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Injury Pattern of Road Traffic Accidents In Tribal District of Andhra Pradesh

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Abstract

Road Traffic Accident (RTA) and the subsequent injury is becoming a growing public health problem in India due to increased motorization. The present study was conducted to investigate the injury pattern among RTA victims during one year period from May 2009 to April 2010. Out of 744 RTA victims 612 (82.26%) were males and 132 (17.74%) were females. According to time interval between occurrence of RTA and arrival of patient to hospital 395 (53.09%) cases reported between 1-6 Hours. Motorized two wheelers 262 (45.17%) and three wheelers 135 (23.28%) were most common vehicles involved rroup occurred due to head injury associated with other injuries in 16 (50%) cases whereas in lower limb tibial fracture was most common in 47 (43.52%) cases. Laceration was the most common injury type affecting lower limb in 134 (32.76%) cases. Ampicillin 423 (56.85%), taxim 174 (23.39%) and monocef 72 (9.68%) were the commonly prescribed antibiotics at the time of admission. 23 RTA deaths with 11 deaths in 21-30 age group occurred due to head injury associated with other injuries.

Thus, pattern of injury will be helpful to understand and prevent injuries in RTA.

Key Words

Road traffic accident, Injury pattern, Vehicle

Introduction

Accident is defined as an unexpected, unplanned occurrence which may involve injury.¹ A Road Traffic Accident (RTA) is said to occur when a road vehicle collides with another vehicle, pedestrian, animal, geographical or architectural obstacle. RTA caused 1.2 million deaths worldwide in 2002. It is the third leading cause of death among people in age group 15-29 year in 2000. In India the reported number of accidental deaths due to RTA is 84,430 in 200.¹

The morbidity and mortality burden due to RTA is increasing in developing countries. This is in contrast with developed countries where the pattern of RTAs is different. Two wheelers are involved in RTA in large proportion in India whereas four wheelers are more commonly involved in developed countries. Moreover, for every death there are as many as 50-100 minor injuries and 10-20 serious injuries which require expensive care, nursing and treatment. According to recent estimates RTA amount at least 1-2 percent of GDP loss to the countries worldwide.¹

One global survey had shown that vulnerable road users pedestrians, cyclists and riders of motorized two wheelers account for about 46% of global road traffic death. The ten countries with highest number of deaths are China, India, Nigeria, United States, Pakistan, Indonesia, Russian federation, Brazil, Egypt and Ethiopia while the countries with lowest road fatalities include Netherlands, Sweden and United Kingdom.² Adilabad is a tribal district located in the Telangana region of Andhra Pradesh. Its rural population is 18,23,004 (73.5%) according to

2001 census.³ Rajiv Gandhi Institute of Medical Sciences Govt. of A.P. (RIMS) is a tertiary level teaching hospital recently established in Adilabad. With this back ground the present study was planned to evaluate the pattern of injury of RTA in Adilabad.

Material & Methods

The present study was conducted at RIMS; Adilabad A.P. Road traffic injury was defined as an injury which results inclusion criteria included the RTA cases of all age groups that reported to the casualty department of RIMS, Hospital. The exclusion criteria included the injuries which do not involve any vehicle e.g. if any person sustained injury due to fall on the road or any individual getting injured at the time of loading or washing vehicle. The study period was one year from May 2009 to April 2010 and a total 744 RTA cases reported. The information related to the victim was sought either from the victim or from the relatives or attendees where the condition of the victims was not conducive. The information collected consists of the details of the RTA victim, details of the injury sustained, vehicles involved in RTA, the treatment given and the outcome. The medico legal records and case sheets of the victim were also referred. The data thus collected was analyzed statistically.

Results

A total of 744 RTA cases reported at RIMS Hospital. Out of this 612 (82.26%) were males and 132 (17.74%) females.

According to the time interval between occurrence of RTA and the arrival of patient to the hospital, it was seen that most of cases 395 (314 male, 81 female) reported between 1-6 hours followed by 293 (261 male, 32 female) within 1 hour and 56 (37 male, 19 female) reported after 6 hrs.

The road users involved in RTA were Riders 233 (31.32%) Pillions 347 (46.64%) and Pedestrians 164 (22.04%) **Figure-1**. Three wheelers and car/jeep/van caused most of the road traffic injuries to pedestrians while bicycle & bullock cart caused none (**Table-1**).

Table 1: Type of vehicles involved in injuries to Pedestrians

Type of vehicle	Male		Female		Total	
	No	%	No	%	No	%
Bicycle	0	0.00	0	0.00	0	0.00
Motorized two wheelers	18	14.52	10	25.00	28	17.07
Three Wheelers	25	20.16	7	17.50	32	19.51
Bus	16	12.90	9	22.50	25	15.24
Truck	24	19.35	1	2.50	25	15.24
Car/Jeep/Van	26	20.97	6	15.00	32	19.51
Tractor	15	12.10	7	17.50	22	13.41
Bullock cart	0	0.00	0	0.00	0	0.00
Total	124	100	40	100	164	100

Figure 1: Riders and Pillions involved in RTA.

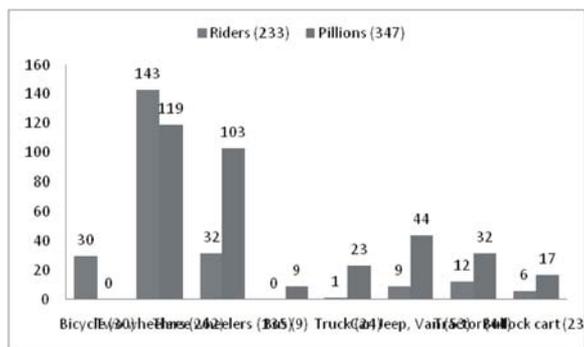


Table 2 : Distribution of RTA cases according to Site of Injury

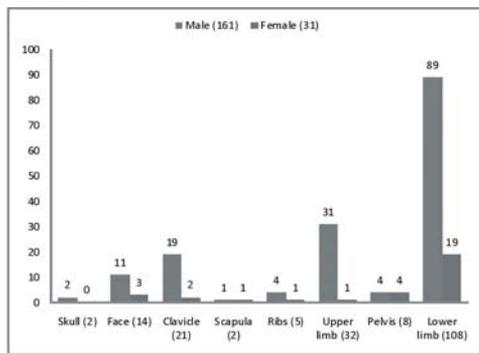
Site of injury	Male		Female		Total	
	No	%	No	%	No	%
Upper limb	35	5.72	7	5.30	42	5.65
Lower limb	145	23.69	33	25.00	178	23.92
Head, Neck, Face	170	27.78	36	27.27	206	27.69
Multiple sites	225	36.76	39	29.55	264	35.48
Abdomen	19	3.10	7	5.30	26	3.49
Chest	16	2.61	8	6.06	24	3.23
Back	2	0.33	2	1.52	4	0.54
Total	612	100	132	100	744	100

Table 3 : Distribution of RTA cases according to fracture in Upper limb and Lower limb

Upper Limb	Male		Female		Total	
	No	%	No	%	No	%
Humerus	11	35.48	1	100	12	37.50
Radius	16	51.61	0	0.00	16	50.00
Ulna	4	12.90	0	0.00	4	12.50
Total	31	100	1	100	32	100

Lower Limb	Male		Female		Total	
	No	%	No	%	No	%
Femur	16	17.98	7	36.84	23	21.30
Tibia	40	44.94	7	36.84	47	43.52
Fibula	24	26.97	3	15.79	27	25.00
Patella	5	5.62	0	0.00	5	4.63
Ankle	4	4.49	2	10.53	6	5.56
Total	89	100	19	100	108	100

Figure 2: Distribution of RTA case according to fractures at different sites



The injuries occurred most commonly at multiple sites followed by Head, Neck, Face injuries. The least affected site was back (Table-2). A total of 192 RTA cases had fractures at different sites (Figure-2). The commonest site of fracture was lower limb followed by upper limb. In upper limb fracture of radius was seen in most of the cases followed by humerus and ulna. In lower limb fracture of tibia was most common (Table-3).

