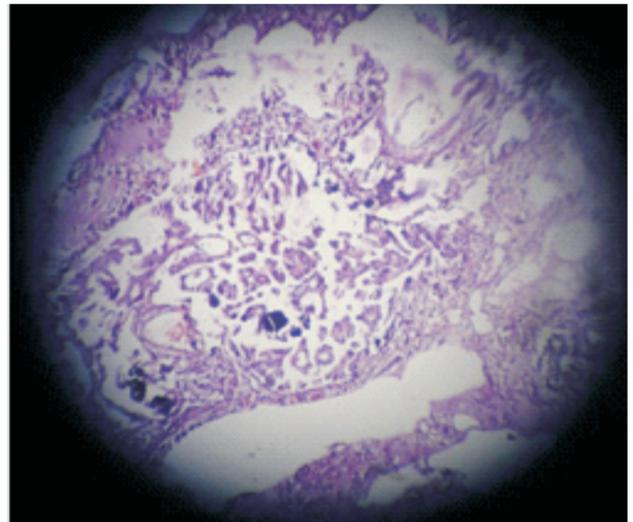


Fig. 3. Adenocarcinoma lung (H&E X100)

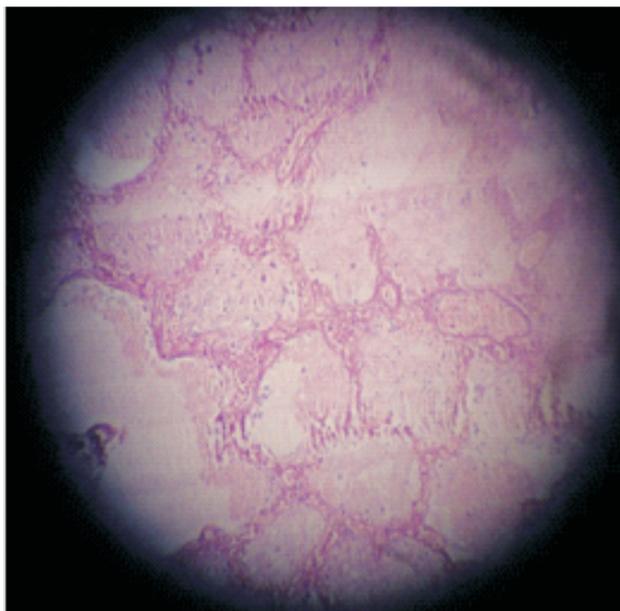


Fig. 1. Sections show pulmonary congestion (H&E X100)

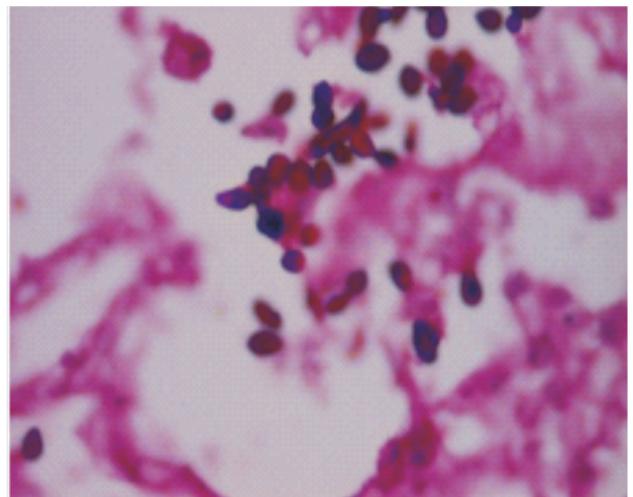


Fig. 4. Pulmonary Candidiasis –sections show budding candida spores (H&E X100)

DISCUSSION

Histopathological evaluation of lungs particularly as autopsy specimens is a great learning tool because in routine practice we get small biopsies i.e. bronchial biopsies that too in cases of suspected malignancies. In other lung pathologies radiological aids are taken into account. So histopathological examination of lungs in autopsies help in predicting not only the cause of death but also is an excellent learning tool enriching the medical knowledge. The present study was done based on objective of learning the importance of lung pathology as a cause of death.

The present study was conducted in between period of 2012-2013 and 50 cases were studied in Department of Pathology for histopathological examination. Male preponderance was noted with male to female ratio of 7:1 which is in concordance to various studies^{1,4,5,6} and age wise distribution of cases shows that the incidence was higher in 4th and 5th decade of life.

Pulmonary congestion and edema (30%) was the most common histopathological diagnosis and it is in concordance with various studies done by A. Pathak & HM Mangal and Selvam V et al.^{1, 4} This common finding could be explained by the fact that lungs are secondarily involved in almost all forms of terminal diseases particularly when cause of death is cardiovascular.

Pneumonia was the second most common diagnosis (14%) and the finding was in discordance with various studies by Selvam V (24.44%) and by Manjit S. et al (18%) and Hjorth et al (23%).^{4,7,8} No specific reason was found for low number of cases in the present study.

Selvam V et al and Manjit et al found tuberculosis in 8.89% and 8.6% cases respectively which was similar to findings in the present study where number of cases turned out to be 10%.^{4,7} Incidence of tuberculosis is very high in India particularly with rise in AIDS (Acquired Immunodeficiency Syndrome). But in one study done by Hjorth et al only 1% cases of tuberculosis was found.⁸

Malignancy was found in 4% of cases and this finding was quite high in comparison to study done by Manjit et al where percentage was only 0.67%.⁷ All

the malignant tumours were carcinomas and in one case the clinical suspicion was of lung abscess and on histopathological examination it was found that underlying cause was adenocarcinoma.

A rare case of pulmonary candidiasis (2%) was found in this study which was an incidental finding and was confirmed using ancillary aids like PAS (Periodic acid Schiff) stain. Also important feature highlighted in this study was 2% cases of interstitial lung disease and allergic bronchitis. These are relatively common lung pathologies but we rarely get biopsies for these entities as additional aids like radiological are used to make the diagnosis. Histopathological examination of lungs for these entities thus enrich medical knowledge.

CONCLUSION

Autopsy study and histopathological examination of viscera particularly organs like lungs is of great value in improving the vision and diagnostic set up for better clinical assessment. They form best learning tools to detect any difference between clinical findings and autopsy findings & also help in making rare and many incidental diagnosis. The present study comprises of 50 cases of lung autopsies highlighting the wide range of histopathological diagnosis ranging from pulmonary congestion to rare diagnosis like pulmonary candidiasis.

ACKNOWLEDGMENT

The authors acknowledge Department of Forensic Medicine & Pathology for primary valuable method for study. We sincerely thank technical staff.

Source of Fund: None

Conflict of Interest: Non Declared

Ethical Clearance: Taken

REFERENCES

1. Pathak A & Mangal H.M. Original research paper Histopathological Examination in Medico-legal Autopsy Pros & Cons. *J Indian Acad Forensic Med* 2010; 32 [2]:128
2. Jhaji KK, Nibhoria S, Sandhu SK et al. A study of Histopathological Examination in Medicolegal

- Autopsies in Faridkot, Punjab. *Indian Journal of Forensic Medicine & Toxicology*. January-June, 2013, Vol.7, No.1
3. Lester Kobzik, the Lung. *Robbins Pathologic Basis of Disease*; 1999; 6th edition 697-701
 4. Selvam V, Thamil Selvi R, Subramaniam PM, Vijayanath V. Prevalence of Common Diseases in lungs and Liver ; A Histopathological study. *JPBMS* 2011;12(09)
 5. Gupta BD & Jani CB. Stats of histopathological examination in medicolegal post mortem examination: Indian Scenario. *J. Forensic Toxicol* 2003; 20(2):15-18
 6. Jani CB, Gupta S, Gupta M, Patel K and Shah M. Forensic Histopathology: Bane or a Boon. *J Indian Acad Forensic Med* 2009;31 (3):222-29
 7. Manjit S. Bal, P.S. Sethi, Anil K Suri, Vijay K. Bodal, G Kaur. Histopathological pattern in lung autopsies; Editorial *JPAFMAT* 2008 Volume 2.
 8. Hjorth L, Jensen HS, Noer H: Acute pulmonary infections at autopsy. A study of clinical and microscopic autopsy findings. *Vgesks Laeger* 1995;157 [49]:6873-6

A Topographic Study of Wormian (Sutural) Bones and their Clinical Significance in the Region of Parietal Bone in Human Skulls of Central India

Dibya Kishore Satpathi¹, Ashutosh S Mangalgi²

¹Associate Professor, Forensic Medicine & Toxicology, L. N. Medical College, Bhopal, ²Professor, Anatomy Chirayu Medical College & Hospital, Bhopal

ABSTRACT

Wormian bones are extra pieces of bones observed along sutures. The study was conducted on 150 human dry skulls for the presence of wormian bones. Wormian bones were observed in 65 skulls out of 150 i.e. 43.33%, along lambdoid suture in almost 37 skulls (24.66%), lambda in 12 skulls (8%), sagittal suture in 8 skulls (5.33%), asterion in 2 skulls (1.33%), pterion in 2 skulls (1.33%), coronal suture in 2 skulls (1.33%) and at bregma in 2 skulls (1.33%). Wormian may be mistaken for the fracture skull. Hence it is important for forensic experts and neurosurgeons to keep its knowledge updated.

Keywords: Wormian Bones, Sutural Bones, Wormian, Bones

INTRODUCTION

Wormian or sutural bones are the extra pieces of bone that occur within a suture in the cranium. Wormian bones are most commonly observed along lambdoid suture^{1,2}. They may be seen along sagittal or coronal suture. Wormian bone may at times be seen at pterion, asterion, bregma or lambda. Wormian bones at lambda are called as os inca bones.

Wormian bones are reported to be observed in association with genetic disease conditions or congenital CNS diseases³, but may also be observed without any underlying genetic diseases⁴.

Variability has been observed among various ethnic groups regarding the incidence of wormian bone. Ethnic variation suggests the possible genetic influences. Clinically wormian bones may be mistaken for the fracture skull on x-ray⁵. Therefore the knowledge of wormian bone is important for neurosurgeon, radiologists and forensic experts. The present study aims at the presence of wormian bones in skulls of Central India.

MATERIALS AND METHOD

The study was conducted on 150 dry human skulls from Chirayu medical college and L. N. medical college Bhopal. Skulls were observed for presence of wormian bones at the corners and margins of the parietal bone.

OBSERVATIONS

In present study 150 skulls were observed for the presence of wormian bones. Wormian bones were observed in 65 skulls out of 150 i.e. 43.33%.

Wormian bones observed most frequently observed along lambdoid suture in almost 37 skulls (24.66%) (Figure 1), lambda in 12 skulls (8%) (Figure 2), sagittal suture in 8 skulls (5.33%) (Figure 3), asterion in 2 skulls (1.33%)(Figure 4), pterion in 2 skulls (1.33%) (Figure 5), coronal suture in 2 skulls (1.33%) and at bregma in 2 skulls (1.33%) (Figure 6).

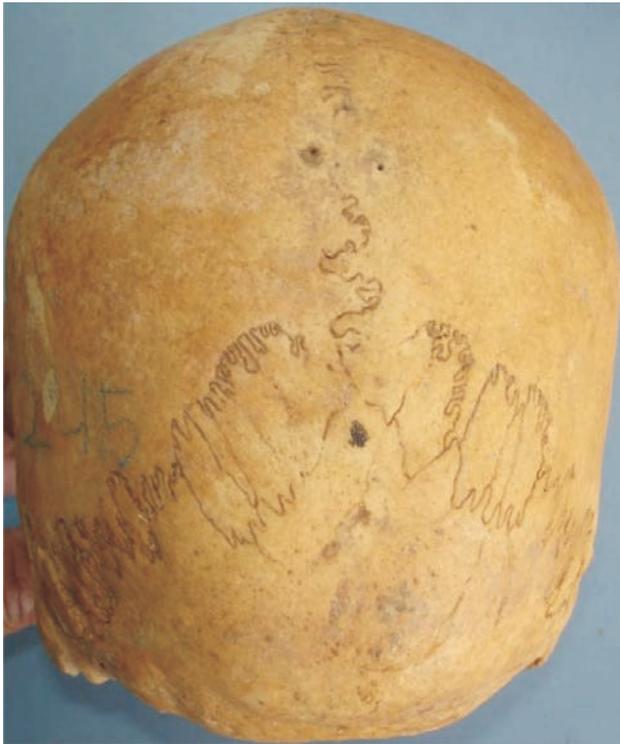


Fig. 1. Illustration shows presence of wormian bones along lambdoid suture.

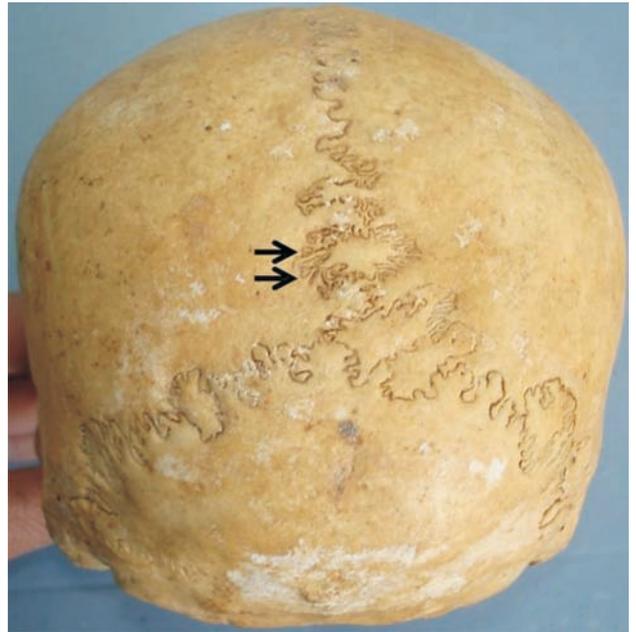


Fig. 3. Illustration shows presence of wormian bone along sagittal suture (marked by arrows)



Fig. 2. Illustration shows presence of wormian bone at Lambda.



Fig. 4. Illustration shows presence of wormian bone at the Asterion.



Fig. 5. Illustration shows presence of wormian bone at the Pterion.

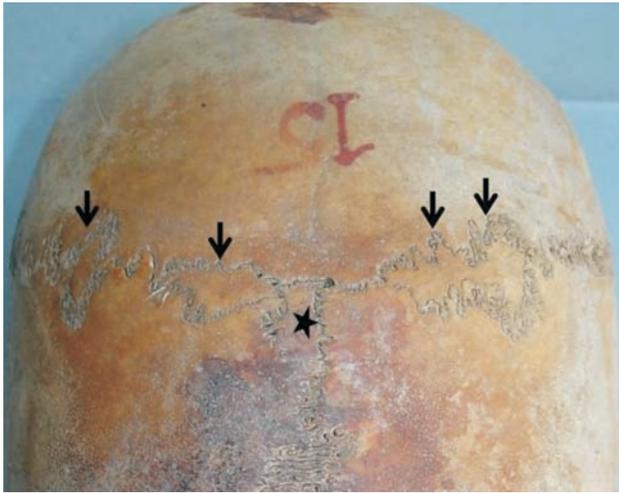


Fig. 6. Illustration shows presence of wormian bone at Bregma and along sagittal suture (marked by arrows).

DISCUSSION

Wormian bones are accessory bones occur within suture of cranial vault. Wormian bones are small separate ossicles formed by detachment of ossifying spicules at the margins of the growing bones⁶. Sutural, intrasutural, intercalary bones are the other alternative names for the wormian bones. Wormian bones may involve outer table, inner table or mostly whole thickness of the skull^{7,8}.

Wormian bones are seen most commonly along lambdoid suture. They may be seen along coronal and sagittal suture, also at pterion, asterion and rarely at bregma. In present study also we observed the wormian bones mostly along lambdoid suture in 24.66% skulls. About half of the wormian bones are located in the lambdoid suture and fontanelles. The second most common site of occurrence is in the coronal suture. The rest occur in any remaining sutures and fontanelles¹.

In present study we observed wormian bones in 65 (43.33%) skulls out of 150. Murlimanju et al, observed the incidence of wormian bone in 73% of cases out of 78 human skulls². Wormian bones observed along lambdoid suture in 56.4% cases, at asterion in 17.9% cases and at pterion in 11.5% cases, at coronal suture in 1.3% cases, at sagittal suture in 1.3% cases. Wormian bones are not observed at bregma^{2,9}. Nayak S, reported wormian bone at bregma in one skull only¹⁰.

Bergman et al (1988) reported presence of wormian bones at lambdoid suture in almost 40% of cases with wormian bones, next common at pterion¹¹.

Pterion is related to middle meningeal artery, Broca's motor speech area on left side¹². Asterion is the surgical landmark to the transverse sinus location which is of great importance in surgical approaches to the posterior cranial fossa¹³.

Khan et al, reported wormian bones in 7 out of 25 skulls at coronal, squamosal and sagittal sutures⁵. Berry and Berry, reported presence of wormian bones at coronal and squamosal sutures¹⁴, but Tewari et al, reported none at coronal, squamosal or sagittal suture¹⁵.

The wormian bones, in themselves, do not carry a negative prognosis, and thus the prognosis will depend on the type and severity of the associated diseases. Higher incidence of wormian bones observed in diseases like osteogenesis imperfecta, cretinism, cleido-cranial dysostosis, progeria, rickets¹⁶. Presence of multiple wormian bones in skull is major finding in cases of congenital osteogenesis imperfecta¹⁷. Jeanty et al, reported four cases of presence of wormian bones by prenatal ultrasound diagnosis, but none was reported with anomaly, concludes wormian bones are not always associated with fetal anomalies⁴. Wormian bones are most commonly associated with the disorders that have reduced cranial ossification, hypotonia¹⁸.

A careful search for other abnormalities should be made. When wormian bones are found in isolation, standard obstetrical management is not altered.

Wormian bones may be the result of additional ossification centres in the fibrous tissue occurs during late foetal ages or postnatally and which remain separated from the primary centres of ossification of cranial bones.

Bennet KA in 1965 reported that the formation of wormian bone is under direct genetic control but due to stress¹⁹, but Pal et al reported in his study on 370 adult human crania of Gujarati population that sutural bones are not formed under stress²⁰.

CONCLUSION

Clinically wormian bones at corners of parietal bone may interfere in making burr hole. They may be mistaken for the fracture skull on x-ray. Prior confirmation of wormian bone is important in posterior approach to the cranial cavity. Therefore the knowledge of wormian bone is important for neurosurgeon, radiologists and forensic experts.

REFERENCES

1. Chambellan V. Etude anatomique et anthropologique sur les os wormiens. Inaugural Thèse, Paris, 1883; 66
2. Murlimanju BV, Prabhu LV, Ashraf CM, Kumar CG, Rai R, Maheshwari C. Morphological and topographical study of wormian bones in cadaver dry skulls. *J morphological sci.* 2011; 28(3): 176-179.
3. Pryles CV, Khan AJ. Wormian bones. A marker of CNS abnormality. *Am J Dis Children.* 1979; 133:380-382.
4. Jeanty P, Silva SR, Turner C. Prenatal diagnosis of Wormian bones. *J Ultrasound Med.* 2000; 19: 863-869.
5. Khan AA, Asari MA, Hassan A. Unusual presence of wormian (sutural) bones in human skulls. *Folia Morphol.* 2011; 70 (4): 291-294.
6. Le Gros Clark WE. *Tissues of the body.* 6th edn, Great Britain, Oxford university press. 1980: 167.
7. El-Najjar M, Dawson GL. The effect of artificial cranial deformation on the incidence of Wormian bones in the lambdoidal suture. *Am J Phys Anthropol.* 1977; 46: 155-160.
8. Barberini F, Bruner E, Crtolari R, Franchitto G, Heyn R, Ricci F, Manzi G. An unusually wide human bregmatic wormian bone: anatomy, tomographic description, and possible significance. *Surg Radiol Anat.* 2008; 30: 683-687.
9. O'Loughlin VD. Effects of different kinds of cranial deformation on the incidence of Wormian bones. *Am J Phys Anthropol.* 2004; 123: 146-155.
10. Nayak S. Presence of wormian bone at bregma and paired frontal bone in an Indian skull. *Neuroanatomy.* 2006; 5: 42- 43.
11. Bergman RA, Afifi AK, Miyauchi R. Skeletal systems: Cranium. In: *Compendium of human anatomical variations.* Urban and Schwarzenberg, Baltimore, 1988: 197-205.
12. Oguz O, Gurarslan Sanli S, Bozkir MG, Soames RW. The pterion in Turkish male skulls. *Surg Radiol Anat* 2004; 26: 220-224.
13. Martinez F, Laxaque A, Vida L, Prinzo H, Sgarbi N, Soria VR, Bianchi C. Topographic anatomy of the asterion. *Neurocirugia (astur)* 2005; 16 (5): 441-446.
14. Berry CA, Berry RJ. Epigenetic variation in the human cranium. *J Anat,* 1967; 101 (Pt 2): 361-379.
15. Tewari PS, Malhotra VK, Agarwal SK, Tewari SP. Preinterparietal bone in man. *Anat Anz,* 1982; 152: 337-339.
16. Burgener FA & Korman M. *Bone and joint disorders, conventional radiologic differential diagnosis.* New York, Thieme medical publishers, 1997:130.
17. Astley R. Metaphyseal fractures in osteogenesis imperfecta. *Br J Radiol.* 1979; 52:441-3.
18. Sanchez-Lara PA, Graham JM JR, Hing AV, Lee J, C Cunningham M. The morphogenesis of wormian bones: A study of craniostosis and purposeful cranial deformation. *Am J of Med Genet A.* 2007; 143A (24): 3243-51.
19. Bennett KA: The etiology and genetics of wormian bones. *Am J Phys Anthropol.* 1965; 23:255.
20. Pal GP, Bhagwat SS, Routal RV. A study of sutural bones in Gujarati (Indian) crania. *Anthrop Anz.* 1986; (1): 67-76

Comparative Study of Incidence of Inca Bones in North and South Indian Human Crania

Makandar U K¹, Kaushal Vishudda M², Rajendra R³, Patil B G⁴

¹Associate Professor Dept. of Anatomy, A.I.M.S & R.C, B.G Nagar, Belur, Nagamangala(Tq), Dist. Mandya, ²Assistant Professor Dept. of Community Medicine, Geetanjali Medical College, Udaipur-313004 (Rajasthan), ³Professor & HOD, Dept. of Anatomy A.I.M.S & R.C, B.G Nagar, Belur, Nagamangala(Tq), Dist. Mandya, ⁴Professor of Anatomy, B.M.Patil Medical College, (Deemed University) Bijapur-586101, (Karnataka)

ABSTRACT

1189 non-pathological dried crania of North and South India are studied for sexual dimorphism and regional (racial) study for inter parietal or Inca bones. Observed that their incidence is insignificant in the study of sexual dimorphism but regionally in North Indian Male crania had 1.96% and Female crania 1.99% of Inca bones are observed while in South Indian Male Crania had 2.80% and Female crania had 2.79 % of Inca bones were studied. These findings of incidence were useful for anatomist, anthropologist and medico-legal expert. Above all to the Radiologist to differentiate the Inca bones from the fracture of the crania. This incidence of Inca Bones irrespective of sex and race (region) certainly represent that, the primates were our ancestors because evolution is not a harmonious progression of all parts of the organism. It is a jerky and asymmetrical transformation and a human cranium is late representatives of our ancestors in the form of interparietal bone. These findings are more or less in agreement with previous workers but sexual dimorphism and study of Inca bones in south Indian population appears to be quite new study.

Keywords: Evolution, Sexual, Regional, Primates, NI = North Indian & SI = South Indian

INTRODUCTION

Interparietal bones are also called "Inca bones" because of their common incidence in the children of Inca population who existed in 14th and middle of the 15th Century, Near high lands of Peru (Western South America). They were Pioneer stretch the earlobes for cosmetic reasons and nobles wore gold disk in them⁽¹⁾. In later life Inca bones are regularly united with occipital bone. Hence inter parietal bones are also called as Inca bones but this term "Inca" is disapproved by anthropologist because these bones are characteristic of carnivorous animals but name still persist⁽²⁾.

Inter parietal bones are also named as "Goethesossicles" because Goethe the anatomist who claimed that inter-parietal bones represent additional

ossification centers near the sutures which are nothing but isolated bones near the lambdoid sutures⁽³⁾. These inter-parietal bones have evolutionary importance rather than sexual or regional importance. Hence attempt is made to study if these bones have sexual or regional (racial) importance.

MATERIAL AND METHOD

1189 crania are studied including NI and SI. It is presumed that, NI is mainly occupied by Aryan race and SI by Dravidian race. Hence four states from NI and four states from SI are selected for study. This method as called SRS (Simple Random Sampling) method is lottery method. Four colleges are selected from every states and totally 32 colleges are visited for study.

Table 1

Crania available	No of colleges	Total No of Crania
UP	389+75+22+40	526
Rajasthan	031+29+22+14	96
Haryana	021+14+09+08	52
Panjab	030+20+19+18	87
Andra Pradesh	036+29+20+18	103
Karnataka	047+39+24+24	134
Kerela	030+21+17+10	78
Tamil Nadu	048+41+17+07	113
	Eleven Hundred Eighty Nine Only	1189

Z test applied to study the significance of difference between two samples.

OBSERVATION AND RESULTS

Table No 2. Percentage incidence of inter partial bones in the crania of NI and SI in both sexes.

NI Male crania 510 had 1.96% and Female crania 25% had 1.99% while SI crania Male 285 had 2.80% and Female crania 143 had 2.79% but sexual dimorphism study shown statistically insignificant ($P>0.05$).

Table No. 3. The Present study is compared with previous workers the results are more or less in Agreement with previous studies but sexual dimorphism study is not carried out by any previous workers.

DISCUSSION

In the present study SI male crania had highest incidence of interparietal bones 2.80% Females followed by SI Female 2.79% and the difference was statistically insignificant ($P>0.05$) (Table No-2) and (Figures 1, 2, 3 and 4).

Similarly NI Male crania had incidence of 1.96% and female had 1.99% the difference was statistically insignificant ($P>0.05$).

Incidence of interparietal bones reported by different workers (Table-3) viz Jain and Kelkar (1969) reported 2.83% Srivastav (1977) 3.7% Malhotra (1978) 0.3% Jaysingh (1979) 2.4% Tewari (1982) 0.4% of North Indian crania but no such study was crania our in SI crania. It is believed that, persistence of interparietal bones in mammals is a separate unfused bone. In primates carnivorous animals like dogs, and cats inter

parietal bones with occipital bone just as human crania in the parietal bone⁽⁴⁾.

Incidence of Interparietal bones was more in male crania of SI 2.80% than Female crania 2.79%. While NI Female crania 1.99% had more incidence of interparietal bones than male crania 1.96%. It is also observed that, male crania had more incidence of inter parietal bones than female crania⁽⁵⁾.

It is also believed that, interparietal bones are nothing but Wormian bones migrated to parietal bone to provide space for developing brain⁽⁶⁾. It can be hypnotized that, incidence of interparietal bones was in response to functional demand, whenever there is space required for cerebral hemisphere the space created and provided by interparietal bones regardless of any cause⁽⁷⁾. It is also believed that inter parietal bones are due to non-fusion of mendosal suture⁽⁸⁾.

When interparietal bones are nothing but Wormian bones their presence might be to fill the gap between membranes of fontanalle⁽⁹⁾, or it could be due to delay in ossification of dermal bones because of nutritional status⁽¹⁰⁾. Variation in the Nutritional leads to improper division of Morulla, Blastulla and Germ Layers. Moreover incidence of Inca bones irrespective of sexes are the result of fluctuation of different climates as bigger animals can easily overcome the colder climate⁽¹¹⁾. Hence crania might have become larger to overcome colder climate by resulting into Inca bones. This pattern is known as Bergmanns Rule. It cannot be denied that today's homosapien once lived on a tree⁽¹²⁾ and undergone multiple stages of evolutions with some remnants of primate's probably Inca bones.

It can be hypothesized that inter parietal (Inca) bones were present in the most of the Inca children, as they were stretching their earlobes to wear golden disk and putting heavy ornament in the neck. Hence these Inca bones might have resulted to overcome the intracranial pressure and antigravity pressure against head and neck. Moreover the incidence of Inca bones could be the Genetic factor in particular race, that race might have drifted to India for survival purpose in olden days because almost all the races have migrated to India and it could be one among them.

SUMMARY AND CONCLUSION

In the present study of incidence of inter parietal bones more in male crania of south India than female

crania while north Indian female crania had more incidence of inter parietal bones than male crania.

Nutritional and Radiological study to throw more light upon this study because morphometric study of dermal bones are uncertain.

This study of incidence of Inca bones demands further Evolution, Genetic, Hormonal, Embryological,

Table No 2. Percentage Incidence of inter Parietal Bones in the Crania of NI and SI in both Sexes with Graph

Name of the Place	MALE		FEMALE		Percentage	Incidence of inter parietal Bones	No. of crania Studied	Percentage
	Incidence of inter parietal Bones	No. of crania Studied	Incidence of inter parietal Bones	No. of crania Studied				
North IndiaMale	10	510	1.96%	5	251	1.99%		
South IndiaMale	8	285	2.80%	4	143	2.79%		
Regional	P value>0.05						P value>0.05	
Significant	Insignificant						Insignificant	
Sexual Dimorphism	P> 0.05Insignificant						P> 0.05Insignificant	

Graph shows percentage incidence of Inca bones in North and South Indian crania of both sexes

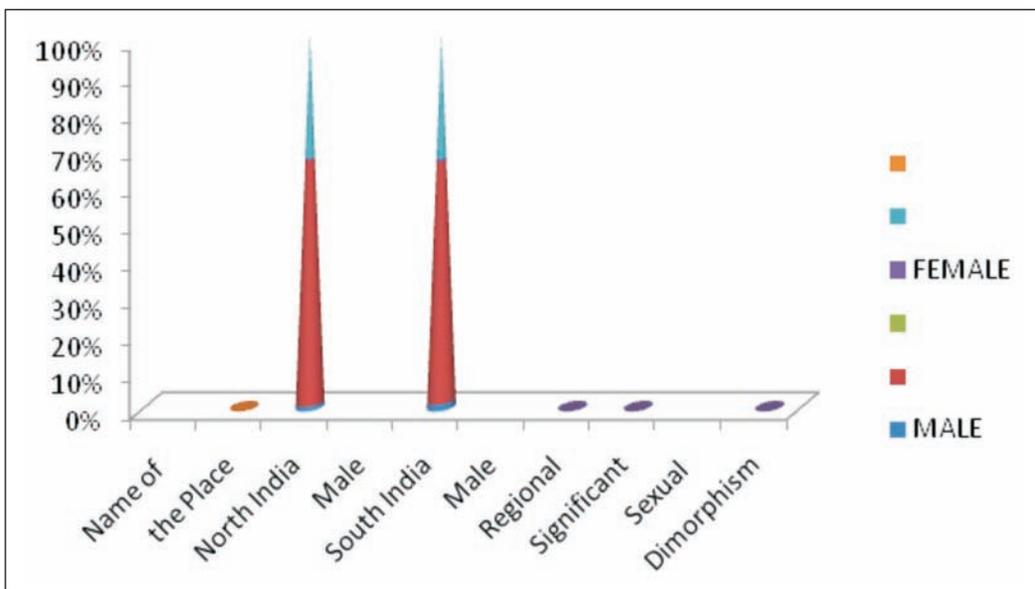


Table No. 3. Incidence of inter parietal bones as reported by different workers

Sr.No.	Worker	Year	No.of skulls studied with place	Inter parietal bone % of Inca bone
1	Jain SP & Kelkar G.N	1969	600 North India UP (Aryans)	2.83%
2	Brues	1977	-Peruvian population	3%
3	Srivatsav	1977	620 Skulls North India (UP)(Aryan race)	3.7%
4	Malhotra.etal	1978	1500 North Indian UP (Aryan)	0.3%
5	Jayasing.etal	1979	500skull North India (UP)(Aryan Population)	2.4%
6	Tewari.etal	1982	1500 North India UP (Aryans race) population	0.4%
7	Pal.etal	1984	348 skull Gujarati population	2.6%
8	Cirreli.etal	1985	150skull European population	4%
9	SaxenaChoudhary.etal	1986	40 skull Nigerian population	10%
10	Magden&Muftuoglu	1990	420 American population	1.6%

Table No. 3. Incidence of inter parietal bones as reported by different workers (Contd.)

Sr.No.	Worker	Year	No.of skulls studied with place	Inter parietal bone % of Inca bone
11	Gopinathan	1992	125 skull North India (Haryana)Population	0.8%
12	Aycan	1993	91skull European	6.5%
13	Katikci.etal	1955	302 skull Turkish population	0.99%
14	Present Study	2008	North India510Male251 Female	1.96%1.99%
		2009	South India285Male143Female	2.80%2.79%



Fig. 1 & 2



Fig. 3. Inca bone of the South Indian Female Crania

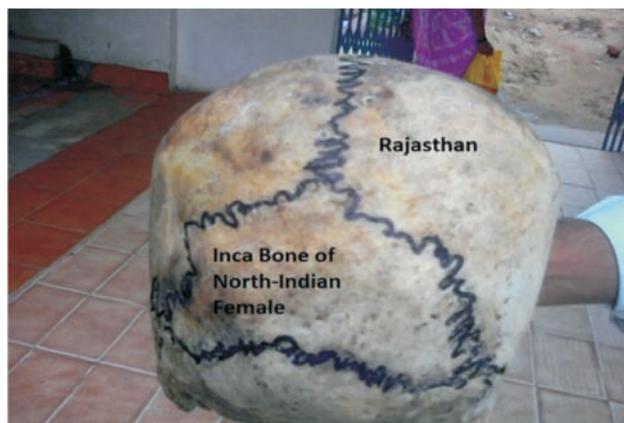


Fig. 4. Inca Bone of the North Indian Female Crania

ACKNOWLEDGEMENTS

We are grateful to all following dignitaries for permitting to carry out the study.

UTTAR PARDESH = Vinodkumar, Dharam Singh, Nafis Farooqui, Shishir Mohan.

PUNJAB = Mukarji. M. M Thukral. V. K. Subhas Kaushal, Manpreet Kaur

HARYANA = Sudhachabra, Sing B. N, Usha Dholl, Dubey K. N

RAJASTHAN = Bhusar, Gupta UK, Hussain Zafri, Agarwal SK

KARNATAKA = Gaikawad P. G, Pwakerslts, Nandyal. V. B, Ramesh CM

ANDRA PRADESH = Jayshree, Satyavati Devi P, Raji Reddy, Venugopal. N

KERALA = Raju Jacob, Bhagya. M, K. Selvarajalithamy, Gopi Nathan.

TAMIL NADU = Deepti Shastri, S Senthilkumar, Ravi kumar, G Subbulaxmi

Above all beloved principal of my college Dr. Shivaramu m. g for his constant encouragement.

Conflict of Interest: Nil

Finance: Self

Ethical Clearance: By A. I. M. S & R. C, B. G Nagar, Bellur, Nagamangala, (Tq) Madhya (Dist.)

REFERENCES

- Keatinge. R and K. Day – Socio-Economic organization of Moche Valley Peru during the chimu occupation of chan chan. Journal of Anthropological Research (1974), Vol 29, 275-294.
- Rivero. M. E, Von Tschudi J. J. – Peruvian antiquities (1851), Page 38-39.

3. Willium.P.L, Bannister L.G, Berry.M.M, Collins.P – Gray's Anatomy 38th Edition, 1998, 583, 606. Churchil Livingstone Publication London.
4. Hamilton.W.J – Textbook of Human Anatomy 2nd Edition (1976) Page 71. Macmillan Company Publication London.
5. Hanihara, Tsuneka.I – Frequency Variations of discrete cranial traits in Major Human Population – Super numeroryossicles. Journal of Anatomy Part-1 (June 2001), 686, 137-152.
6. Srivastav.R.C – Development of Ossification centers in the squamous portion of the occipital bones in man. Journal of Anatomy (1977), 24, 643-9.
7. Malhotra.V.K, Tiwari.P.S, Pandey.S.N and Tiwari S.P – Interparietal bone. ActaAnatomica (Basel). (1978), 101, (1), 94-96.
8. Coon.R.S - People and races New York Macmillan Publication London. (1977).
9. Ranke.J – Skull showing the absence of coronal suture. Journal of Anatomy London, (1934), 69, 109-112.
10. Seethalaxmi.S – Single state has 63000 under fed kids. Times of India Hubli – Dharwar, Belgaum Edition. Daily Newspaper. (2013), May 27th, Page-4.
11. SiddharthVaradarajan - Animals are in bigger in cold climates. The Hindu, Karnataka Edition Daily Newspaper. (2012) Nov. 29th Page-15.
12. Jaideep Bose Executive Editor - Early man lived in tree Times of India Hubli – Dharwar, Belgaum Edition. Daily Newspaper. (2012), Oct. 28th, Page-11.

Non Parasitic Liver Cyst-Incidental Diagnosis Made on Autopsy

Kanwardeep Kaur Tiwana¹, Sarita Nibhoria¹, Preeti Padda², Varinder Nibhoria³

¹Associate Professor Department of Pathology, ²Associate Professor, Department of Community Medicine, GGS Medical College & Hospital, BFHUS, Faridkot, Punjab, ³Medical Officer Civil Hospital Jaito, Punjab

ABSTRACT

An autopsy case report of 70 year old male who died suddenly and post mortem examination was conducted to rule out the cause of death. Viscera consisting of parts of liver, lungs, kidney, spleen and heart were sent to Department of Pathology for histopathological examination. Gross examination of liver revealed a cyst which on microscopy was diagnosed as simple non parasitic cyst measuring 4 cms in size. This case report highlights non parasitic liver cyst an incidental rare diagnosis made on autopsy.

Keywords: Non Parasitic Liver Cyst, Post Mortem Examination

INTRODUCTION

Non Parasitic Liver cysts constitute an uncommon and relatively benign condition. Majority of these cysts are asymptomatic with diagnosis made incidentally on histopathological examination of viscera on autopsy.¹ Incidence of non parasitic liver cyst on autopsy is 0.2%-0.5%. The incidence of cysts increases with age and are slightly more common in females.² This case report highlights a rare diagnosis made on autopsy.

CASE REPORT

A 70 year old male patient who died suddenly and postmortem examination was conducted to ascertain the cause of death. Viscera consisting parts of lungs, liver, kidneys, spleen and heart was send to department of pathology for histopathological examination. On gross examination of liver a cyst was seen measuring 4 cms in size. Microscopically on haematoxylin and eosin stain revealed presence of non

parasitic cyst lined by simple columnar epithelium [Fig. - 1& 2].

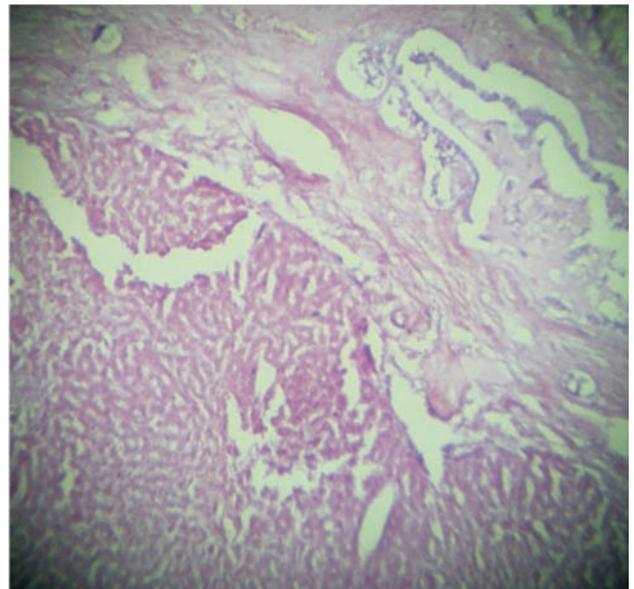


Fig. 1. Sections from liver shows presence of simple non parasitic liver cyst (H& E X100)

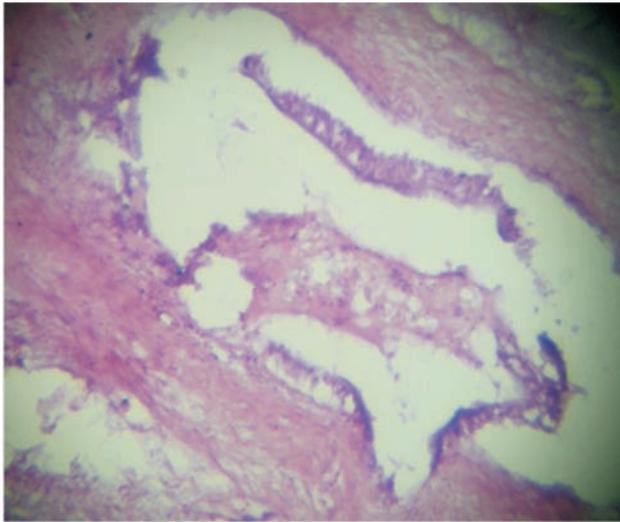


Fig. 2. Sections show columnar lining of simple liver cyst (H& E X400)

DISCUSSION

Non parasitic cysts of liver constitute an uncommon and relatively benign condition which may assume an important role in differential diagnosis of intra-abdominal mass lesion. Eliason and Smith found only 28 cases of hepatic cysts in series of 28000, consecutive autopsies and in no instance was the diagnosis suspected premortem.³ Stoesser and Wangenstein recorded 104 cases in 1929 and after 30 years Morgenstern was able to increase the total number of reported cases to 250.⁴ There are various classifications of liver cysts. Jones gave a widely accepted classification in which liver cysts were classified as proliferative cysts (Cystadenoma), degenerative cysts (pseudocysts), teratomatous cysts, lymphatic cysts, endothelial cysts, blood vessel cysts and retention cysts (Bile duct cysts).⁵

Miliadis and Giannakopoulos classified liver cysts as true and false cysts depending on presence of epithelial lining. True liver cysts include congenital cysts (simple cysts and polycystic liver disease), parasitic cyst (caused by *Echinococcus*), neoplastic cysts (cystadenoma, cystadenocarcinoma) and biliary duct related cysts (Caroli disease). False liver cyst are not lined by epithelium.¹

The etiological factors of simple liver cysts is not known but are believed to be congenital in origin. They are lined by uniform cuboidal or columnar epithelium and perhaps due to progressive dilatation of biliary microhamartomas that fail to develop normal connection with biliary tree.⁶

Incidence of liver cysts rises with age and they are frequently an incidental finding on ultrasonography

and histopathological examination on autopsy.⁶ They are reported in all age groups with commonly affecting 4th to 5th decade. This is in discordance with our case report as patient was 70 years old. They are commonly seen in females with male to female ratio being 3:1⁷ which is in discordance with this case report as deceased was a male.

The vast majority of simple hepatic cysts are asymptomatic and can produce symptoms due to their size and anatomical localization. Although quite rare complications of these cysts can develop due to infection, torsion and spontaneous rupture into peritoneal cavity. Although these complications are very rare but they can significantly affect patient's quality of life.

This case highlights non parasitic liver cysts are often asymptomatic and a rare incidental diagnosis made on autopsy.

Acknowledgement: My sincerest thanks to my technical supporting staff for their constant help.

Conflict of Interest: None

Source of Funding: None

Ethical Clearance: Yes

REFERENCES

1. Miliadis L, Giannakopoulos T, Boutiskos G, Terzis I, Kyriazanos I: Spontaneous rupture of a large non-parasitic liver cyst: a case report. *Journal of Medical Case Reports* 2010, 4:2 doi:10.1186/1752-1947-4-2.
2. Beecherl EE, Bigman DL, Langer B: Cystic disease of the liver. In; Zuidema GD, Yeo CJ eds. *Shakelford's Surgery of the Alimentary Tract*, 5th ed. Philadelphia, WB Saunders Co. pp 447-60, 2002.
3. Eliason EL, Smith DC: As quoted by Manheimer LH. Solitary non parasitic cyst of liver. *Ann Surg* 1953; 137:410-415.
4. Morgenstern L: Rupture of solitary non-parasitic cysts of liver. *Ann Surg* 1959; 150:167-171
5. Jones JFX: Removal of retention cyst from liver. *Ann Surg* 1923; 77:68-89
6. Ismail KA, Mousa GI, Elkhdraway OH, Mohamed HA: Symptomatic Non-parasitic benign hepatic cyst: Evaluation of Management by Deroofing in Ten Consecutive Cases. *Annals of Pediatric Surgery* 2010 Vol 6 No.2:83-89
7. Regev A, Reddy KR et al: Large cystic lesions of liver in adults: a 15 year old experience In a tertiary center. *J Am Coll Surg* 2001, 193:36-45

Spontaneous Rupture of Abdominal Aorta due to Penetrating Atheromatous Ulcer: A Rare Cause of Sudden Death in a Young Individual

Pradeep K Saralaya¹, Y P Girish Chandra², Clement Wilfred D³, Amoolya Bhat⁴

¹Associate Professor, ²Professor and Head, Department of Forensic Medicine, ³Associate Professor, Department of Pathology, M S Ramaiah Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India,

⁴Assistant Professor, Department of Pathology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore

ABSTRACT

Spontaneous rupture of aorta due to penetrating atheromatous ulcer is a rare cause of sudden death in young individuals. Cystic medial necrosis of the aorta in the absence of any known predisposing factors is also uncommon in young age. We present a rare case of penetrating atheromatous ulcer resulting in fatal rupture of aorta affected by extensive cystic medial necrosis in a young man.

Grade IV atheromatous plaques are prone to form ulcers. The resulting intimal tear causes haematoma formation in individuals with a normal tunica media with intact elastic fibers and smooth muscle coat. Coexistence of grade IV cystic medial necrosis had probably predisposed to extension of haematoma into the deeper layers of the wall of aorta and rupture at a young age even without aneurysm or dissection of the aorta. The knowledge of such entities contributes to determine the cause of sudden death and timely intervention prevents fatalities.

Keywords: *Atheromatous Plaque, Cystic Medial Necrosis, Penetrating Atheromatous Ulcer, Spontaneous Rupture of Aorta*

INTRODUCTION

Rupture of the aorta secondary to aneurysm, dissection or trauma is a well known entity. Spontaneous rupture of nonaneurysmal, noninfected aorta is extremely uncommon¹ especially in young individuals. In most of the cases, it is due to penetrating atherosclerotic ulceration (PAU) of the aorta¹ and is encountered in the thoracic aorta of elderly subjects.² Abdominal aorta is an uncommon site of occurrence.¹ The usual causes of cystic medial degeneration of aorta are advanced age and hypertension in elderly and Marfan syndrome or other connective tissue disorders in young individuals.³ The median age of presentation of cystic medial necrosis in non Marfan syndrome patients is fifty years.³ The present case report describes sudden unexpected death in a healthy thirty year old man due to spontaneous rupture infrarenal abdominal aorta affected by cystic medial degeneration through atheromatous plaques without any predisposing familial disorders.

CASE HISTORY

A 30 years old man was brought dead to the hospital after he collapsed following a brief period of diffuse abdominal pain. The deceased was a labourer by profession and was resting at home when the incident took place. There was no history of ingestion of medications, trauma, surgery, hypertension, or any other systemic illness. Personal history revealed cigarette smoking and occasional alcohol consumption. There was no significant family history.

At autopsy the heart weighed 300grams. The anterior descending branch of the coronary showed thickened wall. All the other coronaries, valves and the cardiac chambers were unremarkable. The intima of the ascending thoracic aorta showed brownish discolouration due to haematoma formation(Fig.1a). Abdominal aorta showed atheromatous plaques and rupture below the level of renal arteries. Peritoneal cavity showed 1000ml of blood and blood clots in the retroperitoneal area at the site of rupture of aorta

reaching the pericolic fat around the caecum (Fig.1b). There was no evidence of aneurysm or dissection of aorta. All the other organs were unremarkable.

The heart, thoracic and abdominal aorta along with caecum and ascending colon were sent for histopathological examination. Microscopically there was no infarct or inflammatory cell infiltrate in the myocardium. The anterior descending branch of coronary artery showed American Heart Association (AHA) grade IV atheromatous plaque with grade I luminal compromise. Right coronary and circumflex coronary arteries were unremarkable.

The intima of the thoracic and abdominal aorta showed Grade IV atheromatous plaques (Fig.2). Tunica media of both abdominal and thoracic aorta showed features of cystic medial necrosis characterized by loss of smooth muscle fibers, disarray and fragmentation of elastic lamellae with widening of inter lamellar spaces. The pseudo cystic spaces contained basophilic mucinous substance (Fig.3). The Van Gieson stain enhanced these findings (Fig.4). The infrarenal aorta showed rupture and retroperitoneal haemorrhage. There were no inflammatory infiltrates, bacterial or fungal invasion in the wall of the aorta.

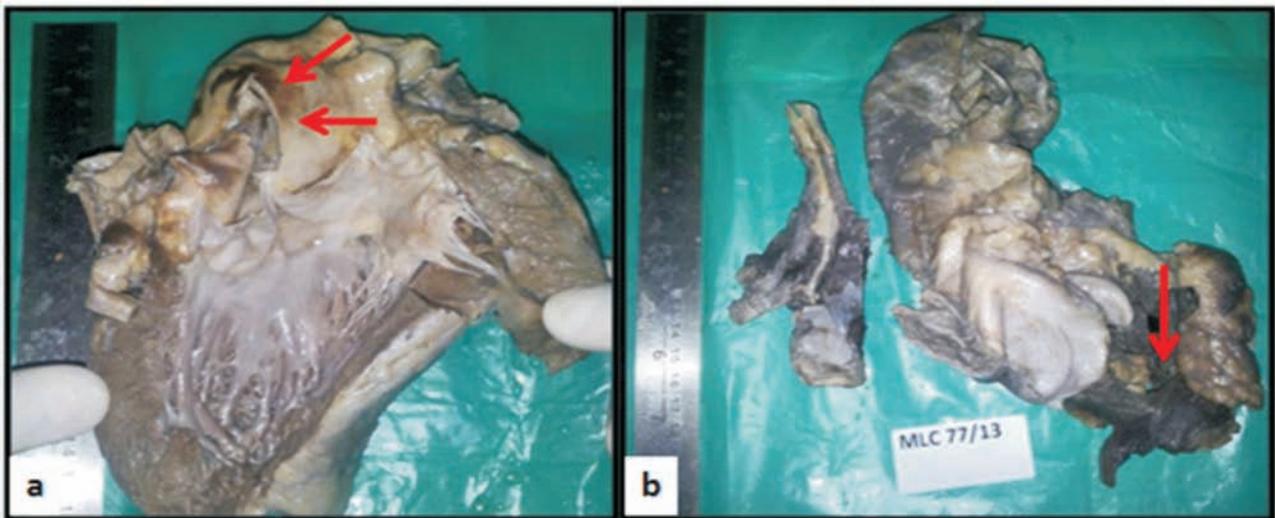


Fig. 1: a) Ascending aorta showing brownish discoloration of tunica intima (arrow) due to intramural haemorrhage. b) Pericolic haemorrhage (arrows).

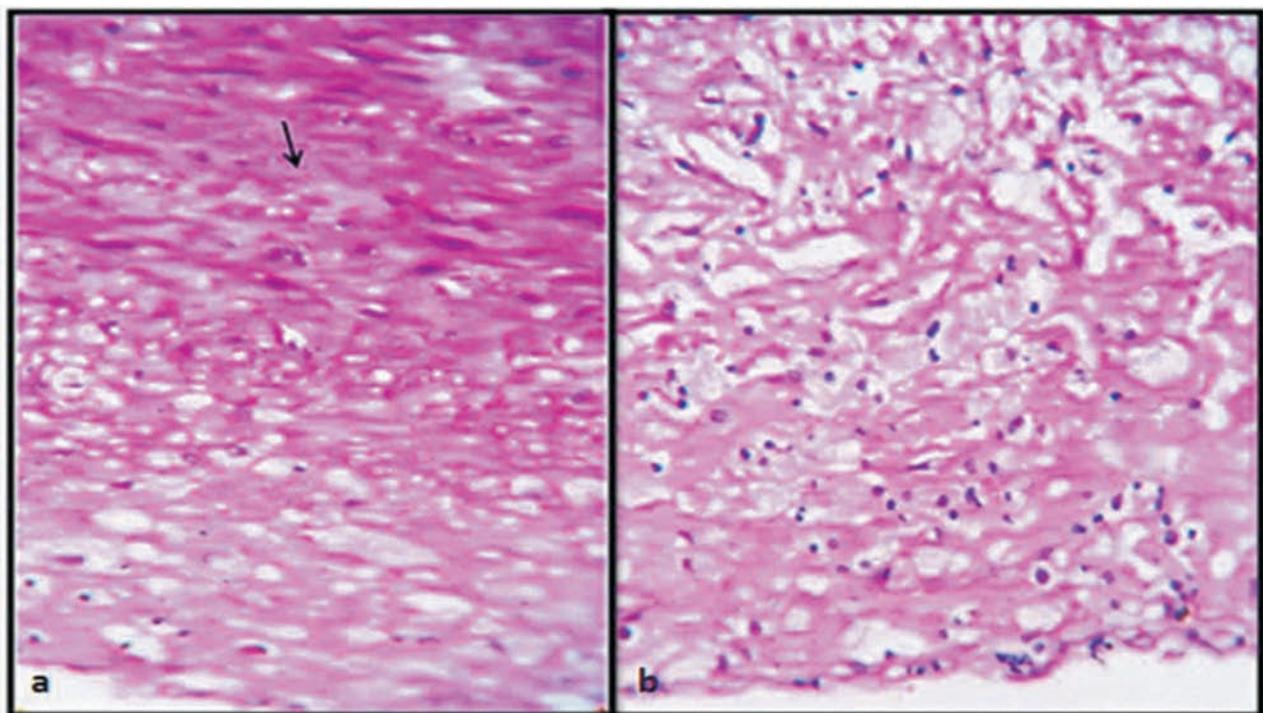


Fig. 2: a) Tunica intima showing atheromatous plaques and subintimal cystic medial necrosis (arrow). b) Atheromatous plaques showing foamy histiocytes, inflammatory cells and extracellular pools of lipid (H&E x400).