The RTA victims suffered from various types of injuries. These injuries were seen most commonly in lower limbs

Figure 3 : Injuries among RTA Cases

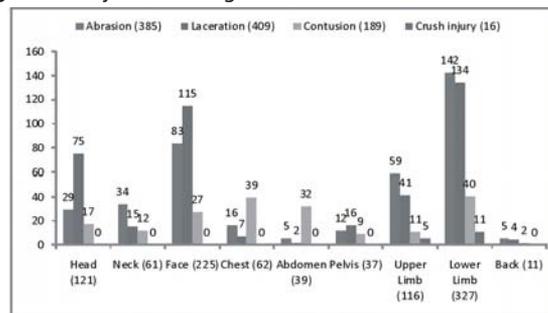


Table 4 : Distribution of RTA Death

Age group	Vehicle involved		Cause of death	
	Vehicle	Victims	Injury	No. %
11-20	Motorized two wheelers	8	Head Injury	5 21.74
21-30	Three wheelers	5	Head & other injuries	11 47.83
31-40	Pedestrians hit by lorry	5	Chest Injury	5 21.74
41-50	Tractors	2	Abdomen injury	1 4.35
51-60	Jeep 3	13	Fracture lower limb	1 4.35

327 (32.73%) followed by face 225 (22.52%) and were least in back 11 (1.10%). The lower limb was the most common site for abrasion 142 (36.88%) laceration 134 (32.76%) and contusion 40 (21.16%). Crush injuries were seen mostly in lower limbs 11 (68.75%) and upper limb 5 (31.25%) (Figure-3).

In the present study the prescription pattern of antibiotics in RTA cases at the time of admission was also studied. It was found that ampicillin was the most commonly prescribed antibiotic in 423 (56.85%) RTA cases followed by taxim in 174 (23.39%), monocef in 72 (9.68%), cefran in 24 (3.23%) cases and least prescribed was gentamicin in 6 cases (0.81%).

A total of 23 deaths occurred due to RTA. Out of this 22 were males and 1 female. Most of the RTA victims 11 were in 21-30 years of age group. Motorized two wheelers were the most common vehicle involved in RTA. In 11 cases death occurred due to head injury associated with other injuries (Table-4).

Discussion

In the present study males were more commonly involved in RTA than females. The reason being increased exposure of males to road traffic and risk taking behavior commoner in males whereas females are confined to houses. Similar observation was made by others.^{4,5}

The time interval between occurrence of RTA and treatment given is most vital for RTA victims. In the present study most of the RTA victims reported between 1-6 hrs. The reason might be the distance between the hospital and the place of accident. In a study carried in urban setup of Rohtak Haryana it was found that most of the RTA cases reached hospital in 1 hour of accident.⁶ autorickshaw and jeep are the most commonly used mode of transportation in village setup due to dearth of public transportation. Secondly, most of the unemployed youth from villages had owned autorickshaw or jeep to earn their livelihood but they have casual attitude towards obtaining license and are less aware of traffic rules. Jha et. al. found that most of the drivers were bicyclists and occupants of bus in RTA since this mode of transportation was used in the hilly terrain of Nepal.⁸

Injury can occur at various sites due to RTA and in the present study it occurred at multiple sites. In a study in Singapore the top cause of death was multiple injuries⁹ whereas in study by

Ravikiran most RTA cases had abdominal injuries.¹⁰

Injury means disruption of the anatomical continuity of any tissues of the body.¹¹ In the present study laceration followed by abrasion was the common type of injury affecting lower limbs. In a study by Jha et. al. abrasions were more common than laceration as bicyclist and bullock cart drivers were most common RTA victims.¹²

Fractures due to two wheelers were commonly seen in lower limbs. The metallic or energy absorbing material does not provide enough protection to the road users and they sustained relatively serious injuries even when road traffic crashes occurs at low velocity. Patil SS inferred that the commonest site of fracture was lower limb followed by upper limb.¹³ Ganveer GB attributed the cause of fracture to the interplay of gravitational force and velocity of the vehicle at the time of accidents resulting in generation of kinetic energy.¹⁴

In the present study injuries at multiple sites being more common, there are increased chances of various infections in RTA cases. Hence, cephalosporins like taxim, monocef should have been more prescribed than ampicillin to which bacteria has developed resistance. But the restricted use of costlier antibiotics might be due to less supply in Govt. hospitals.

The mortality in RTA cases was primarily due to head injury. In case of motorcyclist due to sudden deceleration the body is thrown off the vehicle frequently hitting the head first. The most common lesion is fracture base of skull. Injury to lower extremity is due to the heavy machine trapping the legs beneath it.⁷ In females, sitting sideways on two wheelers increases risk of falling from vehicle and limbs and head bearing much of the impact. Moreover, the RTA deaths occurred more commonly in age group 21-30 as the victims in this age group are more active and mobile. Others found head injury as cause of death in 77.6%⁶ and 68.73% cases.¹⁵

Thus RTA injuries are more common at multiple sites and the mortality is due to head injury caused by motorized two wheelers. This study will be helpful in understanding and preventing RTA thereby decreasing mortality & morbidity

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UV-B assisted Gross Examination of Heart an easy and inexpensive Method for Post Mortem Pathologic Diagnosis of MI

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Abstract

Background

Sudden death after myocardial infarction (MI) frequently needs medico legal autopsy. Determining exact cause of death has much legal and medical consequence. If MI has occurred within 24 hours prior to death; little gross finding would remain on the heart. So existence of a method for more precise determination of likely infarction site in gross examination of heart can aid pathologist to take more targeted samples for microscopic examination and achieve more exact final diagnosis.

Material & Methods

204 cases suspected to develop MI referred to legal medicine center of Isfahan a large city in center of Iran for medico legal autopsy in 2010. Their heart was transferred to a dark room and illuminated with UV-B hand lamp. Areas with white-blue fluorescence were been accounted as positive and samples from them sent for Histopathologic examination.

Results

In 50 cases final diagnosis was MI. amongst them in 39 cases UV-B hand lamp examination assisted pathologist for taking more purposeful samples for Histopathologic examination. New onset (within last ten days) MI with formation of granulation tissue was seen in 15 cases. acute MI was diagnosed in 11 cases.

Conclusion

UV-B hand lamp can be used for locating previous MI and fibrosis on the examined heart; so guide pathologist to take more efficient sampling for histopathologic examination. Its use is recommended in all legal medicine autopsy wards.

Key Words

UV light, fluorescence, myocardium, myocardial infarction, pathology, autopsy

Introduction

In our day, acute myocardial infarction (MI) is the foremost cause of mortality in many countries around the world ⁽¹⁾. Early death within 30 minutes may ensue in 30% of MI cases; half of them occur before arriving hospital ⁽²⁾. Such cases may be classified as sudden unexpected death and would need medico legal autopsy to determine exact cause of death. Over 180 000 deaths are reported to coroners in England and Wales annually, the commonest indication is sudden death in which the cause of death is unknown. In the great majority of these autopsy is performed, on the

instruction of the coroner. This can be a source of distress to bereaved relatives, and certain groups. Jewish and Muslim communities in particular, have religious and cultural objections to the autopsy ⁽³⁾. However it have been suggested that actions can be taken by both the medical and the general communities so as to increase the number of autopsies in a given Institution for obvious reasons ⁽⁴⁾. Sudden unexpected deaths due to natural diseases comprise 15 to 55 percent of medico legal autopsies; among them 80% is due to coronary artery diseases ⁽⁵⁾. Recent organ retention scandals in the UK have increased pressures to find an alternative to the conventional autopsy, but there is very little experience of non-invasive autopsy techniques and these are rarely used in routine practice ⁽³⁾.