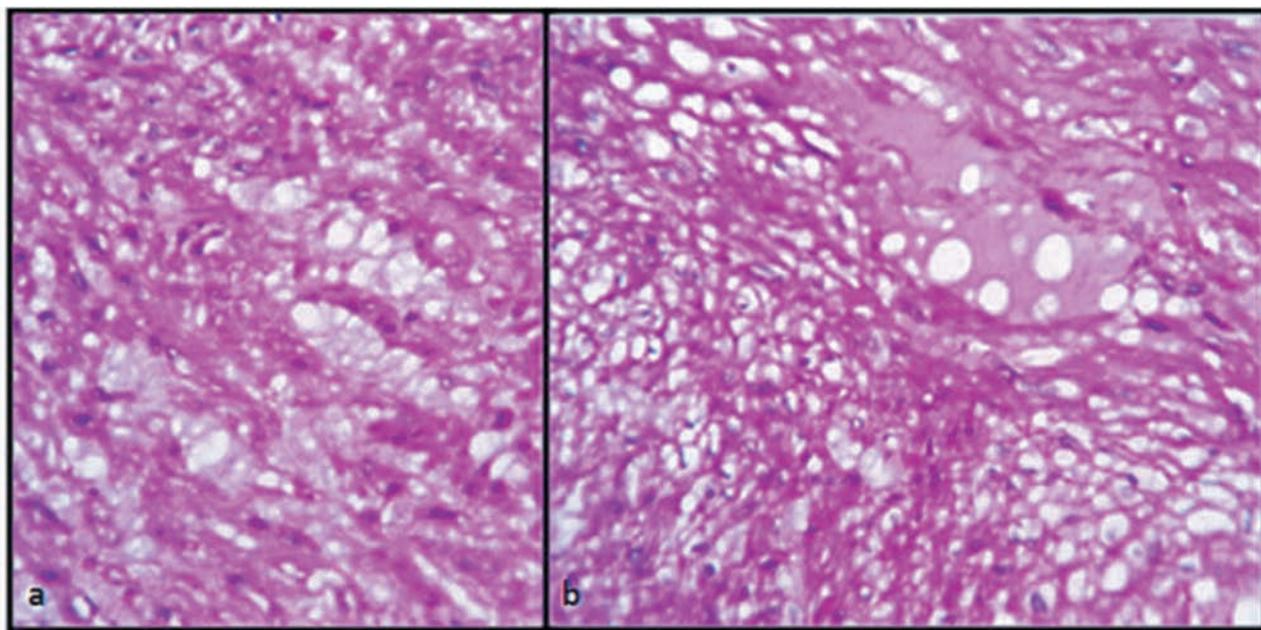


Fig. 3: Tunica media showing widening of interlamellar spaces filled with blue mucinous ground substance (H&E x400).

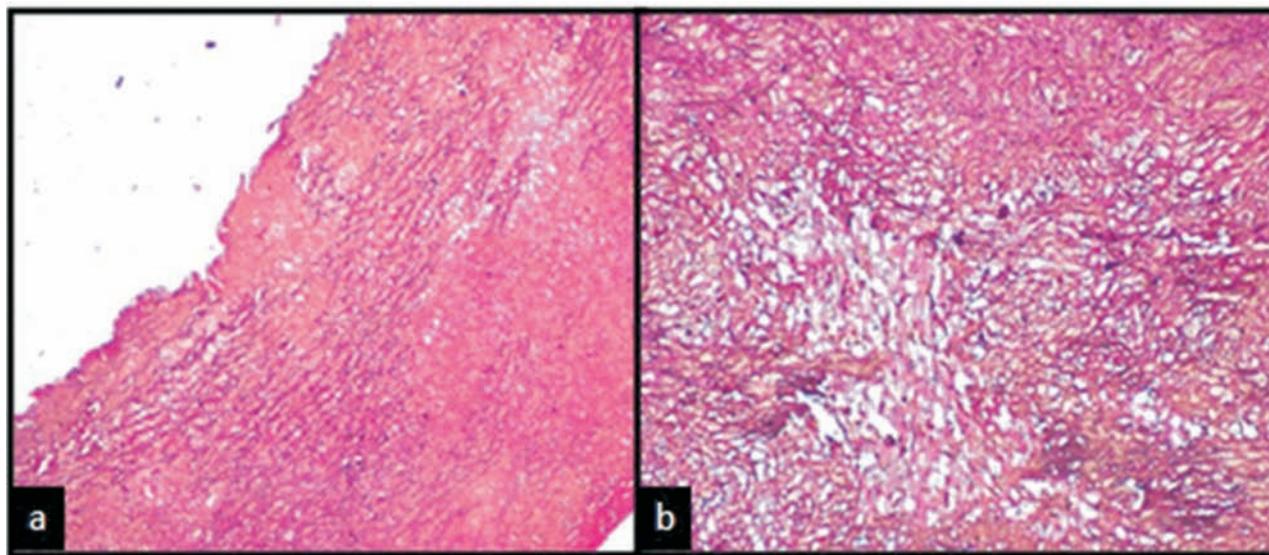


Fig. 4: Tunica media showing disarray and fragmentation of elastic lamellae (Van Gieson (a) x100; (b) x400).

Grade IV atheromatous plaques contain extracellular lipid and are prone to form ulcers. The resulting intimal tear causes intramural haematoma formation individuals with a normal tunica media with intact elastic fibers and smooth muscle coat. However this man exhibited grade IV cystic medial necrosis characterised by elastic fiber disarray and loss of smooth muscle cells in tunica media of aorta which had probably predisposed to extension of haematoma into the deeper layers of the wall of aorta and rupture even without aneurysm or dissection of the aorta. Thus in this patient, cystic medial degeneration might have facilitated the formation of penetrating atherosclerotic

ulcer culminating in spontaneous rupture of aorta at a young age.

Thus based on the autopsy and histopathology findings, spontaneous rupture of the aorta due to penetrating atheromatous ulcer was concluded as the cause of massive haemorrhage and death.

DISCUSSION

Spontaneous rupture of abdominal aorta is a rare event in young subjects and is an uncommon cause of sudden unexpected death. Elderly individuals with hypertension and atherosclerotic plaques in the wall

of the aorta commonly suffer from this condition and typically it involves the infrarenal aorta.⁴ Spontaneous rupture of aorta without hypertension has been reported in the past.⁵

Cystic medial necrosis is a common cause of thoracic aortic rupture in young individuals with Marfan syndrome, Loeys-Dietz syndrome, Ehlers-Danlos syndrome type IV and bicuspid aortic valve. Familial forms without associated syndromes and sporadic cases of cystic medial necrosis exhibiting certain specific gene mutations are well known to occur.^{3,4} The above described case did not exhibit any features of Marfan syndrome. The examination of the heart ruled out the presence of bicuspid aortic valve or other congenital anomalies. The cause for the cystic medial degeneration aorta was unknown in this case as the personal history did not reveal presence of hypertension, autoimmune disease like arteritis or infections like syphilis. Cystic medial necrosis can develop in patients with aortopathies like atherosclerotic disease and even healthy individuals.³ Rupture of aorta affected by cystic medial necrosis is usually secondary to aneurysm or dissection in young subjects.^{4,5} The instant case lacked features of aneurysm or dissection, and showed only cystic medial necrosis and atheromatous plaques at the site of rupture. Cases of sudden death due to spontaneous dissection⁷ and traumatic rupture⁸ of aorta affected by cystic medial necrosis have been reported in young subjects without any familial or genetic predisposing factors in the past. A case of spontaneous rupture of thoracic aorta secondary to cystic medial necrosis Erdheim Gsell in a fifty eight year old lady has been reported.⁶ Abdominal aorta is an uncommon site of rupture in patients with cystic medial necrosis.⁴

Most spontaneous aortic ruptures are associated with perforation through the atheromatous plaque.⁴ Spontaneous rupture of aorta displaying grade four atheromatous plaques in the intima and grade four cystic medial necrosis of the tunica media, without aneurysm formation or dissection pointed towards the diagnosis of penetrating atheromatous ulcer in the described case.

Penetrating atherosclerotic ulcer of the aorta has been considered as an important cause of spontaneous rupture of aorta. About 2.3-7.6% of acute aortic syndromes are caused by penetrating atheromatous ulcer.² It is typically seen in elderly individuals (seventh life decade) with hypertension and

atherosclerosis and usually involves the descending thoracic aorta.^{2,4}

It was first described by Shennan in 1934. Recently it is described as an atypical variant of aortic dissection. The condition is defined as the atheromatous ulcer that penetrates through the internal elastic lamina into the tunica media and is associated with hematoma within the aortic wall.^{2,9,10} Pseudoaneurysm formation, localized dissection, embolization or ruptures are the usual outcomes of penetrating atheromatous ulcer.^{2,9,10} The chances of rupture is reported to be up to 40% .¹¹

Intimal defects resulting from atherosclerotic ulcers occur in patients with advanced atherosclerosis (American heart association grade IV and above). Atheromatous ulcers are asymptomatic and are confined to the tunica intima. Later the ulcer penetrates through the elastic lamina and enters the tunica media (ie, penetrating atherosclerotic ulcer).^{9,10} The stagnation and increased residence time of blood in the region of the penetrating atheromatous ulcer results in elevated intraluminal pressure and a low flow velocity at the level of the aortic wall. The pulsatile arterial flow¹⁰ and exposure of the aortic wall to a relatively low wall shear stress increases the intercellular permeability and contributes to penetrating atheromatous ulcer progression.^{10,11}

CONCLUSIONS

We presented a unique case of sudden death due to spontaneous rupture of abdominal aorta affected by extensive cystic medial necrosis and atheromatous plaques in a young male without any predisposing factors like systemic disease or trauma. In sporadic cases cystic medial necrosis is never diagnosed until the acute aortic syndrome has occurred and the aortic tissue is examined after autopsy or surgery. The findings of autopsy and histopathology are useful to educate the close relatives of the deceased, and to create awareness about the natural history of disease.

Acknowledgement: We would like to acknowledge the Department of Pathology, MS Ramaiah Institute of Medical sciences and Research Centre, Bangalore for their valuable support in evaluating the case.

Conflicts of Interest: None

Permissions: Nil

Source of Funding and Ethical Clearance: Nil

REFERENCES

1. Chervenkov V, Tonev A, Maximov D, Nikolov D, Stoinova V. Spontaneous rupture of a nonaneurysmal infrarenal abdominal aorta due to penetrating ulcer. *EJVES Extra* 2005; 10:101-3.
2. Eggebrect H, Plicht B, Kahlert P, Erbel R. Intramural hematoma and penetrating ulcers: Indications to endovascular treatment. *Eur J Vasc Endovasc Surg* 2009;38:659-65.
3. Yuan SM, Jing H. Cystic medial necrosis: pathological findings and clinical implications. *Rev Bras Cir Cardiovasc* 2011; 26.1:107-15.
4. Libbey P, Bonow RO, Mann DL, Zipes DP, editors. Braunwald's heart disease: A textbook of cardiovascular medicine. 8th edition. Saunders Elsevier 2007. p:1457-90.
5. Yada M, Maze Y, Tokui T, Shomura S. Asymptomatic spontaneous rupture of a non aneurysmal visceral aorta. *Ann Thorac Cardiovasc Surg* 2008;14:336-8.
6. Gary T, Seinost G, Hafner F, Gorkiewicz G, Brodmann M. Cystic medial necrosis Erdheim Gsell as a rare reason for spontaneous rupture of the ascending aorta. *Vasa* 2011; 40:147 -9.
7. Dermengiu S, Ceaus M, Hostiuc S, Curca G C, Dermengiu D, Turculet C. Spontaneous aortic dissection due to cystic medial degeneration. Report of a sudden death case and literature review. *Rom J Leg Med* 2009;17:89 - 96.
8. Kumar PS, Sapeco SD, Pinto RGW, Couto F. Fatal traumatic rupture of ascending aortic aneurysm having idiopathic cystic medial necrosis: An autopsy case. *J Indian Acad Forensic Med* 2010;32:339-42.
9. Hayashi H, Matsuoka Y, Sakamoto I, Sueyoshi E, Okimoto T, Hayashi K, Matsunaga N. Penetrating atherosclerotic ulcer of the aorta: Imaging features and disease concept. *Radiographics*. 2000; 20:995-1005.
10. Macura KJ, Corl FM, Fishman EK, Bluemke DA. Pathogenesis in acute aortic syndromes: Aortic dissection, intramural hematoma, and penetrating atherosclerotic aortic ulcer. *AJR* 2003;181:309-16.
11. D'Ancona G, Amaducci A, Rinaudo A, Pasta S, Follis F, Pilato M and Baglini R. Haemodynamic predictors of a penetrating atherosclerotic ulcer rupture using fluid-structure interaction analysis. *Interactive CardioVascular and Thoracic Surgery*. 2013:1-3.

Elastofibroma Dorsi: A Rare Soft Tissue Tumor Detected Incidentally on Autopsy

Vardendra Kulkarni¹, Seema Bijjaragi²

¹Assistant Professor, ²Associate Professor, Department of Pathology, JJM Medical College, Davangere, Karnataka, India

ABSTRACT

Elastofibroma dorsi is an uncommon benign soft tissue tumor usually located in the infra-scapular region, deep to serratus anterior muscle, and often attached to the periosteum of the ribs, presenting with long history of swelling and occasionally pain and discomfort. It is seen in elderly age group and may be mistaken for a malignant soft tissue tumor due to its size and location. The pathogenesis of the lesion is still unclear, but repetitive microtrauma by friction between the scapula and the thoracic wall may cause the reactive hyperproliferation of fibroelastic tissue. Diagnosis is straight-forward when the lesion is present in characteristic anatomic location and pathognomonic histopathological features are seen. We describe a case of bilateral elastofibroma dorsi detected incidentally on autopsy.

Keywords: *Elastofibroma, Autopsy, Histopathology, Subscapular Mass*

INTRODUCTION

Elastofibroma dorsi (ED) is a benign, slow-growing fibro-elastic tumor that was first described by Jarvi and Saxen in 1961.¹The typical presentation of ED involves a subscapular mass associated with a long history of swelling, discomfort, snapping of the scapula and, in some cases, pain. In 99% of cases, EDs are localized to the infrascapular region between the thoracic wall, serratus anterior, latissimus dorsi muscle, and are often attached to the periosteum of the thoracic wall.² Very rarely, elastofibroma is found in other sites, such as the tip of the elbow, near the ischial tuberosities, the deltoid muscle, foot, inguinal region, orbits, stomach, greater omentum and the intraspinal spaces. It is relatively frequent among elderly women, with a mean age at onset of 70 years. It is bilateral in 10% of cases.³We report a case of bilateral elastofibroma dorsi detected incidentally on autopsy and review the literature.

CASE REPORT

A 60 year old female agriculture worker was brought to casualty with an alleged history of snake bite. She was diagnosed to be in a state of hemodynamic shock and succumbed to the condition in few hours. A medico-legal autopsy was performed and shock due to snake bite was confirmed as the cause of death. Two soft tissue masses were detected on autopsy in bilateral subscapular area. Both the masses were excised and sent for histopathological examination. Grossly the masses were poorly delineated from surrounding tissue, the cut surface showed small areas of adipose tissue interposed between gray-white fibrous areas as shown in figure 1. On microscopic examination the tumor like mass consisted of a mixture of intertwining swollen, eosinophilic collagen and elastic fibers in about equal proportions associated with occasional fibroblasts, small amounts of interstitial mucoid material, and variably sized aggregates of mature fat cells. The elastic fibers appeared degenerated, beaded and fragmented into small flower-like, serrated disks or globules with a linear arrangement (Figure 2). Special stain (Verhoeff's elastin) confirmed the elastic nature of the degenerated fibres (Figure 3). The final histopathology report was signed out as bilateral elastofibroma dorsi.

Corresponding author:

Vardendra Kulkarni

Assistant professor

Department of Pathology, JJM Medical College,
Davangere, Karnataka, India

Mobile :+ 919731501466

E-mail : vardendrak@rediffmail.com

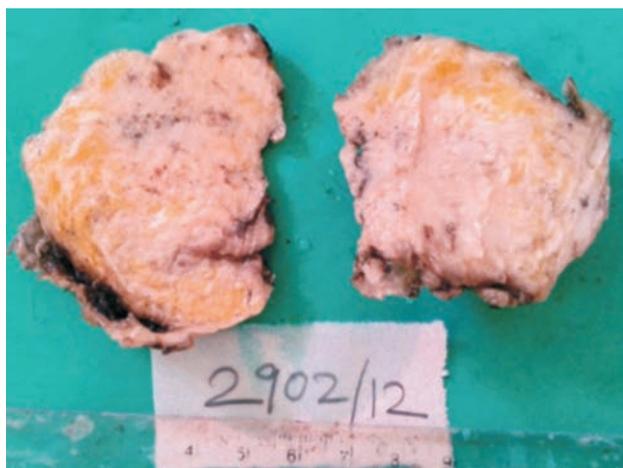


Fig. 1. Gross specimen showing ill defined mass with alternate fibrous and adipose areas

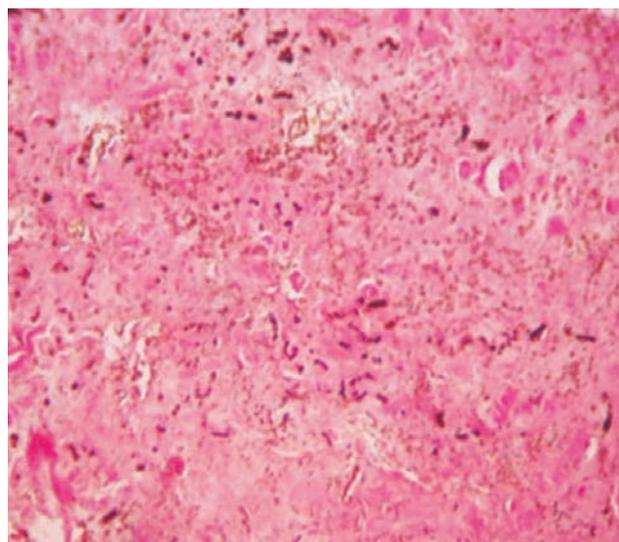


Fig. 2. Photomicrograph showing degenerated elastic fibers with fibrocollagenous tissue (H&E, x100)

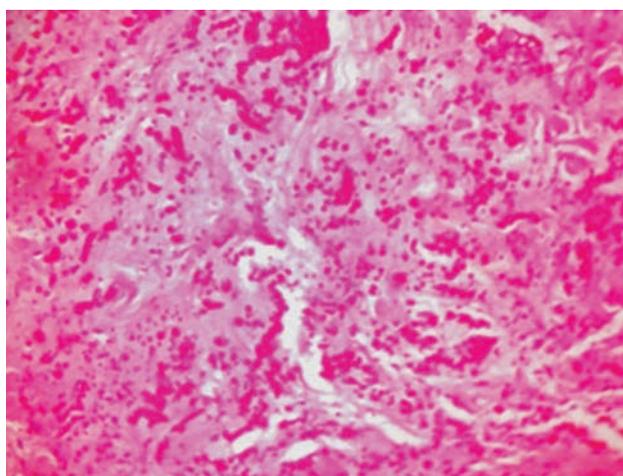


Fig. 3. Photomicrograph showing elastic fibers (verhoff's elastin, x100)

DISCUSSION

Elastoûbroma dorsi is an uncommon benign lesion. Negamine et al.⁴ have described a series of 170 patients from Okinawa. Genetic predisposition was reported with 32% of the 170 patients having a family history of elastoûbroma. All the larger series of elastoûbroma reported in the literature showed elastoûbroma was commoner in females however in the case series reported by Chandrasekar et al⁵ males were more commonly (80%) involved than females. Case series reported by various authors has been shown in table 1.

Table 1. Showing elastofibroma case series published in literature

Sl. No.	Study	Year	Number of cases	Gender Distribution (F:M)	Bilaterality (%)
1	Mackenzie et al ⁶	1968	03	1:2	33.3
2	Nagamine et al ⁴	1982	170	13:1	66.7
3	Daigeler et al ³	2007	07	5:2	14.2
4	Muratori et al ⁷	2008	08	7:1	12.5
5	Chandrasekar et al ⁵	2008	15	1:4	13.3
6	Kastner et al ⁸	2009	11	9:2	09.1
7	Cinar et al ⁹	2009	13	11:2	15.4

The pathogenesis of elastofibroma dorsi is still unclear, but repetitive microtrauma caused by friction between the scapula and the thoracic wall may cause reactive hyper-proliferation of fibroelastic tissue.³ The location of elastofibromas and its incidence among older individuals may be related to the natural

existence of fibro-elastic tissue in this region and suggests a reactive process in response to friction of the scapula against the ribs. Alternatively, the genesis of elastofibroma is thought to involve an overproduction of the collagenous connective tissue with a degeneration of the collagen fibres and an

overproduction of immature elastic tissue, derived from fibroblasts, alternating with deposition of hyperplastic fat.⁶The nature of the altered elastic fibres is disputed and controversial. They may be caused by abnormal elastogenesis or by degenerating as a secondary process, or even by a combination of both processes.³ Swelling, discomfort, snapping of the scapula, and occasionally pain are the most common presenting symptoms. However, it is not uncommon for these tumors to be completely asymptomatic and to be found incidentally during physical examination or during an investigation of a symptomatic mass on the contra-lateral side.

MR is the imaging modality of choice in diagnosing ED and typically demonstrates a well-defined, moderately inhomogeneous mass with no associated soft tissue edema. On T1-weighted MRI, EDs are isointense with skeletal muscle, which explains how these tumors are often diagnostically overlooked. T1- and T2-weighted images both show interspersed linear and curvilinear, hyper intense areas representing fat. Fat saturation gradient technique applied post-gadolinium administration may show subtle areas of heterogenous enhancement within the mass, making it difficult to exclude a soft tissue sarcoma without biopsy. Imaging with CT often reveals homogenous masses with attenuation similar to that of surrounding skeletal muscle and a fat plane that is indistinct from the mass and adjacent skeletal muscle.²

Macroscopically, elastofibromas appear as an irregular, poorly defined, unencapsulated, fibroelastic mass with firm, rubbery consistency. Cut surface reveals strands of white and yellow tissue representing adipose tissue intermingled with fibroelastic tissue in a "checkerboard" pattern. Histologically, fibrous, collagenous strands with eosinophilic, plump, elongated and round-shaped collections of elastic fibers are seen. These fibers may be difficult to visualize on H and E, especially during frozen section diagnosis. An elastin stain (Elastic-van-Gieson) is necessary to highlight these fibers and reveals deeply staining branched and unbranched fibers with central dense core and serrated margins. The lesions are predominantly hypocellular, with benign fibrocytic and fibroblastic cells that lack atypia and mitotic figures, and contain entrapped islands of adipose tissue. Fine needle aspiration is not a recommended diagnostic technique due to this hypocellular nature of ED.²

Diagnosis of elastofibroma was straight-forward in the present case as the lesion was bilateral and located at the characteristic anatomical site with pathognomonic histological features of degenerated elastic fibres interposed with fibrocollagenous and adipose tissue. In case of early lesions and lesions at unusual locations, the differential diagnoses should include nuchal fibroma, fibrolipoma, fibromatoses, sarcoma and subcutaneous metastasis. Under such circumstances, elastofibromas can be differentiated from these lesions using an immunohistochemical panel of vimentin, smooth muscle actin, CD34, CD 99, S-100 and lysozyme.¹⁰

CONCLUSION

Elastofibroma is a rare tumor like lesion of soft tissues occurring characteristically in infrascapular region. Simple surgical excision is the treatment of choice and local recurrence is very rare.

Conflict of Interest: None

Source of Funding: None

Ethical Clearance: Not applicable

Acknowledgements: We thank the department of Forensic Medicine, JJM Medical College, Davangere for providing the case details.

REFERENCES

1. Jarvi O Saxen E. Elastofibroma dorse. *Acta Pathol Microbiol Scand Suppl.* 1961; 51:83-4.
2. Pauline H. Go Meadows M C Essel Marie B. deLeon and Ronald S. Chamberlain. Elastofibroma dorsi: A soft tissue masquerade. *Int J Shoulder Surg.* 2010; 4(4): 97-101.
3. Daigeler A, Vogt PM, Busch K, Pennekamp W, Weyhe D, Lehnhardt M, et al. Elastofibroma dorsi—differential diagnosis in chest wall tumors. *World J Surg Oncol.* 2007; 5:15.
4. Nagamine N, Nohara Y, Ito E. Elastofibroma in Okinawa. A clinicopathologic study of 170 cases. *Cancer.* 1982; 50:1794-805.
5. Chandrasekar CR, Grimer RJ, Carter SR, Tillman RM, Abudu A, Davies AM, et al. Elastofibroma dorsi: An uncommon benign pseudotumor. *Sarcoma.* 2008;2008:756565.
6. Mackenzie D H, Wilson J F and Cooke K B. Elastofibroma. *J. Clin. Path.* 1968; 21:470-475

7. Muratori F, Esposito M, Rosa F, Liuzza F, Magarelli N, Rossi B, et al. Elastofibroma dorsi: 8 case reports and a literature review. *J Orthop Traumatol.* 2008; 9:33-7.
8. Kastner M, Salai M, Fichman S, Heller S, Dudkiewicz I. Elastofibroma at the scapular region. *Isr Med Assoc J.* 2009; 11:170-2.
9. Cinar BM, Akpınar S, Derincek A, Beyaz S, Uysal M. Elastofibroma dorsi: An unusual cause of shoulder pain. *Acta Orthop Traumatol Turc.* 2009; 43:431-5.
10. Ramachandra S, Kuruvila S and Kindi M A. Soft Tissue Swelling at the Subscapular Region. *Oman Medical Journal,* 2012; 27(2): 172-174.

Neurological Manifestation's of Lead Toxicity in a Battery Worker-A Case Report

Varma Sanjay¹, Gupta G B², Malhotra Yogendra¹, Khare R L¹, Singh C³, Agrawal Shweta⁴,
Mandavi Sanjay⁴

¹Assistant Professor, ²Professor & Head, ³Assistant Professor, ⁴Resident, Department of Medicine, Pt. J.N.M. Medical College Raipur & Dr. BRAM Hospital, Chhattisgarh

ABSTRACT

Lead acts as cumulative metabolic poison. Occupational lead poisoning occurs frequently in developing country as it has many industrial uses like manufacture of pipes, storage batteries, ship building. Toxic effect of lead on the body is known as Plumbism. It affects multiple organs, specifically bones, blood, brain, increased risk of cardiovascular disease, coronary artery disease and platelet dysfunction. Lead encephalopathy is rare in adults due to the capacity of the mature brain to sequester lead away from its mitochondrial site of action within the cerebral and cerebellar neurons. It is a life threatening condition and should be treated as an emergency. Here by, we present a case of 18 year old young man with lead encephalopathy with brief review of literature.

Keywords: Lead Poisoning, Lead Encephalopathy

INTRODUCTION

Lead (Pb) has been known for centuries to be a cumulative metabolic poison. [1] The toxicity of lead has been known for more than a thousand year, but occupational lead poisoning still occurs in developing country. Lead has many industrial uses, like manufacture of pipes, cisterns, roof coverings; the manufacture of lead accumulator plates and storage batteries, ship-building and ship-breaking, plumbing, painting and soldering.[2] Lead is ubiquitous in our environment but has no physiologic role in biological systems. Toxic effect of lead on the body is known as Plumbism and it is now well recognized that inorganic lead produces not only clinically defined encephalopathies and neuropathies, but also various behavioural changes indicative of cerebral dysfunction. Exposure of lead can take place either through inhalation of dust, fumes, vapours, or ingestion of contaminated foods or drinks.[3] Lead poisoning affects multiple organs, specifically bones (lead bands at the epiphyses of the long bones), blood (punctate basophilic stippling of erythrocytes and microcytic hypochromic haemolytic anaemia), brain edema, demyelination of the cerebral and cerebellar white matter, [4] Cerebrovascular diseases, stroke, cerebral haemorrhage, tremor, paresthesia, paralysis,[5]

psychomotor impairment, peripheral nervous system (demyelinating neuropathy), gingiva (lead lines), and kidneys (chronic tubulointerstitial disease). [4] In cardiovascular system lead toxicity may result in hypertension, increased risk of cardiovascular disease, coronary artery disease and platelet dysfunction. [5] In the central nervous system, the lesions are thought to be the result of vascular injury. Lead acts as a cellular toxin by inhibiting mitochondrial respiration. Lead encephalopathy is rare, [4] the increased resistance of the adult to encephalopathy and ataxia is believed to be caused by the capacity of the mature brain to sequester lead away from its mitochondrial site of action within the cerebral and cerebellar neurons. Lead encephalopathy requires emergency admission to an intensive care unit with intubation and sedation. A long period of inpatient treatment usually follows admission, although full recovery of cognitive, motor, and emotional function may not occur. [6]

CASE REPORT

An 18 year young man, employed in a battery workshop was admitted to hospital with complaints of giddiness, weakness, headache, vomiting and one episode of convulsion. He had been in this employment for 2 years where he had to dismantle

used batteries. Past history was negative for substance abuse and any poisoning. On clinical examination patient was confused, disoriented and bilateral plantar were absent. After 16 days of hospitalization he suddenly developed bilateral sixth nerve palsy. There was no sensory deficit. On ophthalmic examination bilateral esotropia of 15 degree (Figure.1) and fundus examination showed bilateral papilloedema. Other systemic examination was apparently normal.



Fig. 1. Showing esotropia of Rt. eye



Fig. 2. Showing improvement in Ophthalmoplegia

On laboratory examination Hb was 7.8 gm/dl, documented neutrophilic leucocytosis $13400/\text{mm}^3$, neutrophils count 68, hematocrit 25.7%, MCV-79 fl, MCH-23.9 pg, MCHC-30.3 g/dl and platelet count was adequate. Peripheral smear showed microcytic hypochromic anaemia without basophilic stippling. Urine analysis documented pus cells, Renal function test (RFT) was normal, Liver function test (LFT) was normal, Blood sugar level was normal. Serum Na^+ , K^+ , and Ca^{++} level was 131meq/L, 4.6 meq/L and 8.2mg/dl respectively. Serum level of Lead (plumbum) was

134 $\mu\text{g}/\text{dl}$ (higher). C.S.F. examination could not be performed due to papilloedema. On neuroimaging, MRI brain documented infarction in the left basal ganglia posteriorly (Figure.3) and CT Brain contrast documented bilateral mild diffuse cerebral oedema (Figure.4).

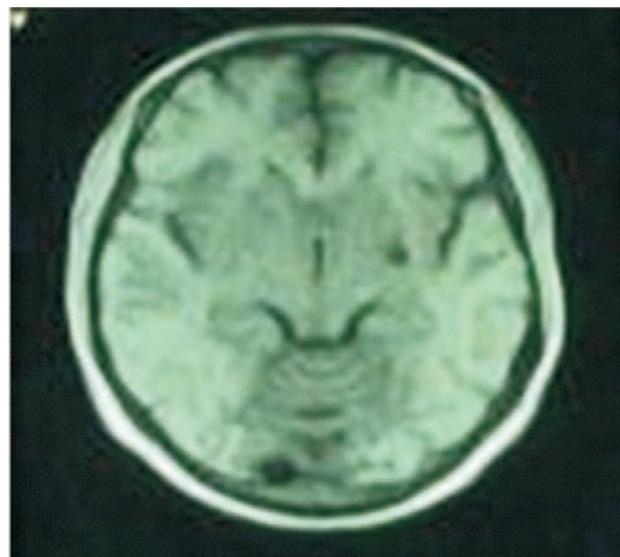


Fig. 3. MRI scan -infarction of Lt.basal ganglia

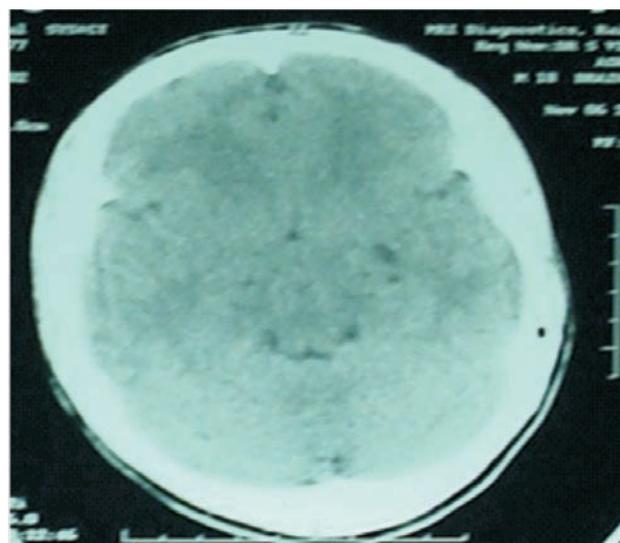


Fig. 4. CT scan-mild diffuse cerebral oedema

He was treated with Phenytoin, Mannitol, Dexamethasone, and D-penicillamine, he responded by improvement in consciousness, plantar reflexes became flexor, improvement in ophthalmoplegia (Figure.2) and had no episode of convulsion. He was discharged in stable conditions.

DISCUSSION

Lead encephalopathy was first documented in 1925. Normal lead levels should be below 10µg/dL. Lead poisoning occurs with the blood level > 40µg/dL. Lead encephalopathy is almost always associated with a blood lead concentration of 100 µg/dL, but levels of lead as low as 70 µg/dL can also cause encephalopathy.^[4] The Control of Lead at Work Regulations had prescribed safety limits for occupational lead exposure in 1998, according to which blood lead values <1.45 micromol/l (30 microgm/100 ml) represent reasonably well-controlled occupational exposure provided there is 6-monthly monitoring, 1.45 - 2.4 micromol/l (30 - 50 mg/100 ml) require investigative action by the employer and 2.4 - 2.9 micromol/l (50 - 60 mg/100 ml) call for suspension of the worker from exposure. However, US CDC and WHO recommends blood lead level > 0.5 micromol/l (10 microgm/100 ml) as cause for concern.

Encephalopathy is the most dramatic and life-threatening development of lead poisoning, with a mortality rate of 25% or more. In adults the main form of exposure is to white lead oxide powder, which may be inhaled, for example, during the manufacture of batteries.^[2]

The adult form of lead encephalopathy is rarer than the paediatric form.^[7] In adults, this encephalopathy can present with serious neurodeterioration and can sometimes be lethal.^[8] Lead encephalopathy can present in acute and chronic forms. Acute lead encephalopathy presents pathologically as cerebral edema,^[9] whereas in chronic lead encephalopathy, extensive tissue destruction with cavity formation and thickening of the veins with cellular disorganization of their walls (suggesting vascular insult in cerebral injury) is seen.^[10] All this can lead to edema, gliosis, haemorrhage, neuronal loss, and perivascular proteinaceous exudates.^[11] Lead acts as a cellular toxin by inhibiting mitochondrial respiration.^[12] Clinically, patients present with headache, vomiting, ataxia, convulsions, paralysis, stupor, and coma in acute forms.^{[7], [9], [13], [14]}

Lead acts as a cellular toxin by inhibiting mitochondrial respiration. The increased resistance of the adult to encephalopathy and ataxia is believed to be due to the capacity of the mature brain to sequester lead away from its mitochondrial site of action within the cerebral and cerebellar neurons.^[1] The onset of cerebral symptoms is usually acute, with

seizures (which may be focal or generalized), delirium and coma, often associated with papilloedema. Any type of neurological sign may develop, including cerebellar ataxia, cranial nerve palsies, optic atrophy, hemiplegia, and decerebrate rigidity. Chronic cases may show mental dullness, poor memory, headache, trembling, head retraction, deafness, hemianopia and amaurosis without fundal changes. Encephalopathy is not a common manifestation of plumbism in the adult. Abdominal colic and neuropathy involving the most frequently used muscles is more usual.^[2]

Whitfield et al^[15] have been suggested the following criteria for diagnosis of lead encephalopathy: 1) Documentation of diffuse encephalopathy with or without focal signs; 2) Diagnosis of lead toxicity using clinical and laboratory aids; 3) Response to chelators; and 4) Exclusion of other causes of encephalopathy.

In our patient, a diagnosis was made on the basis of history of occupational exposure, higher serum level of lead, feature of encephalopathy, and response to chelators. In patient, we found one episode of seizure, headache, vomiting and giddiness. Whitfield et al^[15] (1972) reported the largest series of 23 adults with lead encephalopathy; all of these followed consumption of illicit liquor contaminated by lead (moonshine). Ten of these patients had altered sensorium, 18 of them had seizures. Other symptoms included dizziness, syncope, disorientation, and blindness. One had papilloedema this could be secondary to raised intracranial pressure or to direct involvement of the cerebellum. Severe medical illness, alcohol, dehydration, and emotional stress are known to precipitate symptoms of lead poisoning, but we were unable to identify any such factor in our patient. Basophilic stippling of erythrocytes is reported in 91% of patients.^[10] Peripheral smear of our patient did not have basophilic stippling of peripheral red blood cells.

Segal et al^[2] reported diversity of neurological manifestations in lead encephalopathy such as one case complaining of tremor of the arms and legs, and cramp-like abdominal pains, of 4 weeks' duration, second case presented as one episode of seizure only and third case presented as four attack of seizure.

We found features of encephalopathy (bilateral mild diffuse cerebral oedema and infarction in the left basal ganglia posteriorly) in CT and MRI finding. Perelman et al^[8] reported MR imaging findings such as cerebellar edema, suggested by an enlarged

cerebellum with the disappearance of the cerebellar fissure and protrusion. Lead intoxication can cause intracranial calcification but the pathogenesis of intracranial calcification has not yet been proved satisfactorily. Perelman et al^[8] reported an incidence of 84% cerebellar calcification at autopsy in a study of 44 adults with a history of chronic lead poisoning. Schroter et al^[16] reported bilateral symmetric calcification in the subcortical area of the cerebral hemispheres and basal ganglia on CT. Tuzun et al^[17] reported bilateral symmetrical hypoattenuated lesions in the thalamus, lateral putamen, claustrum, and insula. Reyes et al^[18] reported extensive intracranial calcification on CT in 3 adults with chronic lead poisoning. In our patient, CT and MR imaging did not show any calcification. The extent of clinical recovery was out of proportion to the decline in blood concentrations. Free erythrocyte protoporphyrin and the urinary concentrations of δ -aminolevulinic acid (ALA) or coproporphyrin are better clinical correlates of lead toxicity, rather than estimations of blood lead concentration.^[10] In our patient only the serum lead could be estimated.

Our patient who was a battery worker was found to have lead encephalopathy. He presented with symptoms of one episode of seizure, headache, vomiting, giddiness and on investigations was found to have cerebral edema and infarction in the left basal ganglia posteriorly which may be caused by vasculitis due to lead toxicity. His diagnosis was confirmed by serum level of Lead which came out to be 134 μ g/dl (higher) and he had well responded to use of D-penicillamine, mannitol, and dexamethasone for raised intracranial tension and anti-convulsants for seizures.

In conclusion, burden of lead toxicity may be increasing in developing countries like ours where strict guidelines and screening facilities for workers employed in potentially bio-hazardous occupation may be lacking. So every worker employed in battery workshop and other lead related occupations should be screened for symptoms and signs of lead toxicity, thereby preventing potentially life threatening and disabling manifestations of occupational lead exposure.

Acknowledgement: Authors wish to acknowledge the cooperation of staff of Dr. BRAM Hospital, Raipur, Chattisgarh.

Source of Funding: As the study was done in the existing facilities available in Dr BRAM Hospital

Raipur, no extra expenditure was incurred on the study.

Conflict of Interest: The authors don't have any conflict of interest.

Ethical Committee of: Pt.JNM Medical College, Raipur have given Ethical clearance vide letter No.MCR/Ethics Comm./12/187. Dated 08/05/13.

REFERENCES

1. Ronald Eisler, Lead Hazards to Fish, Wildlife, and Invertebrates: A synoptic review biological report 85(1.14) contaminant hazard reviews, report no. 14, APRIL 1988.
2. I. Segal, D. Saffer, F. Segal, Diverse Neurological Manifestations of Lead Encephalopathy, S. Afr. Med. J., 48, 1721-1722 (1974).
3. Sachdev Yadav, Veena Sharma Lead induced encephalopathy: An Overview International Journal of Pharma and Bio Sciences Vol.2, Issue1, 70 – 86, Jan-March 2011.
4. A.L. Atre, P.R. Shinde, S.N. Shinde, R.S. Wadia, A.A. Nanivadekar, S.J. Vaid R.S. Shinde, Pre- and Post treatment MR Imaging Findings in Lead Encephalopathy, AJNR Am J Neuroradiol 27:902–03 Apr 2006.
5. Vance Vella, Elizabeth O'Brien, Elisa Idris Health impacts of lead poisoning a preliminary listing of the health effects & symptoms of lead poisoning, Health Impacts of Lead Poisoning Update 23rd March 2011.
6. S Cairney, P Maruff, C B Burns, J Currie, B J Currie, Saccade dysfunction associated with chronic petrol sniffing and lead encephalopathy, J Neurol Neurosurg Psychiatry 2004;75:472–476.
7. Bressler JP, Goldstein GW. Mechanisms of lead neurotoxicity. Biochem Pharmacol 1991; 41: 479–84.
8. Perelman S, Hertz-Pannier L, Hassan M, et al. Lead encephalopathy mimicking a cerebellar tumor. Acta Paediatr 1993; 82:423–25.
9. Saryan LA, Zenz C. Lead and its compounds. In: Saryan LA, Zenz C, eds. Occupational Medicine. 3rd ed. St. Louis, Mo: Mosby; 1994:506–41.
10. Jayanti Mani, Nalin Chaudhary, Makarand Kanjalkar, Pravina Ushah Cerebellar ataxia due to lead encephalopathy in an adult, J Neurol Neurosurg Psychiatry 1998;65:797–806.
11. Teo JGC, Goh KYC, Ahuja A, et al. Intracranial vascular calcifications, glioblastoma multiforme, and lead poisoning. AJNR Am J Neuroradiol 1997; 18: 576–79.

12. Holtzman D, DeVries C, Nguyen H, et al. Maturation of resistance to encephalopathy: cellular and subcellular mechanism. *Neurotoxicology* 1984; 5: 97-124.
13. Landrigan PJ, Todd AC. Lead poisoning. *West J Med* 1994; 161:153-59.
14. Alkhatat A, Menon NS, Alidina MR. Acute lead encephalopathy in early infancy: clinical presentation and outcome. *Ann Trop Paediatr* 1997; 17: 39-44.
15. Whitfield CL, Chien LT, Whitehead JD. Lead encephalopathy in adults. *Am J Med* 1972; 52: 289.
16. Schroter C, Schroter H, Huffmann G. Neurologic and psychiatric manifestations of lead poisoning in adults (case report and review of the literature) [in German]. *Fortschr Neurol Psychiatr* 1991; 59:413-24.
17. Tuzun M, Tuzun D, Salan A, et al. Lead encephalopathy: CT and MR findings. *J Comput Assist Tomogr* 2002; 26:479-81.
18. Reyes PF, Gonzalez CF, Zalewska MK, et al. Intracranial calcification in adults with chronic lead exposure. *AJR Am J Roentgenol* 1986; 146 :267-70.

Fatal Case of Hexaconazole Poisoning: A Rare Case Report

Tanmay Sardar¹, Saswata Biswas², Aniruddha Das², Nirmalya Chakrabarti², Partha Pratim Mukhopadhyay³, Subodh Bhattacharyya⁴

¹Senior Resident, ²Junior Resident, Department of Pathology, ³Professor & Head, Department of Forensic & State Medicine, ⁴Professor & Head, Department of Pathology, Burdwan Medical College, Burdwan

ABSTRACT

Hexaconazol (a systemic fungicide) due to its low toxicity, is very rarely reported in literature of pesticide poisoning. With development of agricultural industries and change in the pattern of cultivation, such poisoning may become more frequent in the future. There is no documented report of death due to acute Hexaconazole poisoning till date. Liver is the primary target of organ damage. Severe involvement of other organs is also evident in this report. This fatal poisoning by Hexaconazole, perhaps the only case so far, is being reported for its rarity.

Keywords: Agrochemical Poisoning, Hexaconazole, Fatal poison, Pathology

INTRODUCTION

Hexaconazole, a systemic fungicide, is presently gaining popularity in Indian agricultural industry. In this report, the autopsy findings (including histology of vital organs) of a fatal case of acute Hexaconazole poisoning are presented with an in-depth analysis of its pathology. Considering all available resources and database on toxicology to the best of our ability, this perhaps is the only case report of fatal Hexaconazole poisoning

The end organ damage noted at autopsy (supported with histopathology) are clearly indicative of multi organ involvement. The documented changes are explained on the basis of earlier animal studies and proposed mechanism of action hexaconazole and its metabolites

Poisoning with Hexaconazole is still rare, acute poisoning is rarer and death due to acute poisoning is even more rare. In this report, the autopsy findings of a fatal case of acute Hexaconazole poisoning have been presented.

Hexaconazole: the compound

It is a systemic fungicide, widely used in agricultural fields, active against Ascomycetes and Baridiomycetes⁽¹⁾. In the Indian market it is available in brand names like Hexon (Hexaconazole 5% EC), Conta Plus (Hexaconazole 5% SC), Hexastar (Hexaconazole 5.5% EC)⁽²⁾ etc.

It is absorbed through oral, dermal and inhalational route; undergoes extensive glucuronidation and produces metabolites like Hexaconazole acid, 5-Hydroxyhexaconazole, 5-Ketohexaconazole and Hydroxyketohexaconazole. It inhibits cytochrome P450 monooxygenase and causes subsequent hydroxylation of steroids and fatty acids⁽¹⁾. It is excreted through urine, bile and faeces as well as undergoes enterohepatic circulation⁽³⁾. Hexaconazole has low toxicity. It has been classified as a technical grade active ingredient of pesticide that is unlikely to present acute hazard in normal use⁽⁴⁾. By oral route, LD50 for Hexaconazole is 2180 mg /kg⁽⁵⁾ The LD50 value is a statistical estimate of the number of mg of toxicant per kg of body weight required to kill 50% of a large population of test animals(rats).

CASE HISTORY

On mid September 2013, in the police morgue of Burdwan Medical College, Burdwan, West Bengal autopsy was performed on a 37 year old female from a nearby rural area. She was admitted for 3 days in a private hospital at Burdwan with acute Hexaconazole poisoning. She died due to multi-organ failure following the poisoning.

During autopsy examination, externally there was no specific finding. On dissection, it was found that gastric mucosa was acutely congested and haemorrhagic. The liver was enlarged, hard in

consistency with few pale patches on the surface without any distinct margins. Cut section of liver showed scattered areas of yellowish white patches indicating fatty degeneration. The kidneys were grossly congested and cut section showed both cortical and medullary haemorrhage. The lungs were congested with few whitish patches scattered on the surface. The brain and meninges were congested with no other specific findings.

On histopathological examination, the liver showed degenerative changes in the hepatocytes with fatty changes and prominent sinusoidal spaces and peripheral infiltration of inflammatory cells (Figure 1). The kidneys showed normal looking glomeruli, acute tubular necrosis and wide spread inflammatory cellular infiltration (Figure 2). The lungs showed congestion and hyperinflation with diffuse haemorrhage (Figure 3).

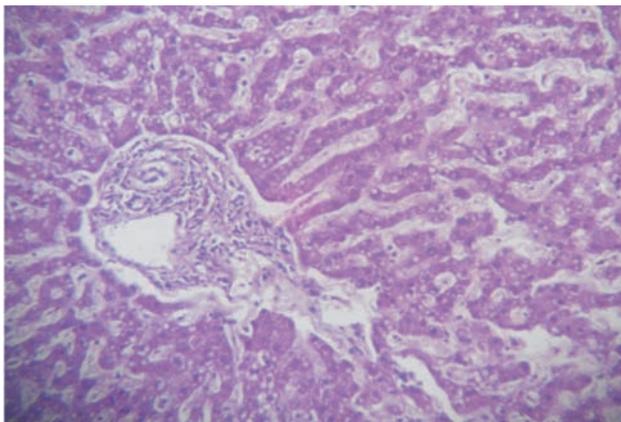


Fig. 1. Microphotograph showing degenerative changes in hepatocytes with fatty changes and prominent sinusoidal spaces and peripheral infiltration of inflammatory cells. [Hematoxylin and Eosin, 10X]

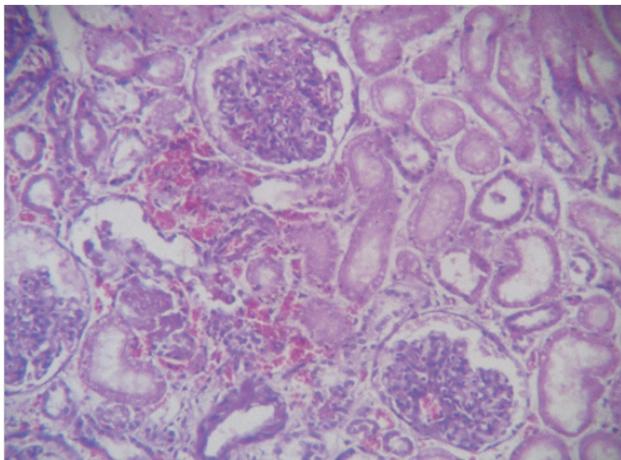


Fig. 2. Microphotograph showing normal looking glomeruli with acute tubular necrosis and wide spread inflammatory cellular infiltration. [Hematoxylin and Eosin, 10X]

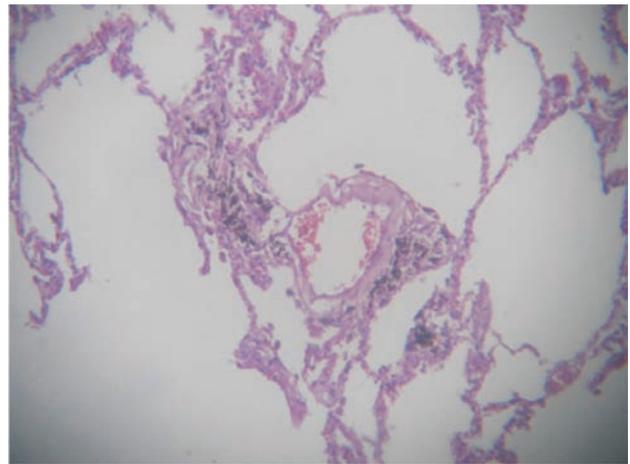


Fig. 3. Microphotograph showing pulmonary congestion and hyperinflation with diffuse haemorrhage. [Hematoxylin and Eosin, 10X]

CASE REVIEW

There is only one reported case of acute Hexaconazole poisoning in human, reported from Christian Medical College, Vellore where the patient had consumed 500 ml of Hexastar and presented with CNS depression and generalized trembling and recovered after supportive treatment⁽²⁾.

DISCUSSION

Suicidal pesticide consumption is very common in agrarian countries like ours. Organophosphates and endosulfan are the leading causes of fatal agrochemical poisoning in the State of West Bengal⁽⁶⁾. Apart from studies from the Northern Indian states where Aluminium Phosphide is a major hazard, the pattern of fatal poisoning is almost similar^(7,8,9).

Poisoning with Hexaconazole is rare and documentation of human poisoning with Hexaconazole is inadequate. One case of Hexaconazole poisoning from South India presented with CNS depression and generalized trembling has been documented. The outcome was complete recovery after supportive treatment⁽²⁾.

Earlier works and reports are primarily on animal studies for chronic and subacute exposure. Those researches have shown liver to be the primary target organ with increase of serum levels of SGPT and Alkaline phosphatase and decrease in plasma urea level. Fatty infiltration of liver parenchyma has been detected by Histopathology. Increase in the weight of liver and kidneys have been reported. Studies have demonstrated that Radio-labeled Hexaconazole is

accumulated in liver, kidney and adrenals. Decreased spermatogenesis and benign Ledig cell tumor were also reported in animal studies. No neurotoxic effect was observed in animals⁽³⁾.

In the present reported case, microscopic changes were found in liver, kidneys and lungs. The hepatic changes were consistent with earlier animal studies. Renal and pulmonary changes is being reported for the first time.

The end organ damage noted at autopsy (supported with histopathology) are clearly indicative of multi organ involvement . The documented changes can be explained on the basis of proposed mechanism of action of Hexaconazole and its metabolites. We also hypothesize that there is a likely involvement of the immune system in the pathology of end-organ damage. Further research with ultra-structural details of organs might be helpful in exploring the mechanism.

The changes in hepatic, renal and pulmonary tissues appeared to be consistent with free radical induced injuries. As there is no specific treatment of hexaconazole, the primary effort should be to remove the poison and provide supportive therapy. The present case report help establish that multi-organ failure, the leading mechanism of death in Hexaconazole poisoning, can be mitigated by adequate protective measure and close monitoring. Also Hexaconazole due to its availability and use, needs to be reckoned with as a formidable poison that might be encountered in clinical practice. Though a rare fatal poisoning, we reiterate the need of adequate facility to detect this poison in Forensic Science Laboratories for benefit in medico-legal cases.

CONCLUSION

Hexaconazole has mild toxicity. Poisoning by this chemical is rare . Fatal case of hexaconazole poisoning is therefore a rarity. Removal from source of poison and supportive therapy is the management for Hexaconazole poisoning. This report shows that though liver is the primary target organ, acute renal failure may also occur in acute poisoning. Cause of death from Hexaconazole poisoning is mainly multi-organ failure. During treatment care should be taken to reduce the free radical induced injury and to overcome the hepatic and renal damages.

ACKNOWLEDGEMENT

H.O.D. of Department of Forensic & State Medicine, Burdwan Medical College, Burdwan and H.O.D. of Department of Pathology, Burdwan Medical College, Burdwan for kind information.

Conflict of Interest: There is no conflict of interest, neither financial nor any other.

Source of Funding: There is no source of funding.

Ethical Clearance: Taken

REFERENCE

1. Hexaconazole Fungicide (Proseed). Canada: Pest Management Regulatory Agency; 2000 Sep 6. 13p. RDD2000-04.
2. David D, Prabhakar A, Peter JV, Pichamuthu K. Human poisoning with hexastar: a hexaconazole containing agrochemical fungicide. *Clinical Toxicology*. 2008, Aug; 46(7): 692-3.
3. Hexaconazole Pesticide Tolerance 6/99 [Internet]. New York: Environmental Protection Agency; 1999 Jun 30 [cited 2013 Nov 21]; 64(125): 35043-9.
4. WHO .The WHO recommended classification of pesticides by hazard and guidelines to classification 2004: 31-35
5. JMPR (1991) Pesticide residues in food – 1990 evaluations. Part II – Toxicology. World Health Organization (WHO/PCS/91.47).
6. Mukhopadhyay Partha Pratim. Studies on Agrochemical Poisoning In North Bengal. Doctoral Dissertation (PhD) University of North Bengal .WB, India.2005: 86-91
7. Mittal N , Shafiq N, Bhalla A, Pandhi P, Malhotra S . A prospective observational study on different poisoning cases and their outcomes in a tertiary care hospital SAGE Open Medicine 2013 DOI: 10.1177/2050312113504213
8. Garg R, Aggarwal S, Singh H, et al. Study of the relation of clin-ical and demographic factors with morbidity in a tertiary care teaching hospital in India. *Int J Crit Illn Inj Sci* 2013; 3: 12–17.
9. Kanchan T, Menezes RG, Kumar TS, et al. Toxicoepidemiol-ogy of fatal poisonings in Southern India. *J Forensic Leg Med* 2010; 17: 344–347.

A Rare Case of Fatal Cardiotoxicity and Methemoglobinemia Following Nitrobenzene Poisoning

B J Kiran¹, P N Venkatarathnamma², S V Srinivas³, K Sabari Girish⁴

¹Final Year Post Graduate, ²Professor, ³Assistant Professor, ⁴Post Graduate (First Year), Department of Medicine, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka

ABSTRACT

A 36 year old rural lady presented with cyanosis and restlessness after ingestion of plant nutrient containing Nitrobenzene 20%. She was diagnosed to be having methemoglobinemia, though treated with methylene blue and symptomatically, she succumbed to death the next day due to severe cardiotoxicity, acute pulmonary edema and cardiogenic shock.