Myocardial necrosis starts within 20-30 minutes after coronary artery obstruction. Initially subendocardial areas are involved. Then necrosis evolves to outer parts of heart wall within 3-6 hours ⁽⁶⁾. However unlike the experimental setting, it is impossible to define the exact time of occlusion in patients suffering from acute coronary occlusion. In humans, factors such as preinfarction angina, stuttering occlusion/reperfusion, collateral blood flow, and many other factors complicate precise determination of duration of ischemia ⁽⁷⁾.

During first 12 hours after MI no changes is seen in gross examination of heart. Within 18-24 hours a faint pallor may be seen. Microscopically coagulation necrosis may be appeared as increased eosinophilia of cytoplasm and karyorrhexis or pyknosis of nuclei. Waving of myocardial fibers and neutrophilic infiltration may crop up 18-24 and 48 hours after MI respectively ⁽⁹⁾. Paucity of signs of MI in gross naked eye examination of heart may lead to out of place sampling for histopathologic examination, missing the diagnosis in autopsy and end to so-called white autopsy. We have tried to establish a simple, handy method for more strict gross examination of the heart after autopsy.

Many therapeutic and diagnostic applications are advocated for UV light in various wavelengths including forensic ones for diagnosis of semen and other biologic liquid stains ⁽⁸⁻¹⁰⁾. UV wavelengths range from 40-400 nanometers (nm) including UV-A (320-400 nm), UV-B (290-320 nm) and UV-C (220-290 nm) ⁽¹¹⁾. UV-C is mainly used for disinfection. UV-B has some effects on skin and immunity and is utilized for treatment of many skin diseases. UV-A is used for pigment deficient skin diseases too ⁽¹²⁾. UV hand light has been used for locating myocardial fibrosis during autopsy with encouraged results ⁽¹³⁾.

We have employed UV-B hand light to found areas of MI in gross examination of heart during autopsy.

Material & Methods

All of cases referred to legal medicine center of Isfahan a large city in central Iran for medico legal autopsy and suspected to have MI were included in the study unless death had occur more than 24 hours ago to surmount possible interference from post mortem changes. Heart of corpses was dissected as classic method with additional longitudinal and transverse sections to examine whole myocardium. Afterward hearts were irrigated with tap water rigorously to be drained from blood and then dried. Lastly they were transferred to a dark room where UV-B hand light was used for gross examination of the hearts. UV-B hand light illumination was applied to external surfaces as well as

dissected surfaces of the hearts. Areas with white-blue fluorescence were considered infarcted areas; so samples for histopathologic examination were taken from these areas.

The procedure was continued for all cadavers until we achieved to 50 cases with definite diagnosis of MI in histopathologic examination. Totally 204 cases were included in the study.

Ethical issues were noticed and all cases were studied anonymously.

Results

General information about studied cases was shown in table 1.

Table 1: General characteristics of the studied cases
50 cases of proofed MI were evaluated among 204 studied cases. Area of infarction varied; otherwise at least one sample from this area were sent for histopathologic examination. 60 of 204 cases had positive fluorescence; however in 50 cases MI was verified in pathologic examination, including 24 cases of previous old MI with fibrosis, 15 cases of recent (within last 10 days) MI with granulation formation and 11 case of acute MI. If histopathologic proof was regarded as gold standard for diagnosis of MI, positive and negative predictive value of UV-B assisted gross examination are 83.33% and 100% respectively as can be calculated from table 2. Its sensitivity and specificity were 100% and 93.5% respectively too.

	Studied cases (total number=204)	Cases with pathologic diagnosis of MI (total number=50)
Mean age (years)	55.6	58.2
M/F ratio	1.22	1.34
Postmortem interval (hours)	18.2	17.9
Heart weight (grams)	385	412

Discussion

Verification of MI either in living patients or in dead bodies has been a diagnostic challenge. Typical findings of recent infarction on microscopic examination included myocyte eosinophilia, contraction band necrosis, wavy myofibrils, vacuolated myocyte cytoplasm, coagulation necrosis, hemorrhage, and neutrophilic infiltrates⁽¹⁴⁾. In those cases where sudden death occurs in a very early stage of infarction, the myocardial lesions cannot easily be detected by traditional macroscopic examination, formazan test or routine histological stains. Thus, examination of hematoxylin–eosin-colored slides will not, with certainty, reveal ischemic lesions until more than 6 h postinfarction. Other techniques, such as measurements of the Na/K ratio, fluorescence and autofluorescence microscopy,

Table 2:

MI in histopathologic examination	UV-B fluorescence positive	UV-B fluorescence negative	Total
+	50	10	60
-	0	144	144
total	50	154	204

the phosphotungstic acid–hematoxylin (PTAH) method and the hematoxylin basic fuchsin picric acid (HBFP) have shown to be either too elaborate or non-specific because they lack the ability to differentiate the early myocardial infarction from the agonal artefacts⁽¹⁵⁾.

Gd (ABE-DTTA) (Gadolinium-Diethylene triamine penta-acetic acid) has been successfully used for continuous detection of myocardial ischemia during 30 min of left anterior descending coronary artery (LAD) occlusion in living patients. The suitability

of GD (ABE-DTTA) for accurate quantification of acute MI has also been demonstrated⁽¹⁶⁾; but naturally the method has no application in post mortem diagnosis.

Of the various techniques that may be employed in the non-invasive or minimally invasive autopsy, magnetic resonance imaging (MRI) offers the greatest potential to identify internal pathology post mortem. MRI can be used to image the whole body and there is every reason to believe that it will offer the same sensitivity to disease as it does in living patients. The technique is exquisitely sensitive to typical intracranial events such as hemorrhage, stroke and tumor. In the soft tissues of the rest of the body, the extent and position of tumor masses is well demonstrated and the presence of major vascular abnormalities is also seen. Coronary artery atheroma and thrombosis is theoretically problematic, since the presence of coronary artery disease may tax the spatial resolution of sequences designed to image the whole body, and post mortem blood clotting may obscure the presence of thrombi. Radiological techniques, including MRI, are already used to assist in the study of neonatal and infant deaths, and are increasingly used in the investigation of deaths in adults. A number of post mortem MRI scans, largely without autopsy, have already been performed for coroners in the investigation of non-suspicious adult deaths, notably by Bisset et al. These were performed in response to pressures from the local Jewish Community and the cause of death, based on clinical history and MRI was accepted by the coroner without formal autopsy in 47 D 53 cases⁽³⁾.

UV fluorescence is a well-known entity in medical field which is used for therapeutic as well as diagnostic purposes. In forensic medicine and sciences it has been utilized for detection of semen and saliva stains, death time estimate in skeletal remains and finger prints invention⁽⁸⁻¹⁰⁾. In one previous study its probable diagnostic value for detection of myocardial fibrosis and scars in gross heart examination has proposed⁽¹³⁾.

In present study we have worked on a new aspect of diagnostic property of UV light extending to recent and acute MI besides old MI that aid pathologists in gross heart examination especially in more guided sampling for histopathologic examination.

As the results show UV fluorescence can be a valuable diagnostic tool in evaluation of MI in gross examination of heart and consequent histopathologic examination. More study with larger scale about the issue is recommended to make clear its value for forensic diagnosis of MI, a conflicting subject in present forensic pathology.

Conflict of Interest

None Acknowledgment the authors extend their thanks to autopsy technicians of Isfahan's medico-legal center.

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Forensic Odontology- The role of Dental Experts

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Abstract

Forensic dentistry has become an integral part of forensic medicine over the past 100 years. This has been due to the dedication of people like Gustafson, Keiser-Nielsen and Suzuki for this field. They established the essential role which forensic dentistry plays mainly in the identification of human remains. The teeth can be used as weapons and, under certain circumstances, may leave information about the identity of the biter. Dental professionals have a major role to play in keeping accurate dental records and providing all necessary information so that legal authorities may recognize malpractice, negligence, fraud or abuse, and identify unknown humans. This paper will try to summarize the various roles of dental experts in forensic medicine.

Key Words

Forensic dentistry, DNA analysis, Dental record, Malpractice

Introduction

Forensic Odontology or forensic dentistry was defined by Keiser-Neilson in 1970 as "that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings." Forensic science refers to areas of endeavour that can be used in a judicial setting and accepted by the court and the general scientific committee to separate truth from untruth.¹

Human identity is the mainstay of civilization, and the identification of unknown individuals always has been of paramount importance to society. Not only is it important to identify the deceased to ensure appropriate obsequies, but also there are issues such as criminal investigations, insurance settlements, and military proceedings that can be resolved only with a positive identification. The identification of a missing individual can aid tremendously in the process of grief resolution of the family and friends.

Identification

Dental identification assumes a primary role in the identification of remains when postmortem changes, traumatic tissue injury or lack of a fingerprint record invalidate the use of visual or fingerprint methods. The identification of dental remains is of primary importance when the deceased person is skeletonized, decomposed, burned or dismembered. The principal advantage of dental evidence is that, like other hard tissues, it is often preserved after death. Even the status of a person's teeth changes throughout life and the combination of decayed, missing and filled teeth is measurable and comparable at any fixed point in time. Teeth are the most durable organs in the body and can be heated to temperatures of 1600 °C without appreciable loss of microstructure. Teeth can survive virtually intact long after other soft tissue and skeletal tissues have been destroyed by

decay or incineration.

Identification by dental means is not a new technique. It has been said that Nero's mistress, Sabina, in 66 A.D. satisfied herself that the head presented to her on a platter was Nero's wife as she was able to recognize a black anterior tooth. The modern forensic case started in 1897 in disaster victim identification in Paris by a Dentist².

Determination of Gender and Race

Ancestry can be assessed by studying the facial skeleton and comparing the features with the main characteristics of the three racial groups: Mongoloid, Negroid, and Caucasoid³. Once ethnicity has been attributed, perhaps the most important of parameters to determine from a skeleton is the gender of an individual. If the gender of a bone is successfully determined, approximately 50% of the population is immediately eliminated from the process of identification. In general, determination of gender is not a difficult problem when a complete skeleton is available, but bony remains are not always found in this condition. For example, in airplane crashes bones can be broken into many pieces and only a small segment may be available to make identification. New approaches that involve the tools of molecular biology like DNA analysis, analysis of specific genes in the DNA.^{4,5}

DNA Analysis in Forensic Dentistry

The dental pulp from the given specimen of the tooth can be used for DNA analysis. Recent tooth specimen could be expected to provide good sources for determination of blood groups. The presence of ABO blood grouping antigens in soft and hard dental tissues make it possible to determine the blood group typing and thereby assist in identifying even a highly decomposed body. However the effect of autolysis, dehydration, loss of pulp antigens or high number of errors due to foreign antigen borne by bacteria in carious teeth may lead to variation in the study.⁶

Whittaker and Rawle⁷ advocate that the antigenicity of powdered dentine and cementum of extracted human teeth remains unaltered without regard to the environmental conditions for a period of 1 to 6 months after extraction⁷. This supports the idea to use precipitin reaction, i.e. the reaction of an antigen with a fixed amount of serum containing antibody, in order to assess the origin of tooth fragments found for example at the area of a natural disaster.

Facial Reconstruction and Facial Superimposition

If the post mortem profile does not elicit the tentative identity of the deceased, it may be necessary to reconstruct the individual's appearance during life. This is the responsibility of forensic artists who utilise the dental profile to help with facial reconstruction. The use of ante

mortem photographs to permit facial superimposition of skeletal and teeth fractures have been used in cases of identification. This technique requires the availability of suitable ante mortem photographs showing the teeth. Often, angulations and magnification impose difficulties in positioning the images⁸.

Age Determination Based On Dental Data

The age estimation is the important part of forensic Odontology. Human dentition follows a reliable and predictable developmental sequence, beginning about 4 months after conception and continuing to the beginning of the third decade of life when development of all the permanent teeth is completed. The use of radiographs is characteristic of techniques that involve observation of the morphologically distinct stages of mineralization. Such determinations are also based on the degree of formation of root and crown structures, the stage of eruption, and the intermixture of primary and adult dentitions⁹.

The age of children can be determined by the analysis of tooth development and subsequent comparison to development charts, usually to an accuracy of approximately 1.6 years. The use of attrition and development of third molars have been suggested as means of ageing those individuals over 18, but both are unreliable. Newer techniques like aspartic acid racemisation and translucent dentine have been proposed and proved to be highly accurate in adult age assessment.^{10, 11}

Radiographic Examination

Radiographs and dental casts are useful tools for medico-legal records. The forensic odontologist produces the post-mortem record by careful charting and written descriptions of the dental structures and radiographs. Radiographs should be marked with holes to prevent confusion — one hole for ante mortem films and two holes for post - mortem films.¹²

A range of conclusions can be reached when reporting a dental identification. The American Board of Forensic Odontology recommends that these be limited to the following four conclusions:¹³

- *Positive identification*: The ante-mortem and post-mortem data match in sufficient detail, with no unexplainable discrepancies, to establish that they are from the same individual.
- *Possible identification*: the ante mortem and post-mortem data have consistent features but, because of the quality of either the post-mortem remains or the ante mortem evidence, it is not possible to establish identity positively.
- *Insufficient evidence*: The available information is insufficient to form the basis for a conclusion.
- *Exclusion*: the ante mortem and post-mortem data are clearly inconsistent.

Bite Marks and Lip Prints

The investigation of bite marks and lip prints, which may be produced in both sexual and non-sexual assaults, homicide and also in non- biological materials and objects left at crime scenes, requires the employment of specialized techniques of photography, impression taking and electric microscopy. In these procedure the proper collection and handling of the material, to ensure the security of the chain of evidence to comply with legal requirements for its acceptability as evidence in court of law.^{11, 13}

Conclusion

The role of Forensic dentistry plays a major role in the identification of those individuals who cannot be identified visually or by other means. The unique nature of our dental anatomy and the placement of custom restorations ensure accuracy when the techniques are correctly employed.

Unfortunately in developing countries like India forensic dentistry is not developed up to the mark, and services of forensic dentist are not being utilised. Government should instruct the Indian Dental association and other responsible agencies to direct the dental surgeons of the country to maintain the dental records casts, x-rays etc. and sample of tissue (tooth in case of extraction and debris of tooth material in case of restorations) of the patients treated by dental surgeons. So the preserved materials (Ante-mortem specimen) may be used in identification of deceased individuals.

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Interest of Conflict

None Declared

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Cheiloscopy Comparison of the Tibetan Refugees in Mundgod and the Population of Belgaum, India

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Abstract

Introduction

When fingerprint, DNA and post-mortem records are not available, lesser known techniques of palatoscopy and Cheiloscopy can throw light on individual identification. The present study was conducted to compare the Lip prints between the Tibetan population from Mundgod and the population of Belgaum and to find out the quadrant wise and gender-wise predilection of lip print patterns.

Material and Methods

Lip impressions were collected from 775 Tibetans from Mundgod and 764 subjects from the population of Belgaum city. A dark shaded lip stick was applied on the lips of the subjects and the impressions were taken on the sticking side of a cellophane tape and stuck on a white paper. The impressions were visualized using a magnifying lens and analyzed by Suzuki's classification.

Findings

The data was entered in Microsoft excel and analyzed using Chi square test. The Type I pattern was more common in males in the first and second quadrants. Type II pattern was more in the Tibetans than in the general population. Type III pattern was more common in males. It was seen more commonly in the Tibetans. Type IV pattern occurred more frequently in females in both the populations. The variability in occurrence of different types of lip prints in both the populations was statistically significant. Lip size of the Tibetans was larger than their counterparts from the general population.

Conclusion

Lip prints have a gender-wise as well as quadrant-wise predilection. The two races compared in this study were found to have differences in the distribution of lip prints.

Key Word

Lip prints; Cheiloscopy; palatoscopy; Individual identification.