Keywords: Cardiotoxicity, Nitrobenzene, Methemoglobinemia, Methylene Blue

INTRODUCTION

Nitrobenzene is an aromatic compound also known as nitrobenzol or oil of mirbane, used in industries, paint, printing and as lubricant oil. It is a pale yellow, oily liquid, odour resembles that of bitter almonds. In India, 20% nitrobenzene is widely used as pesticides and the lethal dose is reported to range from 1 to 10 gm by different studies¹⁻³. Nitrobenzene ingestion primarily induces methemoglobinemia.

Methemoglobinemia is a condition in which the iron within hemoglobin is oxidized from the ferrous (Fe²⁺) state to the ferric (Fe³⁺) state, resulting in the inability to transport oxygen and carbon dioxide. Methemoglobinemia occurs when methemoglobin levels is more than 2% (normal-0-2% of hemoglobin). Presentation can vary from cyanosis to frank seizures, coma and death reflecting the level of methemoglobinemia. 100% oxygen when fails to correct cyanosis it suggests methemoglobinemia.

Acquired methemoglobinemia is much more common than congenital form. Although exposure to drugs is the most common cause of acquired methemoglobinemia but accidental intake of substances containing oxidizing agents should not be overlooked. Methylene blue is treatment of choice for acquired methemoglobinemia⁴.

We report here a fatal case of acute nitrobenzene poisoning in a suicidal attempt by a 35 year old lady presenting as methemoglobinemia and cardiotoxicity.

CASE REPORT

A 35 year old lady presented to our emergency room with h/o vomiting and breathlessness. She was seen at a local hospital, and then referred to our hospital after gastric lavage. 7 hours prior to presentation, she had consumed around 200 ml of plant nutrient containing nitrobenzene 20% (Ranger is the trade name), with suicidal purpose. There was no h/o convulsions, bleeding manifestations and loss of consciousness.

On examination: There was marked central and peripheral cyanosis present.

Pulse: 110/min, low volume, Blood Pressure: 80/60mmHg, SpO₂:74% with 10 litres of oxygen.

No pallor and icterus, extremities were cold.

Systemic examination

Cardiac system: S₁, S₂ heard, tachycardia present, no S₃ and murmurs.

Nervous system: conscious, restless, irritable, pupils dilated and sluggishly reactive to light

Respiratory and abdominal examination was clinically normal.

Investigations: Hemoglobin :11.5 g% , white cell count:15,600cells/mm³, N:90%, L:10%, platelet count: 2.61 L/mm³. ABG: pH:7.06, HCO₃:16, pO₂:80mmHg, pCO₂: 24mmHg, suggestive of severe metabolic acidosis

LFT: Normal

ECG : Showing sinus tachycardia, r SR's^l pattern in lead 3, deep ST depression and T wave inversion in all the leads



Fig. 1(a). Showing Lead-1:

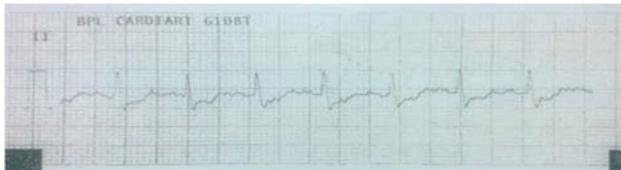


Fig. 1(b). Showing Lead-2:

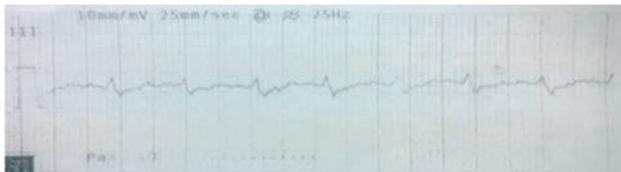


Fig. 1(c). Showing lead 3:

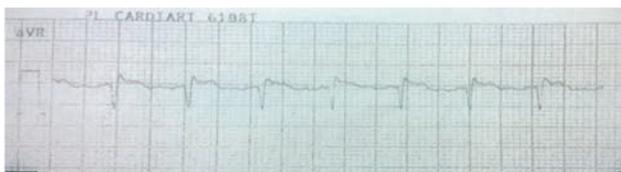


Fig. 1(d). Showing lead aVR:



Fig. 1(e). Showing lead aVL:

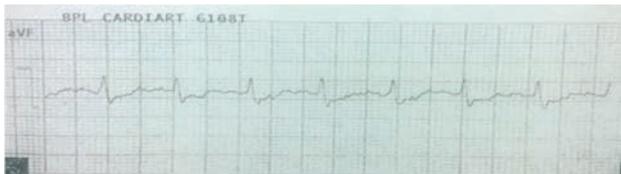


Fig. 1(f). Showing lead aVF:

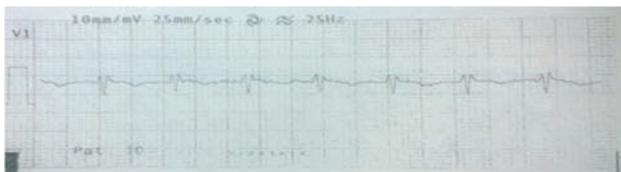


Fig. 1(g). Showing lead V1:



Fig. 1(h). Showing lead V2:

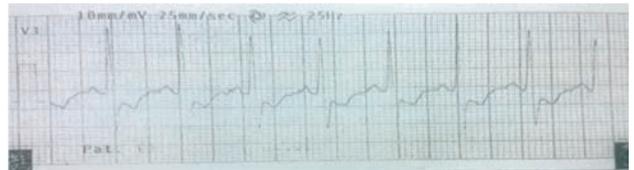


Fig. 1(i). Showing lead V3:

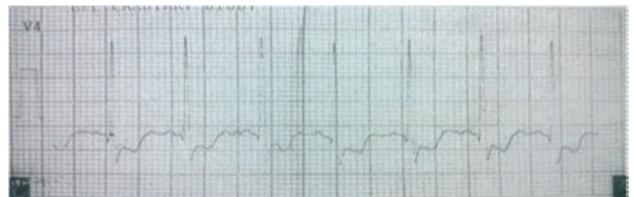


Fig. 1(j). Showing lead V4:

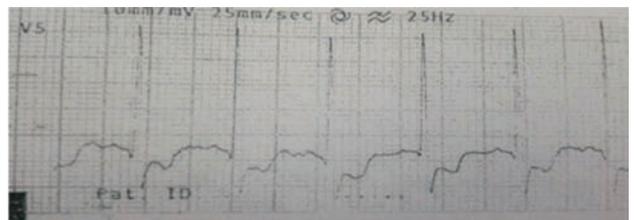


Fig. 1(k). Showing lead V5:

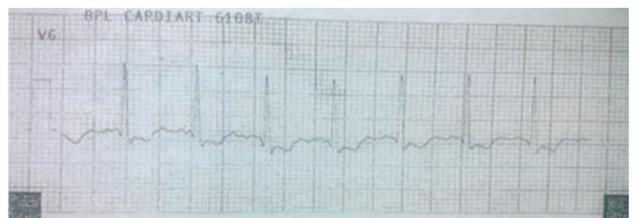


Fig. 1(l). Showing lead V6:

ECHO: Resting tachycardia, no regional wall motion abnormalities, LVEF-50%

Pseudocholinesterase: 4416 U/L.

CK-MB: 36 U/L.

Gross appearance of blood was chocolate brown. Filter paper test for methemoglobinemia was done and found to be positive.(that is dark colored blood of patient didn't get converted into bright red on exposure to air.

Methemoglobin levels-16%.

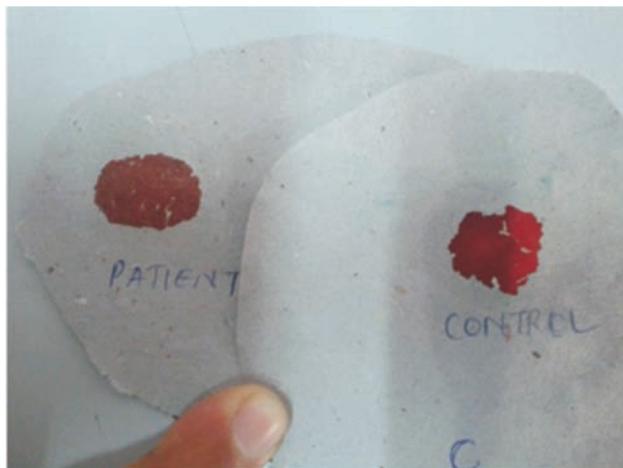


Fig. 2. Showing patient blood which is dark brown color and control blood which is bright red color.

There was no improvement in cyanosis even with high flow oxygen.

Gastric lavage was given with activated charcoal, Methylene blue at the dose of 1 mg/kg was given intravenously, there was no response. Dopamine infusion was started. Repeat ABG showed: pH:7.02, HCO_3^- :10, pO_2 :80mmHg, pCO_2 : 50mmHg, suggestive of persistent metabolic acidosis, without improvement.

6 hours later: A repeat dose of methylene blue was administered. Blood pressure and oxygen saturation didn't improve and tachycardia persisted.

12 hours later: Patient developed pulmonary edema, cardiac monitor showed unifocal ventricular premature beats, ventricular bigeminy, atrial premature beats, sinus tachycardia and ST-T changes persisted. Since she was desaturating she was put on ventilatory support,

24 hours later: patient had sinus bradycardia, cardiac arrest and succumbed to death inspite of resuscitative measures.

DISCUSSION

Normal methemoglobin is less than 1% of the total hemoglobin. Once formed, methemoglobin can be reduced enzymatically either via an Adenine dinucleotide (NADH)-dependent reaction, catalysed by cytochrome b5 reductase, or an alternative pathway utilizing the nicotine adenine dinucleotide phosphate (NADPH)-dependent methemoglobin reductase system⁵.

Acute intoxication is usually asymptomatic up to the level of 10- 15% of methemoglobin, showing only cyanosis. Beyond 20%, headache, dyspnea, chest pain, tachypnea, and tachycardia develop. At 40 - 50%, confusion, lethargy, and metabolic acidosis occur leading to coma, seizures, bradycardia, ventricular dysrhythmia, and hypertension. Fractions around 70% are fatal. Anemic or G6PD-deficient patients suffer more severe symptoms^{5,6}. Leukocytosis has been reported, with relative lymphopenia¹

Other effects include hepatosplenomegaly, altered liver functions, and Heinz body haemolytic anaemia^{5,7}. Liver, stomach, blood, and brain may act as stores and release it gradually⁷.

Recommended treatment is based on the principles of decontamination and supportive management. Methylene blue is the antidote of choice for the acquired (toxic) methemoglobinemia. It is an exogenous cofactor, which greatly accelerates the NADPH-dependant methemoglobin reductase system and is indicated if the methemoglobin levels, which are more than 30%⁶. Methylene blue is converted to leucomethylene blue which is the reducing agent. Leucomethylene blue increases the action of diaphorase-2 by more than five times though normally it has a very low activity. Dose being 1-2 mg/kg followed by bolus of 25-30 ml of normal saline, repeated an hour later upto maximum dose of 7 mg/kg over 24 hours⁸.

Dose beyond 7 mg/kg/day will be harmful as the oxidizing action of methylene blue will become more than the reducing action of leucomethylene blue.

It is contraindicated in patients with G6PD deficiency, because it can lead to severe haemolysis. Ascorbic acid is an antioxidant that may also be administered in patients with methemoglobin levels of more than 30%⁹. Hyperbaric oxygen is reserved only for those patients who have a methemoglobin level > 50% or those who do not respond to standard treatment⁵.

CONCLUSION

We conclude that it is important to diagnose methemoglobinemia at an early stage as it is potentially treatable, if delayed can be life threatening. This patient had predominantly (rare and grave) cardiotoxic manifestations (i.e. tachycardia, persistent hypotension

not responding to inotropes, pulmonary edema, ventricular and atrial arrhythmias, ECG changes, elevated CK-MB and reduced LVEF) which led to her death. As a treating physician one must be aware of these rare complication of nitrobenzene poisoning and manage accordingly.

Acknowledgement: No.

Conflict of Interest: No.

Source of Funding: Self funding.

Ethical Clearance: Obtained.

REFERENCES

1. International Programme on Chemical safety(IPCS) 2003(8.11) Nitrobenzene.Environmental health criteria 230,Geneva:WHO;2003.
2. Toxicological review of Nitrobenzene.Integrated Risk Information system (IRIS);March 2007.
3. Chongtham DS,Phorailatpam,Singh MM,Singh TR.Methaemoglobinemia in nitrobenzene poisoning. J Post grad Med.1997;43:73-4.
4. Verma S,Gomber S.Thinner intoxication manifesting as methemoglobinemia.Indian J Pediatr 2009;76:315-316.
5. Dutta R, Dube SK, Mishra LD, Singh AP. Acute methemoglobinemia. Internet J Emerg Intensive Care Med 2008;11:1092-4051.
6. Chongtham DS, Phurailatpam, Singh MM, Singh TR. Methemoglobinemia in nitrobenzene poisoning. J Postgrad Med 1997;43:73-4.
7. Wakefield JC. Nitrobenzene toxicological overview file format. PDF/Adobe Acrobat Version 1. Available from http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1222068850334: page 1-10.
8. Prasanna L, Rao MS, Singh V, Kujur R, Gowrishankar. Indoxacarb Poisoning: An unusual presentation as methemoglobinemia. Indian J Crit Care Med 2008;12:198-200.
9. Verive M, Kumar M. Methemoglobinemia: Treatment and Medication, e medicine from web med. Available from:<http://www.emedicine.medscape.com/article/956528-treatment>. [cited in 2010].

A Medicolegal Study to Evaluate Relationship between Fingerprint Pattern and ABO Blood Groups

Md Ziya Ahmad¹, R N Karmakar²

¹Associate Professor, ²Professor, Department of Forensic Medicine, IIMSAR(Haldia), W.B

ABSTRACT

The science of identification of fingerprints is an exact science and does not admit any mistakes or doubt. Fingerprint is undoubtedly the most reliable and acceptable evidence till date in the court of law. Due to the immense potential of fingerprint as an effective method of identification an attempt has been made in the present work to analyze their correlation with finger print pattern of right hand thumb and blood group of an individual.

This study was conducted in the department of forensic medicine, IIMSAR, Haldia from January 2013 to July 2013. 50 cases were studied during that period. Among 50 (40 males and 10 females) finger print samples of right hand thumb belonging to the age group of 25 to 40 yrs, the study shows that highest frequency of loop pattern were seen in 'O' blood group 68.18%, followed by 'AB' 66.66%, 'B' blood group 53.33% & 'A' 50% respectively. Whorls pattern were common in blood group A (40%) & B (33.33%).

Keywords: Finger Print, Right hand Thumb, Blood Group

INTRODUCTION

A reliable personal identification is critical in the subject of forensic medicine as it faced with many situations like civil, criminal, commercial and financial transaction frauds, where the question of identification becomes a matter of paramount importance.

Although fingerprints were used as a means of identification for a long time but in this study we have made an effort to take steps further to "Study a relationship between Fingerprint pattern and ABO Blood group", so that one can get an idea about the expected blood group from the study of fingerprint pattern and vice-versa.

Corresponding author:

Md Ziya Ahmad

Associate professor,

Department of Forensic Medicine, ICare Institute of Medical Sciences, Haldia, Purba Midnapur, West Bengal, Pin- 721645

Email: dr.ziyaahmad@gmail.com

Ph. No. - 09931198245

The finger prints are capable of endless variation, so that it has been speculated that there is one chance in 64 millions of 2 persons of having identical finger prints. The patterns are not inherited and is different even in identical twins.

Medicolegal Importance of Fingerprints^{2,3}

- The recognition of impression left at a crime scene, e.g. weapons, furniture, doors, utensils, cloths etc. establish the identity of the criminal.
- Identification in case of accidental exchange of newborn infants.
- To maintain identity records.
- Cheques, bank notes and other legal documents can bear a finger print.

Fingerprint as biometrics: Fingerprint reader is a computerised automatic fingerprint reading system which can record each fingerprint data in seconds. Pattern of 8 fingers are recorded excluding little fingers. The light reflection from a fingerprint can be measured

and converted to digital data which is classified, codified and stored in computers.

Blood

The evidence available through blood typing is not as convincing as genetic fingerprinting but it can readily prove innocence or increase the probability of a defendant being guilty.

Antigen of ABO system can be detected even prior to birth. These antigens are detected by testing red cells with specific AntiA, AntiB and AntiO sera. The corresponding antibodies are determined by using known red cells of A, B and O groups.

MATERIALS AND METHOD

The present study was conducted in the Department of Forensic Medicine from January 2013 to July 2013. Total 50 (40 males and 10 females) cases were included in this study. Those persons who were suffering from infectious or contagious diseases were not included in present study. Before taking the impression each subject was asked to wash their hands and fingers and dry them. Plain impression is taken by lightly pressing the inked bulb surface of right thumb on the paper without any turning movement.

Rolled impression of the subject was taken by first inking the bulb surface of the thumb between the nail boundaries and then rolling the inked finger on the

white paper from one side to another. After taking the fingerprint, the details Name, Age, Address were noted. The next step was to determine the blood group of the subject.

The presence of blood group substance is shown by an agglutination of the red cells when these are mixed with appropriate antisera. The distribution dermatoglyphic fingerprint in right hand thumb of individuals and its relationship with different ABO blood groups was evaluated and analysed.

RESULTS AND OBSERVATIONS

In 7 months study total 50 cases were taken in the Department of Forensic Medicine to evaluate the relationship between right thumb fingerprint and ABO blood groups.

1. Total no. of male cases taken for the study were 40 (80%) and female 10 (20%).
2. The distribution of finger print pattern of right hand thumb among 50 samples taken are:- highest frequency were of Loops pattern with 30 (60%), while frequency of Whorls pattern were 17 (34%) and lowest frequency was of arch pattern with 3 (6%).
3. The present study shows that loops pattern were highest in "O" blood group 68.18%, followed by "AB" 66.66%, "B" group 53.33% and "A" blood group 50% respectively.

Table 1: Distribution of Fingerprint Pattern in Cases:- N=50

Pattern of Finger print	No. of Persons	Percentage
Loops	30	60%
Whorls	17	34%
Arches	3	6%
Composites	0	0
Total	50	100%

Table 2: Distribution of Blood Groups in relation to Sex:- N=50

Sex	BLOOD GROUP							Total
	A '+'	A '-'	B '+'	B '-'	O '+'	O '-'	AB	
Male	6	2	9	2	17	2	2	40
Female	2	0	4	0	2	1	1	10
Total	8	2	13	2	19	3	3	
Grand-total	10		15		22		3	50

Table 3: Distribution of Fingerprint Pattern in relation to sex:- N=50

Sex	FINGER PRINT PATTERN				Total
	Loops	Whorls	Arches	Composite	
Male	24	14	2	0	40
Female	06	03	01	0	10
Total	30	17	3	0	50

Table 4: Distribution of various Fingerprint pattern in relation to Blood groups:- N=50

Fingerprint Pattern	BLOOD GROUP				Total
	A	B	O	AB	
Loops	5(50%)	8(53.33%)	15(68.18%)	2(66.66%)	30
Whorls	4(40%)	5(33.33%)	7(31.81%)	1(33.33%)	17
Arches	1(10%)	2(13.33%)	0	0	3
Composites	0	0	0	0	0
Total	10	15	22	3	50

Few samples of Fingerprint pattern with Name, Sex and Blood Group



Figure 1:Gulam Sex M
AB+Ve Loop



Figure 2:Lalita Sex F
B+Ve Arch



Figure 3:Shankar Sex M
O+Ve Loop



Figure 4:Abhay Sex M
B+Ve Loop



Figure 5:Roshan Sex M
B+Ve Loop



Figure 6: Sanjay Sex M
B+Ve Loop



Figure 7: Bikash Sex M
B+Ve Whorl



Figure 8: Hemant Sex M
B+V Whorl



Figure 9:Yash Sex M
O+Ve Loop



Figure 10:Veto Sex M
O+Ve Loop



Figure 11: Puleno Sex F
O+Ve Loop



Figure 12:Aziz Sex F
O+Ve Loop

DISCUSSION

The present study revealed that blood group O and AB had highest incidence of loops (68.18% and 66.66% respectively) followed by whorls (31.81% and 33.33% respectively). Similarly in blood groups A and B has loop pattern 50% and 53.33% respectively. Finally frequency of arch pattern in blood group A and B were 10% and 13.33% respectively. ¹Bharadwaja et al(2004) reported that loop pattern were highest in blood group AB and O and common in Blood group in A & B. ⁴Noor et al(2010) & ⁵Rastogi et al(2010) shows in their studies that whorl type is common in A & B blood groups. So this study is consistent with other studies made previously.

Summary and Conclusion

The present study shows that loops pattern were common in blood group O & AB 68.18%, 66.66% respectively; whereas in blood groups A & B were 50% & 53.33%. In this study there is a strong correlation between blood group & fingerprint pattern. The science of fingerprint was known in ancient Asyria and was used for purpose of identification in 700 A.D. In 1899, an act was passed by Indian Council that the evidence given by experts to decipher fingerprints was relevant in any case.

Now-a-days fingerprint is the ideal tool in both civil and criminal cases for the purpose of identification.

ACKNOWLEDGEMENT

We sincerely thanks to Principal IIMSAR(Haldia) and tutors of the Department of Forensic Medicine for their cooperation, support and constructive suggestion.

Conflict of Interest: Nil

Source of Funding: Internal Source and self sponsored.

Ethical Clearance: Taken

REFERENCES

1. Bharadwaja, A.Saraswat, P.K. Agarwal, Bharadwaj (2004) – Pattern of Fingerprints in different ABO blood groups.
2. Dr. K.S. Narayan Reddy – The Essentials of Forensic Medicine and Toxicology 24th Edition 2005 (46-48 p).
3. Modi's Medical Jurisprudence and Toxicology – 33rd Edition (514-520 p).
4. Noor, F.I. Farida N. and Irshad, A.H. (2010) - Relation between Fingerprints and different blood groups' Forensic Medicine 2012 June 19(1) 18-21.
5. Rastogi, Prateek, Ms Pillai, Keerthi, R. (2010) – A Study of fingerprints in relation to gender and blood group. Journal of Indian Academy of Forensic Medicine 2010, vol. 32 issue 1.

Estimation of Stature & Sexual Dimorphism from Dimensions of Palm in Living and in Cadavers

More Raghunath S¹, R J Patil², G V Kesari³, B N Umarji²

¹Assistant Professor, Dept of Anatomy, Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat, ²Prof. Dept of Anatomy, KIMS Karad, ³Prof. Dept of Anatomy, Gujarat Adani Institute of Medical Sciences, Bhuj, Gujarat

ABSTRACT

Introduction: Estimation of stature of individual from measurement of different parts of body has always been of particular interest to the anthropologist for long time. In forensic medicine also the estimation of stature from the hand length, foot length, forms an important piece of evidence in court of law.⁹

Materials and Method: Present study was done with 200 subjects (100 males and 100 females) and also 50 cadavers (25 Males and 25 Females) age above 25 years, in the Department of Anatomy, Krishna Institute of Medical Sciences, Karad and different Medical colleges in western part of Maharashtra. Measurements like Hand Length, Hand Breadth, were taken independently on the right and left side of each individual. Beside these, stature of each individual was also recorded. These parameters were analyzed using a standard computer programme. Duration of the study was one year.

Results: In present study, males show higher mean values in each anthropometric dimension than among females. Concerning bilateral asymmetry, only the hand breadth in both the sexes showed statistically significant asymmetry and the right side shows preponderance over the left side in this right handed sample. Correlation coefficients of the length measurements are higher than that of breadth measurements in both the sexes. It is observed that in males, the highest correlation is exhibited by right hand length ($r = 0.723$). There is no difference in the values of hand dimensions in living male and male cadaver, as well as in living female and female cadaver. We can consider either of the value in the medico legal cases for estimation of stature for identification of person in suspected cases. Regression equations were derived for the stature estimation.

Conclusion: The bilateral variation which is insignificant for all the measurements except hand breadth in both the sexes ($P < 0.01$). Sex differences were found to be highly significant for all the measurements ($P < 0.01$). Linear regression equations for stature estimation were calculated using the all the mentioned variables. These regression equations were checked for their accuracy by comparing the estimated stature and actual stature.

Keywords: Stature Estimation, Hand Length, Hand Breadth, Sexual Dimorphism

INTRODUCTION

All the human being occupies this globe to the same species i.e. Homosapiens.¹No two individuals are alike

Corresponding author:

Raghunath Shahji More

Doctors Quarters, Block 'O'

Room No. 01, Shramati Kashibai Navale Medical

College And General Hospital

Narhe (Ambegaon) Pune -411041

Mobile No: 09601060934, 09922403479

Email id: psychiatry.more@gmail.com

in all their measurable traits; even genetically identical twins (Monozygotic) differ in some respects. These traits tend to undergo change in varying degrees from birth to death, and skeletal development is influenced by number of factors producing differences in skeletal proportions between different geographical areas. Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of human body and skeleton. The ultimate aim of using anthropometry in forensic science is to help the law enforcement agencies in achieving 'personal identity' in case of unknown human remains.² Anthropometric

characteristics have direct relationship with sex, shape, and from an individual and these factors are intimately linked with each other.⁵ Relationship between the dimensions of individuals body segment and while body have been of interest to artists, anthropologists, scientists, for many years.⁷ Artist use dimensional relationships in depicting the ideas of beauty, and this resulted in creation of rules of body proportions. The earliest evidence of use such rules come from the ancient Egyptians. Applications of anthropological study are very vast anthropological measurements are utilized for designing proper equipments for industries, defense forces.⁹

In management of patients of burns body surface area is calculated from height and weight where hand-length helps in estimation of height. This study can be useful in artificial limb centers in calculating appropriate length of prosthesis.⁹ This study also be useful in corrective surgeries for leprosy patients, amputation of limb surgeries for accidental injuries. The derived formulae can help to calculate stature in case of patients suffering from spine disorders like kiphoscoliosis. The data collected can be useful in further anthropological studies also. This study is also helpful in forensic medicine for if a hand specimen of medico legal case is found we can estimate the probable stature of that person. So an attempt is made to establish a relation between hand length, hand breadth and stature of an individual.

MATERIALS AND METHOD

The present study consists of a cross-sectional sample of 200 male and females and 50 cadavers from western part of Maharashtra age above 25 years.

The sample for the present study taken from different medical colleges in western part of Maharashtra such as

- I) Krishna Institute Of and Medical Sciences University Karad.
- II) B.J Medical College Pune.
- III) Bharati Vidypeeth Pune.
- IV) Smt. Kashibai Navale Medical College and General Hospital Pune.

Ethical clearance was given by ethical committee KIMS karad. Anthropometric measurements viz. Hand Length, Hand Breadth, were taken independently on

the right and left side of each individual with vernier caliper. Stature of each individual was also recorded.

- Only right handed subjects were considered for in the present study.
- All the measurements were taken in a well lighted room.
- Before taking the measurements, each subject was asked to remove the shoes.
- The measurements were taken by one observer (AS) in order to avoid inter-observer error.
- The measurements were taken using standard anthropometric instruments in centimeters to the nearest millimeter according to the techniques described by Vallois¹².
- The subjects included in the study were healthy and free from any apparent symptomatic deformity.
- All the measurements were taken at fixed time between 2.00 to 4.30 pm.
- The data were subjected to statistical analysis using statistical package for social sciences (SPSS) and regression formulae were calculated for various combinations to reach the best estimate possible.

Measurements are taken as shown in Photo no. 1, 2, 3 stature, hand length, hand breadth respectively.

STATURE : It is the vertical distance between the point vertex and the floor.

Technique: The subject is made to stand in an erect posture and measurement is taken without any wear on head and foot. The subject should stand up against the wall, feet axis parallel or slightly divergent with head balanced on neck in F.H. plane. Hands should hang down. If a wall is not available the subject should stand in an erect posture on a leveled floor. Held the anthrop meter vertically in front of the subject exactly in mid-sagittal plane and by the right hand, movement of cross rod is controlled. No pressure should be exerted since this is a contact measurement.

HAND LENGTH: Anterior aspect of the hand is called as palm so palmar length is taken as hand length. It is projected distance between the point's inter-stylian and the tip of the third finger.

HAND BREADTH

Anterior aspect of the hand is called as palm so palmar breadth is taken as hand breadth.

It is the distance between the most prominent point, out-side of the lower epiphyses of the 2nd metacarpal (metacar-pal radiale) to the most prominent inside point of the lower epiphyses (metacarpal ulnare) of the 5th metacarpal.

RESULTS AND DISCUSSION

Stature, hand length, hand breadth, of living male and female, cadaver of both sexes were measured. Parameters are analyzed using a standard computer programme and comparison was done as shown in (Table No. 1, 2, 3, 4). Linear regression equations were derived for the stature estimation by hand length, hand breadth of male and female .It was compared with actual stature and estimated stature as shown in (Table No.5).

There is difference in mean values of right and left hand length of male and female but there was no statistically significant difference.

In both sexes hand breadth of right and left hand shows statistically significant difference. (Table No.2)

As shown Table No.1 there was a statistically highly significant difference in both the sexes between right and left hand length, and breadth.i.e. both the parameters shows clear cut sexual dimorphism.

In our study we compared the parameters live male and female with male and female cadaver in (Table No .3) and (Table. No.4) respectively, but there was no statistically significant difference in hand length and hand breadth between right and left hands. It shows that we can consider either of the value in the medico legal cases for estimation of stature for identification of person in suspected cases.

As shown in (Table No.5).The correlation coefficient between stature and Right hand length was + 0.7231 in male and + 0.6521 in female which was most significant. It means there is a strong bond between stature and Right hand length and if either of the measurement (Right hand length or stature) is known, the other can be calculated and this would be useful for Anthropologists and Forensic Medicine experts. Linear regression equations are given in (Table No.5).

It is also noticed that females of western part of Maharashtra exhibit a low SEE ($\pm 4 -5.56$ cm.) and a relatively higher correlation coefficient between stature

and all the dimensions of hands than those observed in their male counterparts SEE($\pm 5 -6$ cm.). It suggests that the accuracy in predicted stature would be greater among females than that of males.

Comparison of actual stature and stature estimated from measurements of hands using linear

Regression equations. Minimum, maximum and mean values of the measurements were substituted in their respective regression equation and the estimated stature is calculated. Correlation coefficients of the length measurements are higher than that of breadth measurements in both the sexes.

CONCLUSION AND RECOMMENDATIONS

The results of the present study show that the dimensions of hands and feet can successfully be used for estimation of stature by law enforcement agencies and forensic scientists. The only precaution which must be taken into consideration is that these formulae are applicable to the population from which the data have been collected due to inherent population variations in these dimensions which may be attributed to genetic and environmental factors like climate, nutrition etc.

- Regression equation derived can be of help in artificial limb centers for construction of prosthesis required in cases of amputations following gangrene, trauma, frostbite etc.
- Regression equation derived for stature from other parameters can be utilized to calculate stature in patients suffering from spine disorders like kyphoscoliosis.
- The different formulae derived can be useful for corrective surgeries for leprosy patients.
- Regression equation derived for the stature of individuals can be applied to calculate stature and then body surface are in patients of burns.
- Correlation between various parameters can help in medico- legal cases for identification of body parts as well as for identification of in war casualties.
- This study is help to provide database for biometrics.
- The data collected can be utilized for future anthropological studies.
- Present study helpful for the sexual dimorphism in medico legal cases.

Table 1. Male to female comparison

Sr. No	Hand Length				Hand Breadth			
	Male	Female	Male	Female	Male	Female	Male	Female
1 Sex	Right	Right	Left	Left	Right	Right	Left	Left
2 Side	100	100	100	100	100	100	100	100
3 Sample Size	15.3	14.7	15.1	14.7	7.3	6.7	7	6.5
4 Minimum	21	18.3	21	18.2	9.4	8.3	9.2	8.3
5 Maximum	18.3	16.64	18.17	16.54	8.194	7.43	7.99	7.292
6 Mean	0.953	0.838	0.970	0.806	0.461	0.319	0.498	0.313
7 [Sd]	0.095	0.084	0.097	0.081	0.046	0.032	0.050	0.031
8 (Sem)	198		198		198		198	
9 Degree of Freedom	12.98		12.88		13.63		11.83	
10 'T' Value	Yes		Yes		Yes		Yes	
11 Statistically Significant Or Not [Yes Or No]	< 0.0001		< 0.0001		< 0.0001		< 0.0001	
12 Two Tailed P Value								

Table 2. Male to male and female to female comparison

Sr. No	Male				Female			
	Hand Length		Hand Breadth		Hand Length		Hand Breadth	
1 Parameter	Right	Right	Left	Left	Right	Right	Left	Left
2 Side	100	100	100	100	100	100	100	100
3 Sample Size	15.3	15.1	7.3	7	14.7	14.7	6.7	6.5
4 Minimum	21	21	9.4	9.2	18.3	18.2	8.3	8.3
5 Maximum	18.3	18.17	8.194	7.988	16.64	16.54	7.43	7.292
6 Mean	0.953	0.970	0.461	0.498	0.838	0.806	0.319	0.313
7 [SD]	0.095	0.097	0.046	0.050	0.084	0.081	0.032	0.031
8 (SEM)	198		198		198		198	
9 Degree of Freedom	0.8675		3.036		0.8257		3.089	
10 'T' Value	No		Yes		No		Yes	
11 Statistically Significant or Not [Yes or No]	0.3867		0.0027		0.41		0.0023	
12 Two Tailed P Value								

Table 3. Male to male cadaver comparison

Sr. No	Hand Length				Hand Breadth			
	Male	Male Cadaver	Male	Male Cadaver	Male	Male Cadaver	Male	Male Cadaver
1 SEX	Right	Right	Left	Left	Right	Right	Left	Left
2 Side	100	25	100	25	100	25	100	25
3 Sample Size	15.3	16.4	15.1	16.4	7.3	7.4	7	7.3
4 Minimum	21	20.2	21	20.2	9.4	9	9.2	8.9
5 Maximum	18.3	18.23	18.17	18.07	8.194	8.2	7.99	7.984
6 Mean	0.953	0.960	0.970	0.969	0.461	0.451	0.498	0.424
7 [Sd]	0.095	0.192	0.097	0.194	0.046	0.090	0.050	0.085
8 (Sem)	123		123		123		123	
9 Degree of Freedom	0.262		0.452		0.058		0.037	
10 'T' Value	No		No		No		No	
11 Statistically Significant or Not [Yes or No]	0.794		0.652		0.954		0.971	
12 P' Value								

Table 4. Female to female cadaver comparison

Sr. No	Hand Length				Hand Breadth			
	Female	Female Cadaver	Female	Female Cadaver	Female	Female Cadaver	Female	Female Cadaver
1 SEX	Right	Right	Left	Left	Right	Right	Left	Left
2 Side	Right	Right	Left	Left	Right	Right	Left	Left
3 Sample Size	100	25	100	25	100	25	100	25
4 Minimum	14.7	14.7	14.7	14.7	6.7	7	6.5	6.8
5 Maximum	18.3	18.3	18.2	18	8.3	7.9	8.3	7.6
6 Mean	16.64	16.95	16.54	16.79	7.43	7.42	7.29	7.21
7 [Sd]	0.838	0.780	0.806	0.720	0.319	0.269	0.313	0.222
8 (Sem)	0.084	0.156	0.081	0.144	0.032	0.054	0.031	0.044
9 Degree Of Freedom	123		123		123		123	
10 'T' Value	1.704		1.398		0.144		1.202	
11 Statistically Significant or Not [Yes or No]	No		No		No		No	
12 P' Value	0.091		0.165		0.885		0.232	

Table 5. Regression equation, actual stature and estimated stature comparison

Sr. No.	Parametres	Sex	Side	Regression Equation	See	Co-relation Coefficient	Mean Actual Stature	Estimated Stature		
								Min	Max	Mean
1	Hand Length	Male	Right	$S = 62.74 + 5.62 \text{ RHL}$	± 5.14	0.723	165.55	148.77	148.81	165.55
			Left	$S = 66.351 + 5.461 \text{ LHL}$	± 5.20	0.715		180.82	148.81	165.55
		Female	Right	$S = 75.66 + 4.56 \text{ RHL}$	± 4.47	0.652	151.64	142.79	181.03	151.64
			Left	$S = 74.03 + 4.692 \text{ LHL}$	± 4.50	0.645		143.00	159.42	151.64
2	Hand Breadth	Male	Right	$S = 91.26 + 9.07 \text{ RHB}$	± 6.15	0.564	165.55	157.44	176.48	165.55
			Left	$S = 96.90 + 8.60 \text{ LHB}$	± 6.08	0.577		157.06	175.97	165.55
		Female	Right	$S = 105.20 + 6.26 \text{ RHB}$	± 5.55	0.340	151.64	147.07	157.08	151.64
			Left	$S = 102.10 + 6.80 \text{ LHB}$	± 5.49	0.363		146.26	158.49	151.64

(RHL- right hand length, LHL-left hand length, RHB- right hand breadth, LHB- left hand breadth)

Technique of height measurement

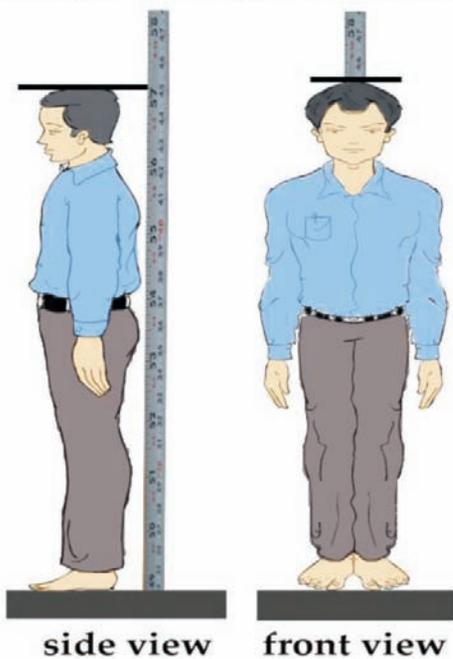


Fig. 1



Fig. 2. Photo Showing the Technique Used For the Hand Length Measurement



Fig. 3 Photo Showing the Technique used For the Hand Breadth Measurement.

Acknowledgement: I express my humble and profound respect to DR. SURESH BACHUWAR my professor and head of the dept. of anatomy, GAIMS BHUJ, for his meticulous advice and appropriate guidance.

Ethical Clearance: From Ethical Committee of KIMS, KARAD

Conflict of Interest- None declared

Financial Support- None declared

REFERENCES

1. Krishan K: Anthropometry in Forensic Medicine and forensicscience- 'Forensic Anthropometry': The Internet journal of forensic science.2007; Volume-2, Number-1.
2. Montagu AA: Handbook of Anthropometry. Springfield, Illinois, U.S.A. Charles C. Thomas Pub Ltd, 1960. Cited in 1.
3. Singh IP, Bhasin MK: Laboratory Manual on BiologicalAnthropology, Anthrapometry. Kamalaraj enterprise, New Delhi, 1989, 4-7.Cited in 9
4. Moenssens AA: Fingerprinting Techniques-Inbau Law Enforcement Series, Radnor, Pennsylvania: Chilton BookCompany, 1995.Cited in 1.
5. Adams BJ, Byrd JE: Interobserver variation of selectedpostcranial skeletal remains. J forensic sciences 2002; 47(6):1193-1202. Cited in 1
6. Topinard P: L Anthropologic: Vol, 1,2nd edition, Paris 1877- quoted by Robins LM. J forensic sciences 1986, Volume-31,Number-1, 143-152. Cited in 9
7. Sultan GS, Emine D, Kizilkanat: Stature Estimation Based On Hand Length and Foot Length. Clinical Anatomy (2005)18:589–596.
8. Chiba M, Terazawa K: Estimation of stature from somatometry of skull. Forensic Sci Int 97:87–92.Cited in 7.
9. Jason DR, Taylor K: Estimation of stature from the length of the cervical, thoracic and lumbar segments of the spine in American Whites and Blacks. J Forensic Sci 1995;40:59–62.
10. Krishan K, Sharma JC: Bilateral upper limb asymmetry and Estimation of stature of a person from arm length and segments.In: Proceedings of IXth all india forensic science conference, state forensic science laboratory (HP), Shimla; 27th–29th April 1995.p.171–8.
11. Patel SM, Shah GV, Patel SV.: Estimation of height from measurements of foot length in Gujarat region. Journal of Anatomical Society of India 2007. 56(1) 25-27.
12. Vallois HV. Anthropometric techniques. Curr Anthropol 1965; 6:127–44. Cited In 10.
13. Tanuj K, Ritesh G.Stature estimation from foot dimensions.Forensic Science International 179 (2008) 241.

A Study of Ossification of Capitate, Hamate, Triquetral & Lunate in Forensic Age Estimation

Ajay Balachandran¹, Moumitha Kartha², Anooj Krishna², Thomas Jerry², Prathilash K², Prem T N²,
Libu G K³, Krishnan B⁴, Liza John⁴

¹Associate Professor, Forensic Medicine, AIMS, Kochi, ²Resident, AIMS, ³Assistant Professor, Community Medicine,
⁴Assistant Professor, Forensic Medicine, T.D. Medical College, Alappuzha

ABSTRACT

The scenario where skeletal age estimation has to be employed arises only very rarely in infancy, but when needed, accurate and specific determination of age becomes imperative. The present study aims to evaluate the ossification of Capitate, Hamate, Triquetral and Lunate in the Kerala population by analyzing wrist X-Rays of 88 children under the age of 5.5 years. ROC curve analysis and ANOVA were the statistical tools employed.

Keywords: Age determination in the living, Capitate, Carpal Bone, Forensic Age Estimation, Hamate, Kerala Data, Lower end of Radius, Lunate, Skeletal Change, Triquetral

INTRODUCTION

Along with secondary sexual characters, and teeth eruption, ossification data is considered to be a reliable indicator of age estimation. Ethnic differences play a role in skeletal maturity.¹ Comprehensive approaches of age estimation which use multiple indicators are inherently superior.^{2,3}

The data which is currently used for age determination from bone ossification in Kerala⁴ is not based on any study published in peer reviewed scientific journals. A study conducted at Calicut (1977)⁵, has not yet been published in peer reviewed journals even though it has found mention in an undergraduate textbook⁶. The data collated in this study itself is incomplete since it does not include many important ossification events like those of carpal bones other than the pisiform. This indicates a large gap in the corpus of knowledge on skeletal ossification of the Kerala population. It is obvious that there is a dearth of published scientific studies to verify the values of ossification followed in the state. The present study attempts to partially fill the gap by collating the time of appearance of Capitate, Hamate, Triquetral and Lunate for use in forensic age estimation.

The legal standards of "preponderance of evidence" and "beyond reasonable doubt" require proof of near

100% probability⁷. So the tests used in forensic age determination should ideally predict the age with near 100% accuracy. There is a need to assess the specificity and sensitivity of the tests used in practice.

MATERIALS AND METHOD

88 wrist X-Rays of children aged less than five and half years taken in the year 2010 and the first half of 2011 (18 month period) collected from the digital archives of AIMS were used for the study. Two X-Rays of one individual taken 1 year and 16 days apart were included in the study. Though the hospital data did not have information on socioeconomic status, date of birth, residential address, complete clinical history, progress notes, investigation results and growth charts were evaluated in all cases.

The collection included X-Rays of both hands. Differences in the ossification of centers between the right and left sides have been noted in literature⁸, but the present study does analyze this difference. The (adjusted) age in years was calculated by counting the number of days between the date of birth and the date of taking X-Ray and dividing it by 365.

Anyone diagnosed with nutritional deficiency; genetic abnormalities; endocrine diseases; global

developmental delay and those cases where stature fell below the 3rd percentile or went above 97th percentile were excluded. The study was confined to residents of Kerala. One case each from Mahe and Lakshadweep were included since these union territories are in linguistic, cultural and geographic contiguity with Kerala.

The present study attempts to put forward sensitive lower cutoff values and specific upper cutoff values for determining age from appearance of the centers in consideration. Radiological evidence of appearance of a particular ossification center is a test which ‘diagnoses’ that the age of the individual is above a particular cutoff value. This cutoff needs to have high sensitivity. When the ossification of one particular center has yet to commence, it can be ‘diagnosed’ that the age of the individual is below a particular cutoff. This cutoff needs to have high specificity. Since a single cutoff cannot be expected to have high sensitivity and specificity at the same time, use of two cutoffs for the lower and upper limits of an age range becomes necessary.

To calculate optimum age range, ROC Curve analysis was done on the data for each ossification

center. ANOVA was used to analyze the variance between different subgroups/categories divided on the basis of the number of carpal bones present.

RESULTS

10 out of 14 districts in Kerala were represented in the study. 62 out of 88 cases (70.5%) were from Ernakulam, Thrissur and Kottayam districts (Figure 1). Thiruvananthapuram, Malappuram, Wayanad and Kannur were not represented in the present study. The sex distribution was even with 43 girls and 45 boys in the study group (Table 1).

Table 1: Age and sex wise breakdown

Age Groups	Male	Female	Total
<0.5	5	4	9
0.6-1.0	9	9	18
1.1-1.5	5	10	15
1.6-2.0	8	9	17
2.1-2.5	5	2	7
2.6-3.0	4	4	8
3.1-3.5	2	3	5
3.6-4.0	1	1	2
4.1-4.5	4	0	4
4.6-5.0	1	0	1
5.0-5.5	1	1	2
	45	43	88

Table 2: Comparison of Kerala Data with other studies.

Carpal Bones	‘Kerala Data’ ⁴	Galstaun ⁹ (Bengalis)		Lall & Nat (Males of U.P.) M. Hassan & D. Narayan ⁹	Bajaj et al 1967 Delhi mixed population ⁶		Present study	
		♀	♂		♀	♂	Adjusted years	In months & years*
Capitate	1 y	6m	6m	6m	1.01(+/-0.25)	1.01(+/-0.25)	0.150- 0.350	1m-5m
Hamate	2 y	8-14m	8-14m	6m	1.01(+/-0.25)	1.06(+/- 1.0)	0.150- 1.000	1m – 1y
Triquetral	3y	2-3y	3-4y	♀ - 3y ♂ - 5y	3.2(+/-1.5)	3.7(+/-1.5)	0.750- 4.150	9m- 4y 2m
Lunate	4y	2-3y	3-4y	6y	4.8(+/-0.22)	6.5(+/-1.5)	1.500- 4.250	1y 6m- 4y 3m

Table 3: Co-ordinates of the ROC Curve for appearance of Capitate and Hamate. (The smallest cutoff value is the minimum observed test value minus 1; the table is truncated at 1.150. The other cutoff values are the averages of two consecutive ordered observed test values). The age range when ossification of capitates commences is between 0.15 and 0.35 years while for hamate, it is between 0.15 and 1.000 year (highlighted).

Positive if Age ≥	Capitate		Hamate	
	Sensitivity	Specificity	Sensitivity	Specificity
-1.000	1.000	0.000	1.000	0.000
.150	1.000	0.667	1.000	0.250
.350	0.976	1.000	0.988	0.500
.450	0.953	1.000	0.975	0.625
.550	0.929	1.000	0.950	0.625
.650	0.882	1.000	0.925	0.875
.750	0.812	1.000	0.850	0.875

Table 3: Co-ordinates of the ROC Curve for appearance of Capitate and Hamate. (The smallest cutoff value is the minimum observed test value minus 1; the table is truncated at 1.150. The other cutoff values are the averages of two consecutive ordered observed test values). The age range when ossification of capitates commences is between 0.15 and 0.35 years while for hamate, it is between 0.15 and 1.000 year (highlighted). (Contd.)

Positive if Age \geq	Capitate		Hamate	
	Sensitivity	Specificity	Sensitivity	Specificity
.850	0.765	1.000	0.800	0.875
1.000	0.718	1.000	0.762	1.000
1.150	0.682	1.000	0.725	1.000

Table 4: Co-ordinates of the ROC Curve for appearance of Triquetral and Lunate. (The smallest cutoff value is truncated at 0.650 and the largest cutoff value at 4.550. The other cutoff values are the averages of two consecutive ordered observed test values). The age range when ossification of Triquetral commences is between 0.75 and 4.15 years whereas Lunate ossifies between 1.500 and 4.550 years (highlighted).

Positive if Age \geq	Triquetral		Lunate	
	Sensitivity	Specificity	Sensitivity	Specificity
.650	1.000	0.241	1.000	0.120
.750	1.000	0.352	1.000	0.253
.850	.941	0.389	1.000	0.307
1.000	.941	0.463	1.000	0.360
1.150	.912	0.500	1.000	0.400
1.250	.794	0.556	1.000	0.493
1.350	.794	0.611	1.000	0.533
1.500	.794	0.648	1.000	0.560
1.650	.765	0.704	.923	0.600
1.750	.765	0.759	.923	0.640
1.850	.706	0.833	.923	0.720
1.950	.647	0.833	.846	0.733
2.050	.618	0.852	.846	0.760
2.150	.618	0.907	.769	0.787
2.300	.529	0.907	.692	0.813
2.550	.529	0.926	.692	0.827
2.750	.500	0.926	.692	0.840
2.850	.471	0.944	.692	0.867
2.950	.441	0.944	.692	0.880
3.050	.353	0.963	.615	0.920
3.200	.294	0.963	.462	0.920
3.400	.235	0.963	.385	0.933
3.550	.235	0.981	.385	0.947
3.650	.206	0.981	.385	0.960
3.900	.176	0.981	.308	0.960
4.150	.176	1.000	.308	0.973
4.250	.118	1.000	.308	1.000
4.550	.088	1.000	.231	1.000

Capitate

Different studies have suggested different cutoffs for age determination using appearance of capitate^{4,6,9} (Table 2). In the present study, the youngest age at which capitate had appeared and the highest age where it was absent were both 0.3 years (Figure 2).

An ROC Curve (Figure 6) was plotted using the co-ordinates (Table 3). The area under the curve was 0.996. The test result variable (age) was shown to have at least one tie between the positive actual state group (capitates present) and the negative actual state group.

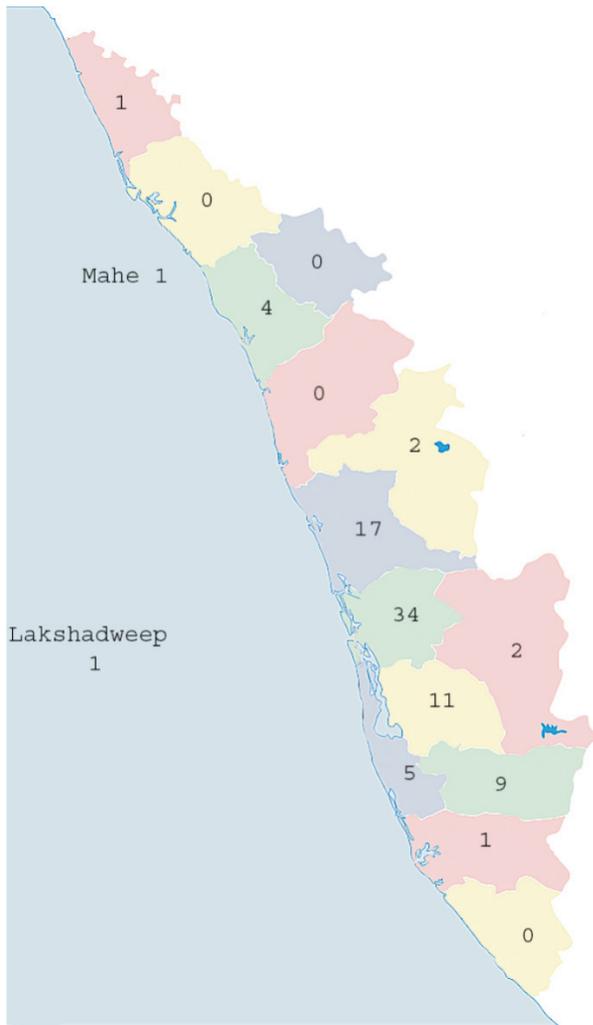


Fig. 1. The distribution of cases

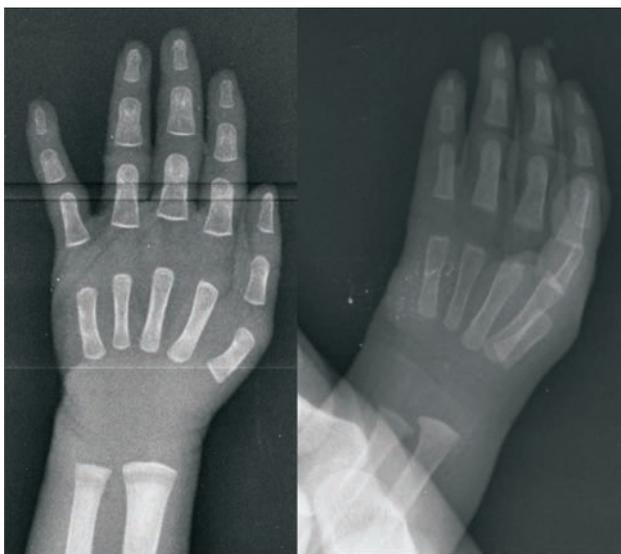


Fig. 2. The left image shows the X-Ray of the oldest subject (3m 19d) where ossification of capitate has not started. The next image shows the youngest subject (3m 9d) where it is present.

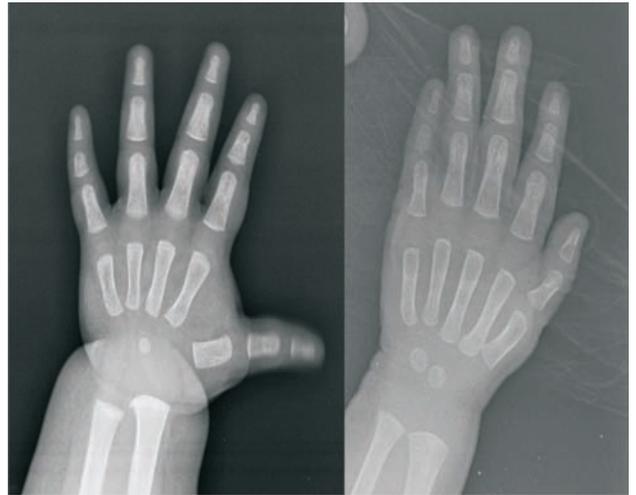


Fig. 3. The left image shows the X-Ray of the oldest subject (10m 22d) where hamate has not ossified. The next image shows the youngest subject (3m 19d) whose X-Ray shows its ossification.

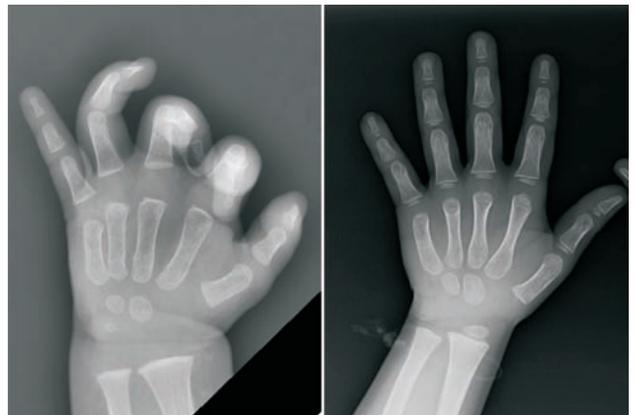


Fig. 4. The image on the left shows the earliest appearance of triquetrum (9m 12d). The image on the right shows the oldest subject (4y 1m 10d) whose wrist does not show the center.