Introduction

evidence in the court of law. History reveals the use of Forensic Odontology since 49 A.D.¹ Based on the quality and quantity of concordant points available different 'levels' or 'categories' of identification can be assigned to cases that indicate their proximity to a positive identification.²

Cheiloscopy is a forensic investigation technique that deals with identification of humans based on Lip traces.^{3,4} There have been instances where "Cheiloscopy" has landed criminals behind bars, substantiating its acceptance in the court of law.⁵

Mucosal area of the lip, called Klein's zone, is covered with wrinkles and grooves that forms a characteristic pattern—the

lip print.⁶ Lip prints are unique to one person, except in monozygotic twins.^{1,6,7}

Smears of lip prints can also be found on objects such as cups, spoons or cigarette butts.⁸ The use of reagents like the Lysochromes and the techniques of Purge and trap gas chromatography have facilitated the development of latent lip prints.^{9,10} There is a need for Lip print identification to be acceptable in the court as scientifically based evidence.¹¹

The size and shape of orofacial structures have been found to vary among different Human races.^{6,12} Differences in palatal rugae pattern between Mysorean and Tibetan populations have been noted to be subtle but definite.¹³ Lip Prints also may be unique for specific races. This study was initiated to investigate the occurrence and predilection of Lip Print patterns among the Tibetans from Mundgod (Mongoloid race) and the population from Belgaum city (Dravidian race), hence forth called Belgaumites.

Material and Method

A comparative study comprising of 1,500 subjects was conducted between the Tibetans of Mundgod and the general population of Belgaum (Figure 1). Mundgod is a Tibetan refugee settlement in Karwar district, Karnataka, India. The city of Belgaum is located in the southwest region of India, with about 5,06,200 inhabitants. Age range of the subjects for this study was between 10 to 25 years. Subjects willing to participate in the study and providing informed consent were included. Ethical clearance was taken from the Institutional Ethical Committee. Prior permission was obtained from the head of the monastery at Mundgod and the concerned authorities at Belgaum.

The subjects were made to sit on a chair with a back rest. A dark shaded lip stick was applied on the lips using a cotton swab. Lip impression was made on a strip of cellophane tape, on the glued portion and stuck on to a white paper, which served as a permanent record. Each lip print was assigned a serial number. The name and general information of the subjects like age, sex, and address were recorded on the consent form.

The lip impressions were visualized by a single investigator, using a magnifying lens. Suzuki's classification (Figure 2) was employed dividing the lip print into four parts similar to four quadrants of the dentition. The determination of the pattern was based on numerical superiority of **Figure 1: Distribution of study subjects by type of population and gender**

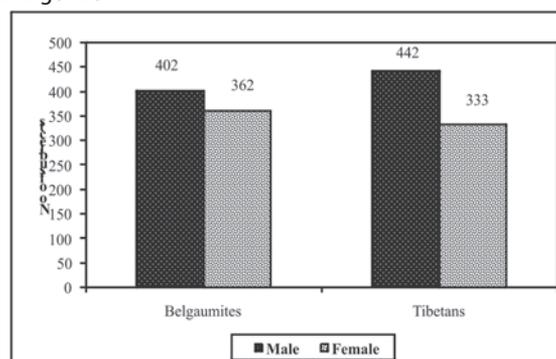
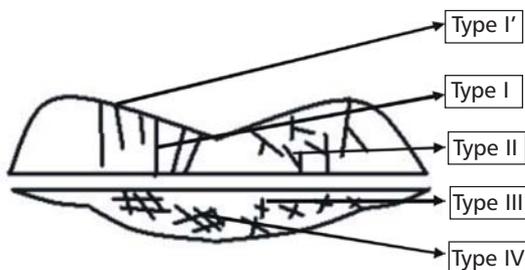


Figure 2: Suzuki's classification of Lip Prints



properties of the lines in the study area.⁷

Data was analyzed using SPSS package (version 12) and presented as frequency and percentages. Chi square test was used to analyze and compare the lip print patterns. The level of significance was set at $p < 0.05$.

Finding

Figure 3 is the photograph depicting the quadrant wise Suzuki's classification of lip prints. Table no.1 shows the distribution of Lip prints in the male subjects of both the populations. Table no. 2 shows the distribution of Lip prints in the female subjects of both the populations.

First Quadrant

Here the vertical Type I pattern was seen in 32.58% of the males and 23.60% of the females. Our study results for this region are in contrast to a similar study done by Vahanwala and Parekh¹ where it was observed that Type I pattern occurred in 26% of males and 36% of females.

In our study Type I' pattern was seen in 15.28% of males and 20.72% of females, not much different from the Vahanwala and Parekh study¹ where it was seen in 18% of males and 26% of the females. The significant point here is the high occurrence of this pattern in Belgaumites, compared to the Tibetan population, in both males and females.

In the present study Type II pattern was seen in 20.62% of males and 15.11% of females. This is in accordance with the Vahanwala and Parekh study¹ where it was seen in 16% of females and 34% of males.

Type III pattern in the present study was noted in 13.03% of males and 10.36% of females. This is in contrast to Vahanwala and Parekh study¹ where Type III pattern was seen in only 2 male subjects (4%) and was not found in female

Figure 3: Suzuki's classification of lip prints

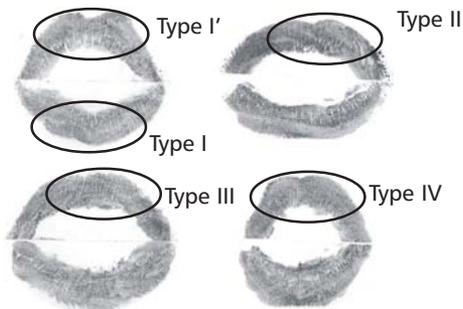


Figure 4: Typical Lip Print of a Tibetan Male showing Horizontal lines

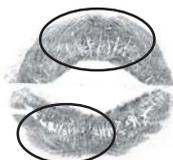


Table 1: Distribution of Lip prints in male subjects according to Population type

Quadrant	Lip print	Belgaumites	%	Tibetans	%	Chi-square
I	Type I	141	35.07	134	30.32	85.331, df=4, p<0.00001 Significant
	Type I'	93	23.13	36	08.14	
	Type II	80	19.90	94	21.27	
	Type III	24	5.97	86	19.46	
II	Type IV	64	15.93	92	20.81	44.0450, df=4, p<0.00001, Significant
	Type I	106	26.37	109	24.66	
	Type I'	77	19.15	25	05.66	
	Type II	84	20.90	97	21.95	
III	Type III	58	14.43	106	23.98	29.3920, df=4, p<0.00001, Significant
	Type IV	77	19.15	105	23.75	
	Type I	48	11.94	65	14.71	
	Type I'	62	15.42	26	05.89	
IV	Type II	282	70.15	319	72.17	80.0930, df=4, p<0.00001, Significant
	Type III	03	00.75	12	02.71	
	Type IV	07	01.74	20	04.52	
	Type I	106	26.37	106	23.98	
	Type I'	101	25.12	35	07.92	80.0930, df=4, p<0.00001, Significant
	Type II	186	46.27	234	52.94	
	Type III	05	01.24	34	07.69	
	Type IV	04	01.00	33	07.47	

Table 2: Distribution of Lip prints in female subjects according to Population type

Quadrant	Lip print	Belgaumites	%	Tibetans	%	Chi-square
I	Type I	86	23.76	78	23.42	1.9320, df=4, p=0.7485 Not Significant
	Type I'	131	36.19	13	03.91	
	Type II	41	11.33	64	19.22	
	Type III	08	2.21	64	19.22	
II	Type IV	96	26.51	114	34.23	101.0510, df=4, p<0.00001, Significant
	Type I	83	22.93	67	20.12	
	Type I'	90	24.86	19	05.71	
	Type II	38	10.50	63	18.92	
III	Type III	07	01.93	64	19.21	53.5050, df=4, p<0.00001, Significant
	Type IV	144	39.78	120	36.04	
	Type I	70	19.33	74	22.22	
	Type I'	90	24.86	20	06.01	
IV	Type II	165	45.58	190	57.06	75.8300, df=4, p<0.00001, Significant
	Type III	00	00	08	02.40	
	Type IV	37	10.23	41	12.31	
	Type I	78	21.54	91	27.33	
	Type I'	138	38.12	38	11.41	75.8300, df=4, p<0.00001, Significant
	Type II	113	31.22	138	41.44	
	Type III	01	00.28	15	04.50	
	Type IV	32	08.84	51	15.32	

subjects.

Type IV pattern was noticed in 18.48% of males and 30.22% of females in the present study. The occurrence of this pattern in Vahanwala and Parekh study¹ was seen in 16% of males and 18 % of females.

Second Quadrant

In the present study Type I pattern was found in 25.47% of males and 21.58% of females. This pattern was seen in 20% of males and 32% of females in the second quadrant in the study done by Vahanwala and Parekh.¹

Type I' pattern was noticed in 12.09% of males and 15.68% of females, whereas in contrast to Vahanwala and Parekh study¹ Type I' pattern was seen in 26% and 22% of males and females respectively.

Type II pattern was seen in 21.45% of males and 14.53% of females in the present study. In contrary to this result Type II pattern was noted in 38% and 18% of the second quadrant in males and females respectively in the Vahanwala and Parekh study.¹

Type III pattern in the present study was noted in 19.43% of males and 10.22% of females. In contrast to our study, Type III

pattern was noted in only 4% (2 subjects) of the second quadrant in males in the Vahanwala and Parekh study.¹ Type III pattern occurred more commonly in the Tibetan population, compared to Belgaumites, for this region.

Type IV pattern was noticed in 21.56% of males and 37.99% of females in the present study. This is on the higher side compared to the Vahanwala and Parekh study,¹ where Type IV pattern was seen in 12% and 22% of males and females respectively. In the present study vertical pattern of lip print has occurred at a higher frequency in the upper lip, whereas Hirth et al observed that the branching pattern was more common in the upper lip, than the other type of lip prints.¹⁴

Third Quadrant

type I pattern was found in 13.39% of males and 20.72% of females in the present study. Type I pattern was seen in 38% and 56% of the third quadrant of males and females in the Vahanwala and Parekh study.¹

In the present study Type I' pattern was noticed in 10.43% of males and 15.83% of females. Vahanwala and Parekh study¹ has reported 40% and 22% occurrence of Type I' pattern in the third quadrant of males and females respectively.

In the present study Type II pattern was seen in 71.21% of males and 51.08% of females. Type II pattern was noted only in 14% and 10% of the third quadrant in males and females respectively in the Vahanwala and Parekh study.¹

Type III pattern in the present study was noted in 1.78% of males and 1.15% of females. In the Vahanwala and Parekh study,¹ Type III pattern was not seen at all in the third quadrant. In the present study this pattern is more common in the Tibetans compared to the Belgaumites. In a study by Brautzsch et al distribution pattern of labial furrows observed in test persons of the Mongolian-type population was found to be clearly differentiated from that seen in representatives of the European-type and Negro-type population who showed resembling distribution patterns.¹³

Type IV pattern was noticed in 3.20% of males and 11.22% of females in the present study. Type IV pattern in third quadrant in Vahanwala and Parekh study,¹ was seen in 8% of males and 10% of the females.

Fourth Quadrant

In the present study Type I pattern was found in 25.12% of males and 24.32% of females. In the Vahanwala and Parekh study,¹ Type I pattern was noticed in 42% and 50% of the males and females respectively.

In the present study Type I' pattern was noticed in 16.11% of males and 25.32% of females. Vahanwala and Parekh study¹ has reported 44% and 28% frequency of occurrence of Type I' pattern in the fourth quadrants of males and females respectively.

Type II pattern was seen in 49.76% of males and 36.12% of females in the present study. In the Vahanwala and Parekh study,¹ Type II pattern was noticed in only 4% and 8% of the fourth quadrants of males and females respectively.

Type III pattern in the present study was noted in 4.62% of males and 2.30% of females. No Type III patterns were seen in the fourth quadrants in the study by Vahanwala and Parekh.¹

Type IV pattern was noticed in 4.38% of males and 11.94% of females in the present study. In the Vahanwala and Parekh study,¹ this pattern was seen in 6% and 10% of the fourth quadrants of males and females respectively.

In the Sharma P, Saxena S, Rathod V study,¹⁵ Type I and I2 were most commonly seen in females whereas Type IV were seen most commonly in males. The notable feature among most of the lip prints from the Tibetans was the occurrence of a horizontal type of lip print (figure 4), which was not seen in the Belgaumites. El Domiaty MA et al have reported the occurrence of horizontal lip prints amongst the Saudi individuals in Almadinah

Almonawahar province.¹⁶ Moreover the lip size of the Tibetans was larger than their counterparts from Belgaum.

Occurrence of specific lip print patterns among males and females which has been noticed in the present study would be of use only when the entire lip trace is available at the crime scene. Much research has been done regarding the development of latent lip prints.^{8-10,17-21}

Conclusion

Lip prints have a gender-wise, race-wise and quadrant-wise predilection. Type I pattern was more common in males in the first and second quadrants compared to females. Type I' was more common in the Belgaum females, whereas it occurred more frequently in the Tibetan males. Type II pattern occurred more frequently in males in all the quadrants. Its occurrence was more in the Tibetans than in the general population. Type III pattern was more common in males, in all the quadrants, in both the populations. It was extremely rare in the lower lip of females from Belgaum. Type III pattern was more common in the Tibetan population. Type IV pattern occurred more frequently in females compared to males in both the populations and was more common in the Tibetans.

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Free Radical and Antioxidant Status Among Organophosphate Pesticide Exposed Sprayers

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Abstract

Objective

To study the antioxidant status and the extent of oxidative stress in organophosphate pesticide exposed sprayers.

Material and Methods

The study was conducted in 50 organophosphate pesticide (OP) poisoned sprayers. Superoxide dimutase (SOD), catalase (CAT) and malondialdehyde(MDA) were estimated as an index of antioxidant status and oxidative stress respectively and comparisons were made in the levels of cholinesterases (AChE;BuChE) and glutathione(GSH) between healthy control subjects and OP poisoned sprayers.

Results

There were significantly fall in both blood AChE and BuChE in the pesticide exposed group as a result of multiple exposures to mixture of OP pesticides. Blood AChE and BuChE showed decrease of 18.4 % and 18 % respectively in the exposed group. Blood GSH levels, an antioxidant molecule was also found to be significantly lowered in the OP pesticide exposed group. The increase in lipid peroxidation as reflected by elevated levels of MDA in the pesticide exposed group indicates oxidative stress. Exposure to OP pesticide showed elevated RBC-SOD activity in this study, SOD effectively dismutates superoxide anion into hydrogen peroxide and O₂. The RBC-CAT activity was also found to be elevated in the exposed workers in this study as a result of OP pesticide induced poisoning. The increased activity of CAT

Table 1: Biochemical Profile of Pesticide Sprayers Compared to Controls

Bio Chemical Parameters	Controls (n=18) Mean ± S.D.	Sprayers (50) Mean ± S.D.
ACh E(IU/L Blood)	670.90 ± 23.63	531.25 ± 18.25*
BuChE(IU/L Blood)	542.66 ± 43.28	451.04 ± 16.87*
GSH (µg/ml Blood)	29.56 ± 2.63	18.31 ± 1.65*
MDA (nmolTBARS/ml Blood)	9.43 ± 0.78	26.30 ± 2.02*
CAT (µ mol H ₂ O ₂ hydrolysed X 10 ⁴ /ml/g Hb)	105.5 ± 15.20	135.69 ± 12.34*
SOD (µ mol hydrolysed X 10 ⁴ /ml/g Hb)	3.29 ± 0.79	8.03 ± 2.46*

The values are expressed mean ± S.D.