Fig. 5. The image on the left shows the X-Ray of the oldest subject (4y 2m 2d) without ossification of lunate. The image on the right shows the X-Ray of the youngest subject (1y 7m 17d) whose wrist shows the center.

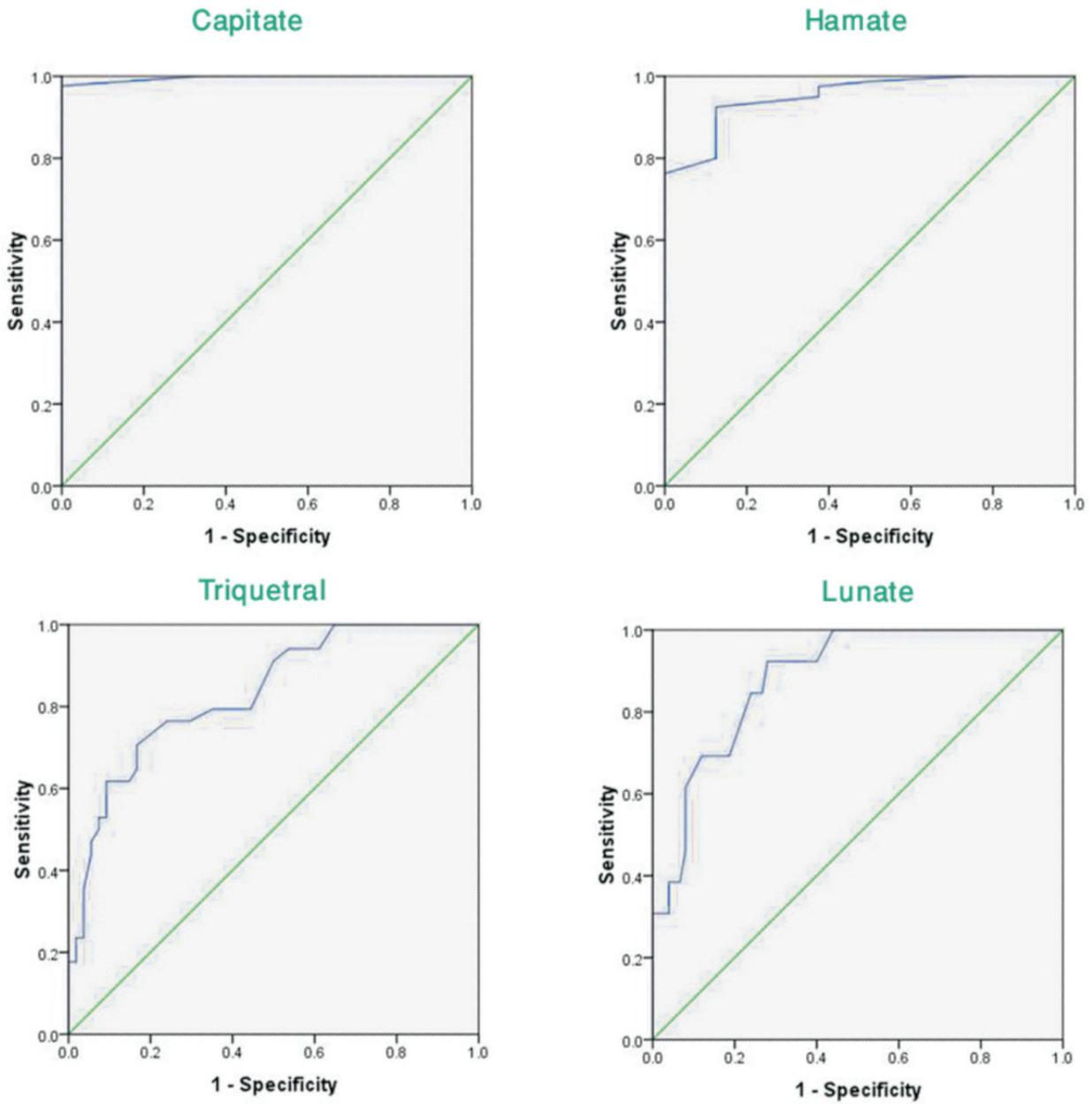


Fig. 6. ROC Curve for appearance of the four carpal bones. Diagonal segments are produced by ties.

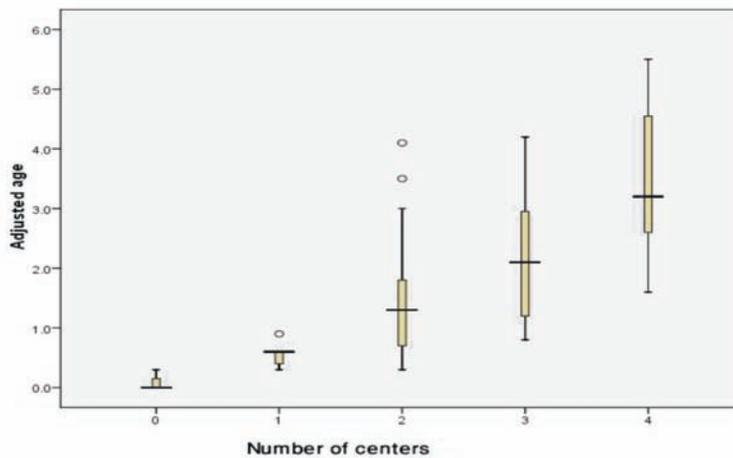


Fig. 7. Box plot showing the differences between five categories.

The data suggests that if 0.15 years (55 days) is taken as the lower limit of the age range and 0.35 years (128 days) is taken as the upper limit, the maximum sensitivity and specificity are obtained. The age range of 1 – 5 months can be used with accuracy in forensic age examination setting (Table 2). While converting the adjusted age in years to months, the lower cutoff limit was adjusted down to the lower whole month to preserve 100% sensitivity. Likewise the upper cutoff was adjusted up so that diagnosis of age would still have 100% specificity. The same method was used for the other centers discussed below.

Hamate

The different cutoffs suggested for appearance of hamate^{4,6,9} can be seen in Table 2. In the present study, the earliest age at which hamate was seen in X-Rays was 0.3 years whereas the oldest subject whose wrist X-Ray did not show the center (Figure 3) was aged 0.9 years.

An ROC Curve (Figure 6) was plotted using the co-ordinates (Table 3). The area under the curve was 0.953. The test result variable (Age) was shown to have at least one tie between the positive actual state group (those with radiologically demonstrable ossification of Hamate) and the negative actual state group.

The data suggests that if 0.15 years (55 days) is taken as the lower limit of the age range and 1 year is taken as the upper limit, the maximum sensitivity and specificity are obtained. The age range of 1 – 12 months can be used for forensic age examination in the practical setting (Table 2).

Triquetral

The different cutoffs suggested by different authors for appearance of triquetral^{4,6,9} can be seen in Table 2. In the present study, the earliest appearance of the center was in the X-Ray of a subject aged 0.8 years and the other extreme where the center was absent at the age of 4.1 years (Figure 4).

An ROC Curve (Figure 6) was plotted using the co-ordinates (Table 4). The area under the curve was 0.833. The test result variable (Age) was shown to have at least one tie between the positive actual state group (those with radiologically demonstrable ossification of Triquetral) and the negative actual state group.

The data suggests that if 0.750 years (9 months) is taken as the lower limit of the age range and 4.150 years

(4years and 2 months) is taken as the upper limit, the maximum sensitivity and specificity are obtained. The age range of 9 – 50 months can be utilized for forensic age estimation (Table 2).

Lunate

The different cutoffs suggested for appearance of lunate^{4,6,9} is shown in Table 2. In the present study, the oldest subject whose X-Ray did not show the ossification center of Lunate was aged 4.2 years. At the other extreme, the center had appeared in a subject aged 1.6 years (Figure 5).

An ROC Curve (Figure 6) was plotted using the co-ordinates (Table 4). The area under the curve was 0.885. The test result variable (age) was shown to have at least one tie between the positive actual state group (those with radiologically demonstrable ossification of Lunate) and the negative actual state group.

The data suggests that if 1.500 years (18 months) is taken as the lower limit of the age range and 4.250 years (4years and 3 months) is taken as the upper limit, the maximum sensitivity and specificity are obtained. (Table 2). The age range of 18 – 51 months can be utilized for forensic age estimation.

Number of Carpal Bones and Age

The mean age of the group was 659.05 days (1.806 years) with standard deviation of 448.039 days (1.2284y). In the present study, the carpal bones were ossified in a constant sequential pattern (capitate first, hamate second, triquetral third and lunate fourth). The group could be divided in to five categories based on the appearance of the individual centers (Figure 7).

For the first category (no carpal bones), the mean age was 43 days (0.1y) with SD of 59.195 days (0.1732y). The second category (capitates present) had a mean age of 200.2 days (0.56y) with SD of 86.326 days (0.2302y). The third category (capitate and hamate present) had mean age of 510.87 days (1.4y) with SD 298.831 days (0.818y). The fourth category (capitate, hamate and triquetral present) had mean age of 815.35 days (2.226y) with SD 378.098 days (1.0252y). In the last category where capitate, hamate, triquetral and lunate had appeared, there had a mean age of 1260.33 days (3.467y) with SD 454.613 days (1.2572y).

The variance in mean age between the above categories (Figure 7) is found to be statistically significant (ANOVA: $P < 0.001$).

Discussion and Conclusions

Like the other ossification centers, the ossification of the bony centers¹⁰ of hands and wrist is also subject to variation. The ossification of the four centers analyzed in the present study confirmed this variation (Table 2).

The present study showed that the age of ossification of capitate, hamate and lunate were closer to the data obtained in Bengal (Galstaun) and UP (Lall & Nat, M. Hassan & D. Naraiian)⁹ than the 'Kerala Data'⁴. It was seen that the ossification of triquetral occurs over a wide age range similar to the range given by the Bengal study. The 'Kerala Data' claims that if a single carpal bone (capitates) alone is present, the age is above 1; two carpal bones mean that the age is above 2; three carpal bones suggest that the age is above 3 and four bones mean that the age is above 4. The present study proves that this is not true (Figure 7).

The 'Kerala Data'⁴ as well as the present study does not take into account the sexual differences, which is a drawback¹¹.

The authors feel that the results of the present study strongly suggest that a series of major studies to collect and standardize data from all parts of the state including all socio-economic sections¹² of the population is needed. Atlases like GOK, the Greulich-Pyle (GP), and the Tanner-Whitehouse (TW3) which are widely used for forensic age estimation¹³ can also be adopted for our population.

Acknowledgement: None.

Conflict of Interest: Nil.

Ethics Clearance: Obtained from AIMS Kochi as per policy.

REFERENCES

1. Soegiharto BM, Cunningham SJ, Moles DR Skeletal maturation in Indonesian and white children assessed with hand-wrist and cervical vertebrae methods *American Journal of Orthodontics and Dentofacial Orthopedics*. 2008 Aug;134(2):217-26.
2. Introna F, Campobasso CP, Biological vs legal age of living individuals, in: Schmitt A, Cunha E, Pinheiro J (Eds.), *Forensic Anthropology and Medicine: Complementary Sciences from Recovery to Cause of Death*, Humana Press, Inc., Totowa, NJ, 2006;57-82.
3. Schmeling A, Geserick G, Reisinger W, Olze A, Age estimation, *Forensic Sci. Int.* 165(2-3) 2007;178-181.
4. Umadethan B. *Personal Identity*. Forensic Medicine 1st ed., CBS Publishers New Delhi: 2011;51-52
5. Balachandran K. *Age Determination from Ossification Changes*. Thesis for MD (Forensic Medicine), Calicut University. 1978
6. Guharaj PV, *Personal Identity*, Forensic Medicine, 1st ed., Orient Longman, Hyderabad, 1982 reprinted in 1999;27 - 32
7. Buchanan A, Norko MA (Eds.) *The Psychiatric Report: Principles and Practice of Forensic Writing*. Cambridge University Press. Cambridge, NY, 2011;222
8. Wankhade PA, Tirpude BH, Khandekar IL, Hussaini N, Wankhade SP *A Roentgenographic Study of Wrist Joint Ossification for Age Estimation in the Male Population of Central India*. *Journal of Forensic Medicine, Science and Law* Vol 22(1) Jan-Jun 2013
9. Mathiharan K, Patnaik AK (Eds) *Modi's Medical Jurisprudence and Toxicology*. 23rd ed., LexisNexis, New Delhi 2011;288-291
10. Garn SM, Rohman CG, Variability in the order of ossification of the body centers of the hand and wrist. *American Journal of Physical Anthropology*. Vol 18(3);219-230.
11. Bala M, Pathak A, Jain RL Assessment of skeletal age using MP₃ and hand-wrist radiographs and its correlation with dental and chronological ages in children. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2010 Apr-Jun;28(2);95-9
12. Santoro V, Donno AD, Marrone M, Campobasso CP, Francesco Introna *Forensic age estimation of living individuals: A retrospective analysis* *Forensic Science International* 193: 2009;129.e1-129.e4
13. Buken B, Erzengin OU, Buken E, Safak AA, Yazıcı B, Erkol Z Comparison of three age estimation methods: Which is more reliable for Turkish children? *Forensic Science International*. 183:2009;103.e1-103.e7

Correlative Study of Gall Bladder with Liver in South Indian Cadavers

Rajendra R¹, Makandar UK², Tejaswi H L³, Ajay N⁴

¹Professor and Head, ²Associate Professor, ³Asst Professor, ⁴PG Dept. of Anatomy, Aims, B G Nagar, Belur, Nagamangala (Taluk), Mandya (Dist) Karnataka

ABSTRACT

78 non-pathological Gall Bladders and Livers were studied morphometrically. The length and breadth of GB was compared with that of the respective liver. The measurements were taken by measuring Tape. Morphologically Normal (Pyriform) GBs were 53.2%, cylindrical 11.4%, oval shaped 11.4%, partially intra hepatic 5.1%, intra hepatic 3.8%, hour glass 6.3%, phrygian cap 3.8%, double GB 1.3%, left sided 2.5%. Metrically length and breadth of GB was highly significant ($p < 0.01$). Correlative coefficient values between length of GB and length of Liver was +0.356 and p value was highly significant ($p < 0.01$). Similarly breadth of GB and breadth of Liver correlative coefficient was +0.242 and p value was significant ($p < 0.05$). By these values of GB we can explore the length and breadth of liver. Hence physiological liver can be differentiated from pathological liver (hepatomegaly) especially during the liver transplantation. This study will certainly help anatomists, anthropologists and medico legal experts to compare the south Indian GB and Liver with that of other parts of the country and abroad. Moreover to radiologists and laparoscopic surgeons during cholecystectomy and liver transplantation.

Keywords: Gall Bladder, South India, Variations, Coefficient

INTRODUCTION

It was a belief that GB diseases were quite common in the short statured, broad faced and asthenic population. [1] Hence attempt is made to study the morphometry of GB because this institution is in South India and majority of the people are short statured with black complexion and are presumed as of Dravidian race. [2]

GB and liver developmentally belong to the same entity, hence length and breadth of the GB is correlated with length and breadth of the respective liver. Moreover the parameters of the GB and liver given in text book belong to European population; hence an

attempt is made here to measure the parameters of GB and liver of South Indian population. The exact capacity of the GB cannot be measured as it may expand 50 times its original volume. [3]

MATERIALS AND METHOD

A total of 78 GB and livers were studied. 38 were from the dissection theater of AIMS which was preserved in the cooler. 40 were studied from Department of Anatomy, Government Medical College, Mysore. Photographs of the variations of GB were taken. The length and breadth were measured by measuring tape (tailor's tape). Statistically, t-test was applied for comparison and correlative coefficient(r) was also studied.

OBSERVATION AND RESULTS

Table No1 - Morphological classification of GB, with percentage and graphs.

Corresponding author:

Rajendra R

Door No 2139, 2nd Cross, 2nd Phase Rajiv Nagar 2nd Stage, Mysore-560019

Ph. No: 9945967597

Email-dr.rajendra.r@gmail.com

Table No 2 – The present morphometric study was compared with previous workers. of India and abroad.

Table No 3 – Comparative study of length and breadth of GB by ANOVA (t) test which is highly significant (p< 0.01).

Table No 4a – Correlative coefficient between length of GB and length of liver which is + 0.356, highly significant p value (p<0.01)

Table No 4b – Correlative coefficient between breadth of GB and breadth of liver was + 0.242 which is significant p value (p< 0.05)

Table No 1. Morphological classification of GB

Particulars	Incidence	Percentage
Normal	42	53.2
oval shaped	9	11.4
cylindrical	9	11.4
hour glass shaped	5	6.3
partially intrahepatic	4	5.1
intrahepatic	3	3.8
phrygian cap	3	3.8
left GB	2	2.5
double GB	1	1.3
	78	98.8

Table 2. Comparison Of Present Morphometric Study Of GB With Previous Workers

Sl. No	Name of The Worker	Year of Study	Place of Study	Max Length (cms)	Max.breadth (cms)	Shape With Percentage	%
1	Lee Mc Gregar Etal	1986	South Africa	7.5-10			
2	Turner & Fulcher	2000	Usa	10	3.5	Elliptical	
3	Moore & Dailey	2006	Usa	7.0-10		Pear Shaped	
4	Cfhari & Shaw	2008	Usa	7.0-10	2.5	Pear Shaped	
5	Vakil & Pomfret	2008	North America	7.0-10	4	Pirifom	
6	Stranding	2008	London	7.0-10		Flask Shaped	
7	Jaba Rajguru, Satyam Khase et al	2012	North India	5.0-12	2.5-5	Normal Gb	85
						Flask Shaped	5
						Cylindrical	3.33
						Hour Glass	1.67
8	Present Study	2013	South India	4.0-11	2.5-5	Normal	53.2
						Oval Gb	11.4
						Cyllindrical	11.4
						Hour Glass	6.3
						Partially Intrahepatic	5.1
						Intrahepatic	3.8
						Phyrigean	3.8
						Left Gb	2.5
						Double Gb	1.3

Table 3. Comparison between length and breadth of GB

Particulars	Sum of Squares	df	Mean Square	t value	p value
GBL * GBB					
Between Groups (Combined)	10799.65	30	359.988	2.825	0.001
Within Groups	5989.338	47	127.433		Highly significant
Total	16788.99	77			

GBB = GB breadth, GBL = GB length.

Table 4(a). Correlation coefficient of length of GB and Liver Correlations

Particulars	GBL	LIVERL
GBL		
Pearson Correlation	1	.356**
Sig. (2-tailed)		.001
N	78	78
LIVERL		
Pearson Correlation	.356**	1
Sig. (2-tailed)	.001	
N	78	78

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4(b). Correlation coefficient of breadth of GB and Liver

Particulars	GBB	LIVERB
GBB		
Pearson Correlation	1	.242*
Sig. (2-tailed)		.033
N	78	78
LIVER B		
Pearson Correlation	.242*	1
Sig. (2-tailed)	.033	
N	78	78

*. Correlation is significant at the 0.05 level (2-tailed).

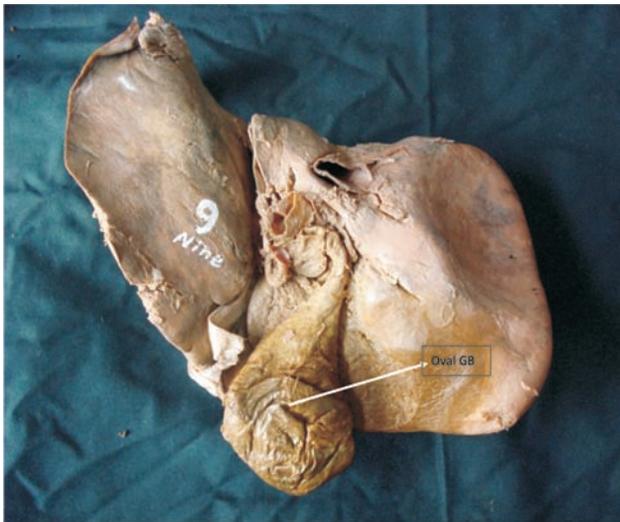


Fig. 1. Specimen showing oval shaped gall bladder

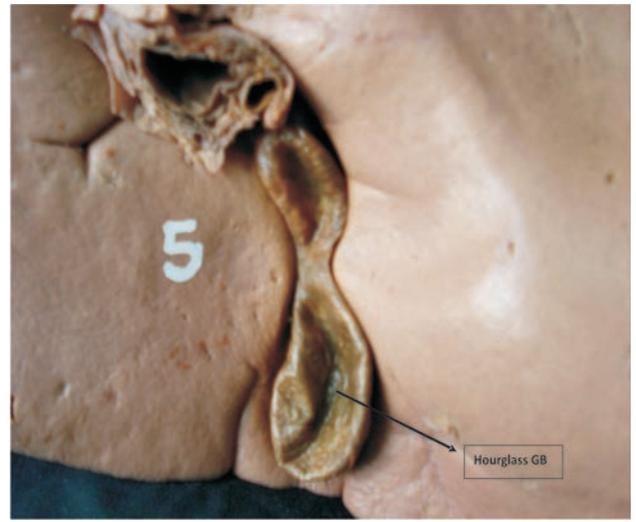


Fig. 3. Specimen showing hourglass shaped gall bladder



Fig. 2. Specimen showing cylindrical gall bladder

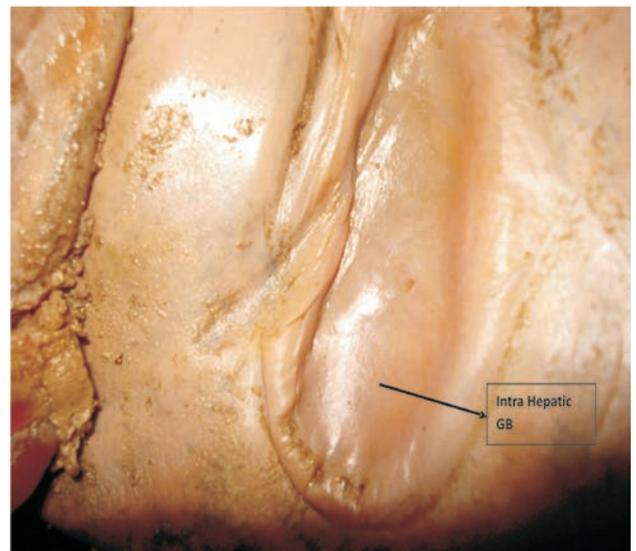


Fig. 4. Specimen showing intrahepatic gall bladder

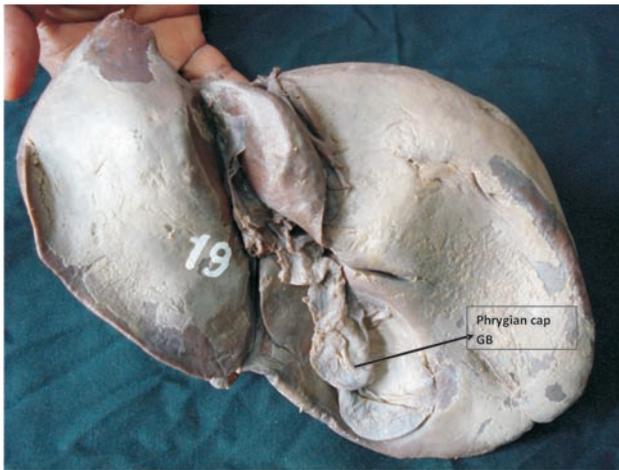


Fig. 5. Specimen showing Phrygian cap anomaly of gall bladder

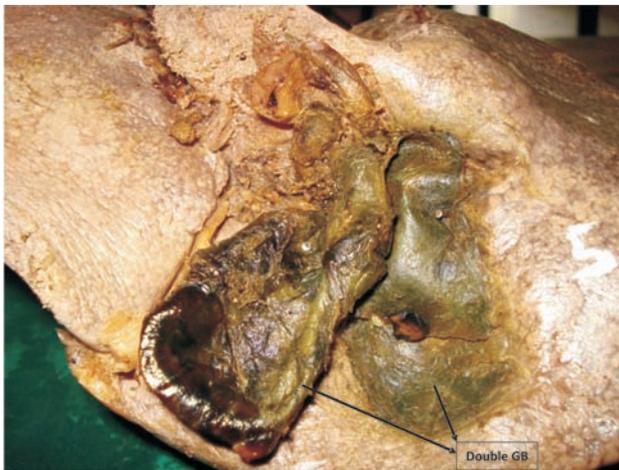


Fig. 6. Specimen showing double gall bladder

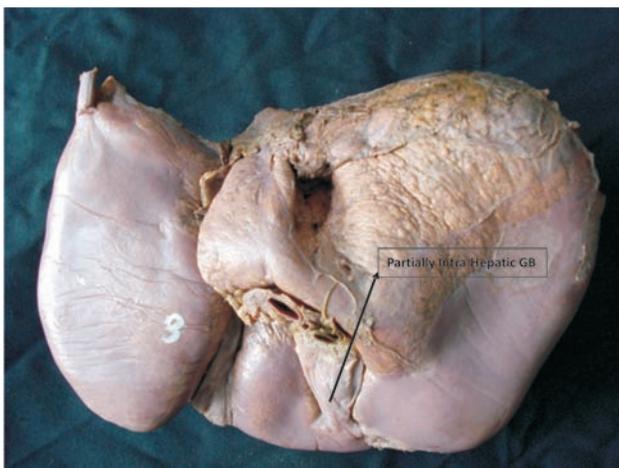


Fig. 7. Specimen showing partially intrahepatic gall bladder

DISCUSSION

In the present study (Table No 1) the normal shape of GB was 53.2% and oval GB was 11.4% (Figure 1), cylindrical GB 11.4% (Figure 2), Hourglass GB was 6.3% (Figure 3), partially intra hepatic GB 5.1% (Fig-7), intrahepatic GB (Fig-4) 3.8 %, phrygian cap GB 3.8%,(Fig-5) left GB 2.5%, double GB 1.3%. (Fig-6) It was also noted that during fetal life, GB is entirely intrahepatic. [3] 2 % left GB was observed in North India.[4] 2% double GB and 3% intrahepatic GB was also observed in Western India. [5][6] 85% normal GB was also reported in North India.[7] The present study was compared with previous workers of India and abroad (Table No 2). There is no exact known cause to define these variations but following are the probable reasons. A) As contraction of GB and secretions of bile are under activation of cholecystokinin and secretin hormones which are released from adreno-axis of pituitary gland, maturations of functional activity of liver depends on adreno-axis of pituitary. Hence role of pituitary may be responsible for these variations. [8] B) Microscopically, there is no muscularis mucosa in GB rather there is a muscularis lamina consisting of irregular anastomosing bundles of smooth muscles running in longitudinal, circular and oblique directions, moreover concentration of bile solely depends on the ability of epithelium which withdraws water and inorganic ions from the bile. The height of the cells of the epithelium is quite variable to respond to the degree of contraction of bile. [8] Hence indefinite muscular framework might have resulted into variations of shape and size of the GB. C) The plasticity of hepatic parenchyma is observed in fetal life as it does not develop completely until several years after birth but with proliferation of hepatic parenchyma there is an increase in the size and shape of the GB, cystic duct and common bile duct hence there is a mutual or reciprocal relation between GB and functional liver as pars cystica is a spur of pars hepatica (9). Hence delay in proliferation or plasticity of hepatic parenchyma might result in Variations of morpho metricity of GB. D). As there is an intimate relation between germ layers, fate or destiny of Anatomy of any gland or organ is difficult to predict, especially in the secondary mesoderm which undergoes such an intimate differentiation that it is hardly possible to follow-(10) Hence it clearly indicates that these variations of the GB and length and breadth

of the liver are resulted in response to the functional need of the body. In the metrical study, length and breadth of GB and correlative coefficient between the length and breadth of GB with liver are highly significant ($p < 0.01$) (Table No 3 & 4 a & b). These values are very much important to the clinician to explore the normal liver and also during liver transplantation. As there is no literature available in English to correlate these values, it can only be hypothesized that glandular cells don't reach full differentiation until their secretory functions are imminent; moreover proteolytic enzymes that are present in the alimentary tract of human fetus are variable even at full term.^[11] Hence there has to be anatomical variations to adapt or cope with physiological functions. Apart from this, genetic signaling requires proper nutrition because each hormone or enzyme is regulated by each gene.^[12] Nutritional^[13], ecological or environmental factors also play a contributory role for deciding the morphometricity of any gland. Anthropologists or anatomists still have much to learn about the relative roles of genetic and direct environmental influences on the variations in the size and shape of glands in humans because humans have developed from the interaction between hereditary and environment.