*Statistically Significant p<0.05

seen in the poisoning cases coupled with an increase in the blood lipid peroxidation level (MDA) suggests an insufficient antioxidant defense.

Key Words

Antioxidants, free radicals, malondialdehyde (MDA),

pesticide poisoning, superoxide dismutase (SOD), catalase (CAT), glutathione (GSH), cholinesterases.

Introduction

Pesticides are biocides capable of killing all forms of life. They are some of the deadliest; poisons produced by man, hence present a health hazards in long term exposure even at low levels. Organophosphates (OP) pesticides are commonly used worldwide in agricultural and in pest control¹.

Clinical manifestations of OP pesticides poisoning are caused by excessive synaptic accumulation of acetylcholine (ACh). Organophosphate compounds irreversibly inhibit the enzyme acetyl cholinesterase (AChE) and butyryl cholinesterase, resulting in excessive accumulation of ACh, leading to the paralysis of cholinergic transmission in the CNS, autonomic ganglia, parasympathetic nerve endings, some sympathetic nerve endings and neuromuscular junction². BuChE inhibition, by contrast appears not to result in clinical features, however its activity is more easily measured than AChE activity and BuChE assays are widely available and therefore commonly recommended in the early assessment of OP pesticide poisoned patients.³ It is reported that OP pesticides, besides their inhibitory effect on AChE, also induce changes characteristic of oxidative stress⁴. Superoxide dismutase (SOD), whose substrate is a free radical (superoxide anion; O₂⁻) catalyzes dismutation reaction resulting in the generation of hydrogen peroxide (H₂O₂). This H₂O₂ is decomposed to water and molecular oxygen by the action of catalase. When the radical production overwhelms the endogenous levels decreased, they cause considerable cell damage / death. All the major bio molecules such as lipids, proteins and nucleic acids may be attacked by free radicals, but lipids are probably most susceptible.⁵

The cells have different mechanism to alleviate oxidative stress and repaired damaged macromolecules. The primary defense is offered by enzymatic and non enzymatic antioxidants which have been shown to scavenge free radicals and reactive oxygen species (ROS). The antioxidant enzymes, SOD, CAT and glutathioneperoxidase (GPX) have been shown to be significantly affected by pesticides⁶. Antioxidants belonging to the second line of defense including glutathione (GSH), vitamin C, Vitamin E (mainly α-tocopherol) and β-carotene.⁷

OP poisoning may induce oxidative stress leading to generation of free radicals. Free radicals are formed which then increases oxidative destruction of lipids (lipid peroxidation), is a destructive self perpetuating chain reaction, releasing malondialdehyde (MDA) as the end product.⁸

In view of this our study included enzymatic and non-enzymatic antioxidant parameters such as activities of cholinesterases(AChE;BuChE), superoxide dismutase, catalase,glutathione and oxidative stress, lipid peroxides.

Material and Methods

Subjects

The present study was conducted at the MGM Medical College, Navi Mumbai, during the period of Jan'08 to Dec'09. Informed consent was obtained from the pesticide sprayers. The study was cleared by The University Ethics Committee, MGM University of Health Sciences, Navi Mumbai. Fifty male pesticide sprayers were involved in the age group of 17-55 years engaged in pesticide handling and spray. They were several years exposed to pesticides through accidental inhalation during the spraying. This study was compared with 18 normal healthy control subjects.

Collection of Samples

Blood samples were collected in a total 50 OP pesticides patients along with 18 normal healthy subjects as a control. 10 ml of venous blood was collected from each subject in sterile, heparin (200 units) containing vials. The blood was immediately centrifuged at 3000 rpm for 15 minute and the plasma separated. The cells were washed with normal saline and RBC's were subjected to lysis.

Cholinesterase Estimation⁹

Acetyl cholinesterase and butyryl cholinesterase activity in blood was estimated by method of Ellman et al (1961) as modified by chambers and chambers (1989) by taking acetylcholine iodide as substrate and expressed as mmoles hydrolyzed/h/L blood (I/U). For assay, 0.025 ml of 25 time diluted blood and 0.015 ml of diluting buffer Tris-HCl 0.1 M, pH-7.4 was taken and it is made up to 4 ml with 0.1 M Tris-HCl buffer, pH 7.4; 1.0 mM Acetylcholine iodide. It was incubated for 15 minutes with shaking at 37°C. The reaction was then stopped with 0.5 ml mixture of DTNB and SDS (0.04 and 44% in diluting buffer Tris-HCl 0.1M, pH 7.4) respectively. The absorbance was read at 412 nm with suitable blank and was converted to equivalent of mmoles hydrolyzed using molar extinction coefficient of 13600 mole/L⁻¹cm⁻¹.

Glutathione Estimation¹⁰

The level of GSH was estimated in the blood by the method of Jallow et al, 1974. 0.5 ml of blood was mixed with 1.5 ml of water, 2.0 ml of 10 % TCA and centrifuged at 2000 rpm for 15 min. To the supernatant (1.0 ml), 4.0 ml 0.1 M phosphate buffer (pH-7.4) and 0.1 ml of 0.4 % DTNB in phosphate buffer was added and the color was read at 412 nm.

Lipid Peroxides Estimation¹¹

The product of lipid peroxidation Malondialdehyde was estimated in the blood by the method Stocks and Dormandy, 1971. 0.5 ml of blood in phosphate buffer (pH 7.4; 0.1 M) was incubated for 30 minutes at 37°C and centrifuged. To the supernatant (3 ml) collected added to 1 ml 1% TBA and then placed in boiling water bath for 15 minutes. Contents were cooled in ice water and centrifuged for 15 minutes at 2500 rpm. The absorbance was taken against a suitable blank at 532 nm and was converted to equivalent of malondialdehyde (nmol/ ml blood) using molar extinction coefficient of 1.56×10^5 mole/L⁻¹cm⁻¹.

Catalase Estimation¹²

CAT activity was determined by the method of Sinha (1979), using H₂O₂ as substrate and expressed as imol H₂O₂ decomposed/min/g Hb. The isolated blood corpuscles were washed twice with 0.9% NaCl solution. They were then lysed with 20 parts of cold water. The lysate was used as such or the hemoglobins were removed beforehand. The lysate was properly diluted with water for the assay of its catalase content

Superoxide Dismutase Estimation¹³

Superoxide dismutase (SOD) activity determination, we adopted the method of Misra and Fridovich (1972). Two ml of packed cells were lysed by addition of an equal volume of cold deionized water. Hemoglobin was then precipitated by adding chloroform: ethanol (1.5: 1) mixture. The mixture was centrifuged at 3000 rpm for 15 min, and the SOD activity was measure in the supernatant. To 0.88 ml of riboflavin solution (1.3 X 10.5 mM in 0.01M potassium phosphate buffer, pH 7.5) 60 µl of O-dianisidine solution (10.2 mM in ethanol) was added. To this 1 ml of distilled water was added and kept away from light. Hundred µl of the separated SOD was added and optical density (OD) measured at 460 nm using the spectrophotometer. The cuvette was then transferred to the illumination box for exactly 4 min and the OD was remeasured against blank containing ethanol in place of enzyme. The SOD was estimated from the standard graph plotted using different concentrations of pure bovine SOD.

AChE and BuChE

The RBC- AChE and plasma BuChE levels were 531.25 ± 18.25 IU/L and 451.04 ± 16.87 IU/L respectively, which were significantly lower (Pd<0.05) than their respective healthy controls. The AChE and BuChE showed decrease of 18.4% and 18% respectively in the exposed group. The poisoning of OP pesticides in exposed sprayers was reflected by extent of the AChE and BuChE inhibition.

GSH and MDA

The mean \pm SD values of blood GSH in exposed subjects were 18.31 ± 1.65 µg/ml, which was significantly lower than their respective healthy controls. The decrease in blood GSH level could be conjugation reaction (GSH consumption) superseding the cells ability to regenerate GSH, pesticide exposures enhance lipid peroxidation and also deplete the GSH level. The decrease in blood GSH activity may also be due to its participation in the activation, initiate and progression of lymphocytes and increase GST activity.