CONCLUSION

These variations and significant values will certainly help the clinician, anatomist, anthropologist and medico-legal expert to differentiate the South Indian findings with other parts of the country and abroad. Above all this study will help the laparoscopic surgeon to take preventive measures before cholecystectomy and transplantation of liver and the radiologist to differentiate the normal from anomalies. This study warrants for further genetic, embryological and nutritional studies because even though to some extent they are purely anatomical, glandular activities like secretion, concentration and contraction require pharmacological agents or nervous stimulations and secretory functions of the cells which are yet to be established. As GB is cut and discarded if pathological hence least attention is paid for the study.

ACKNOWLEDGEMENT

The author is thankful to Dr. Dakshayani K R, Professor and HOD, Mysore Medical college and Research Institute, Mysore for her kind permission to study the liver and GB and Dr. Srinivasa B M, Asst Prof of Community Medicine for his statistical assistance. Above all I thank my beloved Principal Dr. Shivaramu M G for his constant encouragement.

Conflict of Interest: No

No Finance

This research work has been approved by the ethical committee of the institution.

REFERENCES

1. Hooton. E L – Body built and diseases up from ape. 2nd edition 1931, 688. The macmillan company New York publication.
2. Bhasin M K – Genetic of caste and tribes of Indian population. Milieu. International journal of Genetics 2006, vol6(3), 233-274.
3. Bailey and Love – Short practice of surgery 17th edition, 1977, 878, HK Lewis and company London publications.
4. Chrungoo R K, Kacchroo S L, Sharma A K, Khan A B, Nadeem A S – Left sided GB. Journal of minimal access to surgery. July-sep 2007 vol3(3), 108-110.
5. Gupta Indrajit, Mujumdar, Chakraborty, Ghosh – A study on anomalies of GB and associated structures – J.Anat.soc.India 2012, vol61(2) 205-213.
6. Desolneux G, Mucci S, Lebigot J, Arnaud J P and Hamy A – Duplication of GB – A case report. Hindawi publishing corporation gastroenterology research and practice 2009, 1-3.
7. Jaba Rajguru, Satyam Khare, Jain, Ghai, Singla, Goel – Variations in the external morphology of GB. J.anat.soc.India. 2012, 61(1), 9-12.
8. Myrin Borysenko and Theodore Beringer. Functional histology – accessory digestive organs, 3rd edition, 1989, 357-59, Little Brown and company Boston/Toronto/London publications.
9. Hamilton, Boyd and Mossman's Human embryology. Alimentary system chapter 11th 4th edition, 1976, 343 – 349. The Macmillan publications London and Basingstoke.
10. Gross Clark W.E.Le – tissues of the body 6th edition, 1971, 24, oxford university press publication.
11. Lucas Keene. M F and Hewer E E – Glandular activity in the human fetus. Lancet, July 1924, 37 – 46.
12. Newman M T – Nutritional and genetic adaptations in man. In a Daman (ed) 3rd edition, 1975, 210 – 259, physiological anthropology. New York Oxford University press publication.
13. Karnataka state has 63,000 under fed kids by Sita Laxmi – 27th may 2013, 1st page – Times of India Hubli edition (Daily News paper)

Death due to Consumption of Calcium Hydroxide or "Choonā" Presumed to be a Slimming Agent: An Unusual Case Report

Mohit Chauhan¹, Monisha Pradhan², Jatin Bodwal³, C Beherea⁴

¹Junior Resident, ²Assistant Professor, ³Senior Resident, Department of Forensic Medicine and Toxicology, Maulana Azad Medical College, New Delhi, India, ⁴Assistant Professor, Department of Forensic Medicine and Toxicology, AIIMS, New Delhi, India

ABSTRACT

Calcium hydroxide is a strong alkali which may cause irreversible injury to tissues that comes in contact with this substance. It is commonly consumed as "choona" in paan or betel leaf preparations in this part of the world. We present a rare case of death due to overdose of calcium hydroxide consumed for a strange belief of being a slimming agent. The corrosive effects of calcium hydroxide caused severe bleeding from the upper GI tract and proved to be fatal. The social myths and ignorance with respect to such toxic compounds are resulting in morbidity and mortality even in this age. Here we have discussed the incidence, symptomatology, pathology and manner of calcium hydroxide poisoning.

Keywords: Caustic, Alkali, Calcium Hydroxide, Choonā, Poisoning, Gastrointestinal Damage

INTRODUCTION

Calcium hydroxide, Ca(OH)_2 , traditionally called slaked lime, is a strong alkali having a pH of more than 12 in a saturated state. It is a white amorphous powder obtained when calcium oxide or quicklime is mixed or "slaked" with water. It is known by various names like hydrated lime, builders' lime, pickling lime.¹ It has various edible uses such as pickling and in some Asian countries it is known as "Chuna" and is popularly used as an additive to 'paan' or betel leaf preparations and tobacco. It is known to increase the stimulant effects of alkaloids present in the betel leaf and tobacco.² It is a constituent of many household products like hair removers and hair relaxers and are used in whitewash, mortar and plaster. It is also widely used in endodontic procedures as the initial filling.³

Its toxicity and pathology is similar to any other alkali and causes liquefactive necrosis by denaturing of proteins as well as saponification of fats. It has properties to cause corrosive burns when it comes in contact with skin and mucus membrane.^{1,3} It can cause

severe ocular burns and can lead to permanent damage to the cornea.^{4,6} On ingestion the gastrointestinal damage can be extensive. Alkaline liquids are often highly viscous and thus persist for a longer duration in the esophageal mucosa causing more damage to the esophagus than stomach.³ The incidence of poisoning and chemical burns by calcium hydroxide is less frequent than other alkalis more commonly available in household products and detergents like hydroxides and carbonates of sodium, potassium and ammonia. Here we report an unusual case of calcium hydroxide poisoning resulting from intentional ingestion due to some ignorant false beliefs.

CASE REPORT

A 32 year old man was brought to the emergency department with history of multiple episodes of hematemesis after intentional consumption of calcium hydroxide compound also known as "choona" in the local language. He had been consuming the compound as slurry mixed with water since eight days believing

it to have weight reducing properties as advised by one of his relatives. He had an episode of blood stained vomiting on the third day. However, he refused treatment despite repeated requests by his family members. The deceased was an alcoholic and an auto-rickshaw driver by profession.

On arrival the deceased was conscious, oriented but drowsy. His BP was 170/100mmHg and pulse rate was 84/minute. The respiratory and cardiac functions were normal and clear. The ABG report on the day of arrival was pH: 7.447, PO₂: 107.4mm; PCO₂: 17.3mmHg; 1013; SO₂: unstable, 1013; Hct: out of range 1006; HCO₃: 11.7 mmol/l; SO₂ ©: 98.2 mmol/l; BE: -9.3 mmol/l; BE ecf: -12.4 mmol/l; temp: 37° C. The random blood sugar level was 110 g%. The ABG report on the second day of hospital stay was pH: 7.096; PO₂: 42.5 mmHg; PCO₂:22.7mmHg; SO₂: out of range; Hct: 17.7%; HCO₃: 6.8 mmol/l; SO₂: 53.4%; BE: -21.1 mmol/l; BE ecf: -22.9 mmol/l; temp: 37° C. His treatment included a Ryle's tube gastric lavage, intravenous antacids, antibiotics, fluids and an upper GIT endoscopy was planned. However, his condition deteriorated on the second day of admission and he expired despite resuscitative efforts. The provisional cause of death was given as metabolic acidosis and hyperkalemia following caustic ingestion. Autopsy was requested as death was due to unnatural cause.

AUTOPSY REPORT

At autopsy it was a dead body of a middle aged man of heavy built and good nutritional status weighing 88 kg and of 164 cm height. (Fig 1) The tongue was corroded and appeared brownish black in color. (Fig 2) There were no injuries over the body on external examination. The esophageal mucosa was congested and did not show any gross damage.(Fig 3) Stomach wall was intact with hemorrhagic mucosal wall and contained coffee colored altered blood about 50 cc in volume. (Fig 4)There were areas of ulceration in the gastric mucosa with the largest ulcer measuring 3.0 cms × 1.5 cms × 0.2 cms.(Fig 5) The small intestine contained dark brown color altered blood all along the tract and the mucosa appeared mildly congested with scattered superficial erosions. (Fig 6) Liver showed cirrhotic changes with multiple nodules over the surface and on cut section of varying in size from 0.3 mm to 12 mm. Other internal organs were congested and appeared normal. The cause of death was

hemorrhage and shock consequent upon massive gastric bleed following caustic ingestion and the manner as accidental overdose.



Fig. 1. Image of the deceased showing truncal obesity; the reason for consumption of calcium hydroxide



Fig. 2. Brownish black discoloration of the tongue due to corrosive effects of calcium hydroxide.



Fig. 3. The relatively spared esophageal mucosal wall.



Fig. 4. The hemorrhagic stomach wall with altered blood in the cavity.

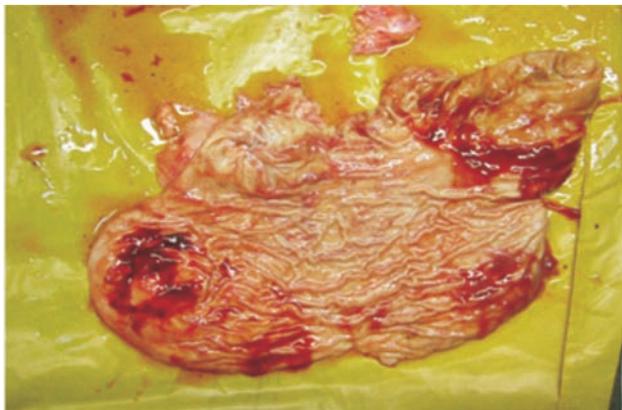


Fig. 5. Stomach wall with patchy areas of hemorrhage and ulcer.



Fig. 6. Intestinal cavity containing altered black colored blood with scattered erosions.

DISCUSSION

Caustic ingestion causes severe injury of gastrointestinal tract and causes significant morbidity and mortality. Household products, containing alkaline caustics, like bleach or sodium hypochlorite, caustic soda or sodium hydroxide, detergents and cleaning agents containing carbonates of sodium and potassium

cause significant proportion of such injuries. Calcium hydroxide, though a strong base, is not frequently found in these products, thus poisoning is rare. However, it is widely used in “paan” preparations in India and the neighboring countries and is a constituent of many products like hair removers and relaxers, whitewash and dental fillings.

Caustic poisonings are usually accidental or suicidal and rarely homicidal.^{1,3,7-12} The manner of poisoning in this case was rather unusual as it was neither suicidal nor accidental but there was an overdose of calcium hydroxide without the deceased having any intention to kill himself. He consumed a packet of “choona” containing about a 10 gm of calcium hydroxide mixed with water daily for eight days. Its fatal dose being 5 -50mg/kg body weight, it was sufficient to cause such damage. Collapse and death can occur within 24 hours in calcium hydroxide poisoning if taken in saturated form.¹ Here death was delayed possibly due to the dilution of the compound. Symptoms and signs after ingestion of Ca(OH)₂ include severe burning pain in the throat and stomach, nausea and vomiting, thirst, and shock.

Corrosives are lethal to the GI tract on ingestion and cause severe damage, life threatening complications and death. The severity of gastrointestinal damage depends upon the type, quantity and concentration of the corrosive substance and the duration of exposure. Holinder and Fridman have classified endoscopic changes into three degrees.¹³ First degree includes superficial damage associated with hyperthermia, epithelial desquamation and mucous edema. Second degree includes transmucous damage affecting all of the mucosal layers, followed by exudation, erosions and ulcerations. Third degree includes transmural damage associated with ulcer’s penetration in the deep layers of the tissue and neighboring organs. In our case, the deceased consumed the alkali over a period of time causing daily accumulation in the gastrointestinal tract. The prolonged contact with the gastric mucosa and small intestine caused third degree damage including severe transmural erosions and deep tissue ulceration. Alkalis usually cause more esophageal damage than gastric mucosa.^{1,3} In this case the esophagus was spared as the “Choona” was consumed after diluting it with water. This decreased the alkali’s viscosity and adherence to the esophageal mucosa causing less contact and minimal damage to it. The early complications of corrosive ingestion are perforation and gastrointestinal bleeding. In this case there was

no perforation but extensive gastrointestinal bleed caused the death of the patient. The metabolic acidosis resulted due to the bicarbonate loss from the mucosal damage of the GI tract caused by the alkali.

CONCLUSION

Calcium hydroxide's wide edible use in "paan" preparations in this region makes it easily accessible and is socially acceptable without inhibition. However, unawareness of its toxicity may cause such unwarranted deaths and morbidity. It may continue to be harmful to the societies where it is traditionally consumed considering its carcinogenic properties. Stricter laws are required to curb its use and awareness of its potential toxicity should be spread among the general public of this region.

Conflict of Interest: The authors declare no conflict of interest in publishing this article.

Source of Support: There is no funding and sponsorship from anywhere for reporting of this case report.

REFERENCES

1. Modi. A Textbook of Medical Jurisprudence & Toxicology, 24th edition, Lexis Nexis Butterworths Wadhwa, Nagpur, 2011.
2. Thomas, S.J.; MacLennan, R. (1992). "Slaked lime and betel nut cancer in Papua New Guinea". *The Lancet* 340 (8819): 577-8.
3. Goldfrank's Toxicologic Emergencies, 9th Edition, McGraw Hill Professional, 2010.
4. Lipski M, Buczkowska Radlińska J, Góra M. Loss of sight caused by calcium hydroxide paste accidentally splashed into the eye during endodontic treatment: case report. *J Can Dent Assoc* 2012; 78:57.
5. Midelfart A, Hagen YC, Myhre GB. Chemical burns to the eye. *Tidsskr Nor Laegeforen*. 2004; 124(1):49-51.
6. Agarwal T, Vajpayee RB, Sharma N, Tandon R. Severe ocular injury resulting from chuna packets. *Ophthalmology*. 2006; 113(6):961
7. Schaffer SB, Hebert AF. Caustic ingestion. *J La State Med Soc*. 2000 Dec; 152(12):590-6.
8. Eyer F, Zilker T. Caustic injuries of the eye, skin and the gastrointestinal tract. *Ther Umsch*. 2009 May; 66(5):379-86.
9. Zarkoviæ S, Busiæ I, Voliæ A. Acute states in poisoning with corrosive substances. *Med Arh* 1997; 51:43-6.
10. Rodríguez MA, Meza Flores JL. Clinical-epidemiological characteristics in caustics ingestion patients in the Hipólito Unanue National Hospital. *Rev Gastroenterol Peru* 2003; 23(2):115-25.
11. Arévalo-Silva C, Eliashar R, Wohlgelernter J, Elidan J, Gross M. Ingestion of caustic substances: a 15-year experience. *Laryngoscope* 2006; 116(8):1422-6..
12. Nuutinen M, Uhari M, Karvali T, Kouvalainen K. Consequences of caustic ingestions in children. *Acta Paediatr* 1994;83(11):1200-5..
13. Chibishev A, Simonovska N, Shikole A. Post-corrosive injuries of upper gastrointestinal tract *Prilozi* 2010; 31(1):297-316.

Abuse of Sections of IPC'S 304 (B) and 498 (A) - A Case Report

R Ravikumar

*Assistant Professor, Department of Forensic Medicine, Rajarajeshwari Medical College and Hospital
Kambipura, Bangalore*

ABSTRACT

Indian penal code is the main criminal code of India. It is a comprehensive code, intended to cover a substantive aspects of criminal law. Indian Penal Code, 1860, sub-divided into twenty three chapters, comprises five hundred and eleven sections. Sections 304B and 498A of the Indian penal code (1) were enacted to make it easier for the wife to seek redress from potential harassment by the husband's family. Dowry laws have come under criticism as they have been misused by women and their families. Here is a case where a woman died alleged had been murdered by her husband and mother in law and was booked under 304B and 498A. During autopsy there was no external injuries or internal injuries found in the body incidentally liver was enlarged weighing 5kg's, histopathology report and chemical analysis reports ruled out the foul play and confirmed the pathology of the deceased. The success of the investigation of dowry death cases largely depends upon forensic medicine experts.

Keywords: *Indian Penal Code, Sections 304B and 498A, Abuse, Autopsy*

INTRODUCTION

IPC section 498a and 304b was originally designed to protect married women from being harassed or subjected to cruelty by husbands and/or their relatives. In the last 20 years of criminal law reform a common argument made against laws relating to violence against women in India has been that women misuse these laws. The police, civil society, politicians and even judges of the High Courts and Supreme Court have offered these arguments of the "abuse' of laws vehemently⁽²⁾. Many instances have come to light where the complaints are not bonafide and have been filed with oblique motive⁽³⁾. The allegation of misuse is made particularly against Sec 498A of the IPC, and against the offence of dowry death in Sec 304B. Investigations into the death in such cases should be investigated upon by all the necessary experts, essentially beginning from scene of crime specialists to the DNA fingerprinting specialist and all modern techniques shall be used for proper and prompt investigation of all alleged dowry death cases⁽⁴⁾.

Definition of 304-B I.P.C (Dowry death) refers to⁽¹⁾ Where the death of a woman is caused by any burn or bodily injury or occurs otherwise than under normal circumstances within seven years of her marriage and

it is shown that soon before her death she was subjected to cruelty or harassment by her husband or any relative of her husband for, or in connection with, any demand for dowry, such death shall be called "dowry death"⁽⁵⁾ and such husband or relative shall be deemed to have caused her death.

- (2) Who ever commits dowry death shall be punished with imprisonment for a term which shall not be less than ten years but which may extend to imprisonment for life.
- Chapter XX-A of Indian Penal Code, 1860, refers to 'cruelty by husband or relatives of husband' and includes section 498-A. 498-A refers to 'cruelty by husband or relatives of husband' States that whoever being the husband or relative of the husband of woman, subjects such woman to cruelty shall be punished with the imprisonment for a term which may extend to three years and also be liable to fine.
- The two sections are not mutually inclusive but both are distinct offences and persons acquitted under section 304B for the offence of dowry death can be convicted for an offence under sec.498A of IPC

- These sections are: Cognizable where the accused can be arrested and jailed without warrant or investigation, Non-Compoundable where the complaint cannot be withdrawn by the petitioner, and Non-bailable where the accused must appear in the court to request bail. the accused are presumed guilty, and for all practical purposes, the burden is on the accused to prove innocence in the courts.

Problem Of the Situation: Case can be filed just based on a single-sentence complaint by the wife. Approximately 60,000 such accusations per year are affecting about 200,000 people are directly by these false accusations. The number of such cases has increased by about 100% in the last 10 years and by more than 15% in just the last two years. This poorly formulated law is inviting unscrupulous people to file false cases, and causing the imprisonment of innocent people without investigation. It amounts to ulterior motives including to get the punishment made even to innocent or all innocent husband side. This is the only one set of two penal procedures (498A + 304B I PC) that deal with the same kind of offence. In real life, however, all these are being (ab)used with *mala fide* mind that may hardly be established⁽⁶⁾.

CASE REPORT

A body of a female aged about 31 yrs brought to autopsy with u/s 498A, 304B R/W 34 IPC 3, 4 DP Act, History was that the husband and the mother of the husband alleged to have abused her physically, with allegation of poisoning leading to her death.

During Examination was about 155 cms length, moderately built and nourished. Faint Post mortem staining present over back, Rigor mortis present all over, No external injuries was present over the body.



Fig. 1. Showing no external injuries over the body.

Internal examination: During opening the abdomen incidentally, we found liver enlarged, hard in consistency, with multiple white nodules over its surface, and weighing about 5.1 kgs. Spleen is intact. Lungs were edematous c/s exuding froth mixed blood. Stomach was empty, Uterus and breast tissue were normal, No significant findings other than liver were found at autopsy. Thus Heart, brain, pieces of lungs, half of each kidneys, spleen, breast tissue and uterus with both ovaries were subjected to histo-pathological examination, Blood and viscera sent to FSL for chemical analysis.

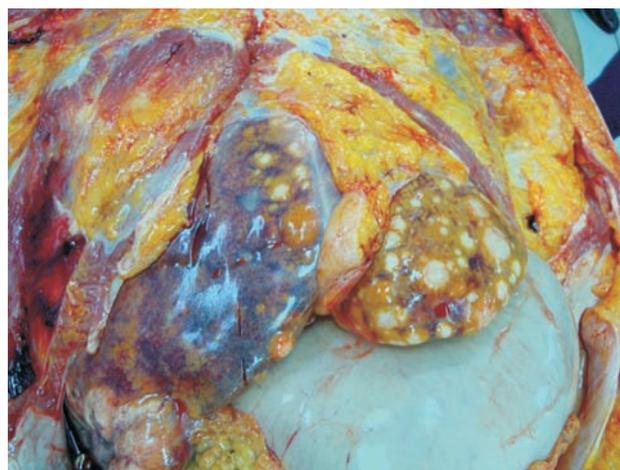


Fig. 2. On opening abdomen showing enlarged Liver.



Fig. 3. Showing multiple white nodules in the Liver.

INVESTIGATIONS

- FSL report was negative for the routine poisons, histo-pathological reports shows Liver microscopy showed autolytic hepatocytes with tumour cells arranged in discrete lobules which are round to oval showing pleomorphism with hyperchromatic

nucleus and indistinct nucleoli, All other organ were unremarkable.

- Impression: undifferentiated tumour metastatic secondary's liver
- Final opinion: Death is due to complications of undifferentiated tumour with metastatic secondary's in liver.

CONCLUSION

The object of the provision of laws is prevention of the dowry menace. Unfortunately, this law has been misused to harass men and their families rather than protect genuine female victims of harassment. The success of the investigating officer in investigating dowry death cases largely depends upon forensic medicine experts. Doctor should make a record of the history of the injuries and the persons responsible for it, when the victim is brought to the hospital, noting the time and name of the person who gave the history. The condition of the victim should be recorded at frequent intervals. Care should be taken that no person has discussion with the victim to avoid any undue influence being exerted on her. Magistrate may be called to record the dying declaration. Visit to the scene of crime by the doctor and other forensic Scientists is very helpful in determining the manner of death. While doing autopsy he should examine for the injuries both externally and internally and in suspected deaths

due to unknown natural causes specimens should be sent to histopathology and chemical analysis. Detailed examination helps in revealing the cause and manner of death thus helping the innocents saving from punishment/misuse from these sections.

Acknowledgement: Work attributed to Bangalore medical college, Bangalore, Karnataka.

Conflict of Interest Statement: None.

REFERENCES

1. Sections 304B, 498A, Indian penal code (IPC) Criminal law; India, 1983.
2. Section 498A of IPC – its use and misuse, Pathlegal, Akshay goel, Dec 2 (2010).
3. Misuse of IPC 498A and Dowry acts, Sushil kumar Sharma Vs Union of India; JT 2005 (6), SC 266.
4. Kulashreshta. P, Sharma R.K, Dogra T.D. The study of sociological and Demographical variables of Unnatural deaths among young in South Delhi within seven years of marriage. JPAFM, 2002.
5. Reddy KSN. The Essentials of Forensic Medicine and Toxicology, 29th edition, published by K. Suguna Devi. 2010.
6. Reversal of Vulnerability in Marriage: A Juridical Study with Special reference to Domestic Violence. GJLS Vol. 1, No. 1. 2013.

Call for Papers / Article Submission

Indian Journal of Forensic Medicine & Toxicology has commenced publication since 2007. IJFMT will be published two times in a year.

Purpose & Scope: Indian Journal of Forensic Medicine & Toxicology is a peer reviewed six monthly Journal. It deals with Forensic Medicine, Forensic Science, Toxicology, DNA fingerprinting, sexual medicine and environmental medicine. It has been assigned International standard serial No. p-0973-9122 and e-0973-9130 **website: www.ijfmt.com**. This journal is also indexed with Index Copernicus (Poland).

The journal encourages research from theoretical perspectives, research reports of evidence based practice as well as praxis research work that focuses on the interface between theory and practice and how each can support the other. In addition, the journal strongly encourages reports of research carried out within or involving countries in the Asia- Pacific region.

Invitation to submit papers:

A general invitation is extended to authors to submit journal papers for publication in IJFMT.

The following guidelines should be noted:

1. The article must be send by E-mail in word only as attachment. Hard copy need not be send.
2. The article should be accompanied by a declaration from all authors that it is an original work and has not been sent to any other journal for publication.
3. References should be in Vancouver style.
4. As a policy matter, journal encourages articles regarding new concepts and new information.

Prof. R.K. Sharma Editor Institute of Medico-Legal Publications

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Mobile: 91-9971888542, Fax No: +91 11 3044 6500

Email: editor.ijfmt@gmail.com, Website: www.ijfmt.com



Indian Journal of Forensic Medicine & Toxicology

Institute of Medico-Legal Publications

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Mobile:91-9971888542, Fax No: +91 11 3044 6500

Email: editor.ijfmt@gmail.com, Website: www.ijfmt.com

CALL FOR SUBSCRIPTIONS

About The Journal

Print-ISSN: 0973-9122 Electronic - ISSN: 0973-9130 Frequency: Six Monthly

“Indian Journal of Forensic Medicine & Toxicology” is a peer reviewed six monthly Journal. It deals with Forensic Medicine, Forensic Science, Toxicology, DNA fingerprinting, sexual medicine and environmental medicine. It has been assigned International standard serial No. p-0973-9122 and e-0973-9130. The Journal has been assigned RNI No. DELENG/2007/21789.

The Journal is indexed with Index Copernicus (Poland) and is covered by EMBASE (Excerpta Medica Database). The journal is also abstracted in Chemical Abstracts (CAS) database.

Journal Title	Pricing of Journals					
	Indian			Foreign		
Indian Journal of Forensic Medicine & Toxicology	Print Only	Print+Online	Online Only	Print Only	Print+Online	Online Only
	INR 7000	INR 9000	INR 5500	USD 450	USD 550	USD 350

Note for Subscribers

Advance payment required by Demand Draft in the name of Institute of Medico-Legal Publications payable at New Delhi

Cancellation not allowed except for duplicate payment.

Claim must be made within six months from issue date.

A free copy can be forwarded on request.

SEND REMITTANCE TO :

Prof. R. K. Sharma Editor

Indian Journal of Forensic Medicine & Toxicology
Institute of Medico-Legal Publications

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Mobile:91-9971888542, Fax No: +91 11 3044 6500

Email: editor.ijfmt@gmail.com, Website: www.ijfmt.com

**Registered with Registrar of Newspapers for India
(Regd. No. DELENG/2007/21789)**

**Published, Printed and Owned : Dr. R.K. Sharma
Designed and Printed : M/s. Vineeta Graphics, B-MCF-188, Subash Colony Ballabgarh,
Faridabad (Haryana), Mobile No. 9990005734, 9990005742
Published at : 4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001
Editor : Dr. R.K. Sharma, Mobile:91-9971888542, Fax No: +91 11 3044 6500**