The mean \pm SD blood level of MDA was 26.30 ± 2.02 nmolTBARS/ml, which was significantly higher than their healthy control (9.43 ± 0.78). The increase in lipid peroxidation as reflected by elevated levels of MDA in pesticide exposed group indicates oxidative stress.

CAT and SOD

The mean \pm SD blood level of CAT in exposed subjects was 135.69 ± 12.34 (µmol H₂O₂ hydrolysed x10⁴ /ml/g Hb), while it was 105.5 ± 15.20 in respective healthy control. It showed elevated CAT activity in this study, as a result of OP pesticide induced poisoning. The increased activity of CAT seen in the poisoning cases coupled with an increase in the blood lipid peroxidation level (MDA) suggest an insufficient antioxidant defense.

The mean \pm SD RBC- SOD value were 8.03 ± 2.46 (µ mol hydrolysed X 10⁴ /ml/g/Hb) in exposed sprayers as compare to normal healthy control (3.29 ± 0.79). Exposure to OP pesticide showed elevated RBC-SOD activity in this study, SOD effectively dismutates superoxide anion into hydrogen peroxide and O₂.

Discussion

OP pesticide poisoning is primarily a problem of developing countries like India. In the present study, it was found that increased neurological symptoms count were observed among the pesticide sprayers and farmers suffered from acute OP pesticide poisoning due to either occupational or intentional inhalation or ingestion of OP pesticides. Our findings support the previous studies of OP pesticides and neurological symptoms reported in farm workers (Gomes et al 1998; strong et al 2004)¹⁴, green house workers (Walcarck et al 1999)¹⁵ and factory workers (Bellin and Chew 1974)¹⁶.

The role of oxygen free radical (OFR) has been well established in many chronic disorders. The signification of the implication of OFR in acute condition like OP pesticide poisoning has not been investigated so far.

The effects of the organophosphates on fish revealed that besides AChE inhibition, there were changes characteristic of oxidative stress¹⁷. In humans OPIs were shown to reduce the total cholesterol and phospholipids level of RBC membrane following phosphamidon and malathion¹⁸. The basis of OPI toxicity in the production of OFR may be due to –

1. Their "redox-cycling" activity—they readily accept an electron to form free radicals and then transfer them to oxygen to generate superoxide anions and hence hydrogen peroxide through dismutation reaction¹⁹.
2. Generation of free radicals probably because of the alteration in the normal homeostasis of the body resulting in oxidative stress, if the requirement of continuous antioxidants is not maintained.

In the present study, blood cholinesterase levels significantly lower than those of control group. Blood Acetyl-cholinesterase as well as blood butyryl-cholinesterase activities decreased and this reflected the inhibition of ChE activity due to pesticides poisoning in this study. Similar observations were reported earlier on AChE activity during OP pesticide toxicity (Vidyasagar et al)²⁰.

The present investigation of AChE activity therefore is important in context of selection of this enzyme as a potential biochemical marker in OP pesticides exposed population. Thus the main target of OP pesticides is AChE which hydrolyses ACh in cholinergic synapses and neuromuscular junctions (Ecobiochon 1991; Amitai et al 1998)²¹ this result in the accumulation of ACh in the synapses which inturn induces hyperactivity in cholinergic pathways.

In the untreated pesticide sprayers, the antioxidant enzymes, superoxide dismutase (SOD), Catalase (CAT) and GSH were significantly affected. The acute poisoning in sprayers lead to decreased glutathione and elevated MDA level as well as increased activities of catalase (CAT) and SOD. Prakasam et al (2001)²² also reported significant elevation of MDA levels in pesticides sprayers' thereby suggesting oxidative stress (Bachowski et al 1998). Vidyasagar et al (2004) also found higher MDA level with inhibited AChE activity of OP poisoned patients. The antioxidant system has been found to be susceptible to damage by OP pesticides (Kale 1999) and these pesticides have potential to generate free radicals in biological system (Hazarika et al 2003), have reported that oxidative stress induces an efflux of GSSG from erythrocytes, which may decrease the red blood cell GSH. It is possible that, the decreased GSH level observed in this study was not sufficient to combat with the enhanced production of MDA during increased lipid-peroxidation as a result of pesticides poisoning (Yoshioka et al 1997)²³. It has also been advocated that the cysteinyl residue of GSH offers a nucleophilic thiol which is important in the detoxification of electrophilic metabolites and metabolically produced oxidizing agents.

GSH is a substrate of enzymes namely GPx and Glutathione-S-transferase. GSH/GSSG ratio is a very important indicator of the redox status of the cell (Rana et al 2002)²⁴. It has been observed that pesticides poisoning disturb this ratio, again confirming the presence of oxidative stress. Our results suggest

that pesticide poisoning induces oxidative stress by depleting intracellular GSH and increasing ROS production. GSH is known to play a key role in regulating intracellular levels of ROS by scavenging free radicals to maintain the intracellular redox status. Organophosphate pesticides appear to disturb this key cellular pathway perhaps by disrupting mitochondria metabolism as suggested recently by Oelgado et al 2006; Chan et al 2006 and Sherer et al.²⁵

The increased activity of CAT seen in the poisoning cases coupled with an increase in the lipid peroxidation level (MDA) suggests an insufficient antioxidant defense. CAT, an enzyme that transforms hydrogen peroxide into hydrogen and oxygen, plays an antioxidant role and its activity increasing in acute poisoning submitted to oxidative stress. SOD has been reported to participate in the reduction of superoxide anion to less reactive molecular oxygen and hydrogen peroxide species. The H₂O₂ can be further decomposed by CAT or by glutathione peroxidase in the presence of reduced glutathione. Compound with other antioxidative enzyme, SOD and CAT are more sensitive and efficient and respond more rapidly in the face of oxidative stress (Dewez D et al 2005)

It is concluded that there was a considerable increase in lipid peroxide levels indicating an enormous oxidative stress with considerable alterations in enzymatic and non enzymatic antioxidants, in OP pesticide exposed sprayers.

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Identification of a Deceased in Disaster by Complete Denture Prosthesis

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Abstract

Occurrences of mass disasters, both natural and man-made, reported worldwide over the last decade are numerous and well documented, the forensic odontologist will almost certainly be one of those called upon to identify disaster victims or at anytime when the features of the body are destroyed beyond all recognition.¹

In cases of complete edentulousness, to facilitate a simple and inexpensive means of dental identification, standard techniques of marking dentures have been advocated Which involve typically, the inclusion of some form of a printed label.²

Key Words

complete edentulousness, complete dentures, Microchip board, Microchip, Carbide bur, disinfection, ultrasonic cleaners, solutions of 1% hypochlorite, 4% chlorhexidine, 4% sodium perborate.⁷

Source(s) of support: Nil

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Introduction

Occurrences of mass disasters, both natural and man-made, reported worldwide over the last decade are numerous and well documented, the forensic odontologist will almost certainly be one of those called upon to identify disaster victims or at anytime when the features of the body are destroyed beyond all recognition.¹

In cases of complete edentulousness, to facilitate a simple and inexpensive means of dental identification, standard techniques of marking dentures have been advocated which involve typically the inclusion of some form of a printed label.² Recently more high-tech method of denture labeling achieved via the use of radiofrequency identification (RFID)-transponders.³

RFID technology was first introduced in 1940, during World War II, and Used to identify aeroplanes belonging to the Royal Air Force, to distinguish friendly aircraft from the enemy; hence the name identification Friend or Foe.⁴ It forms a part of a technology known as "automatic identification and data capture" and is used to identify, locate and track people, animals and property.⁵

From a forensic odontological perspective, the feasibility of using RFID-tags was first investigated for forensic use in 2004 by Millet and Jeannin⁶. The procedure as a simple means employed "read-write" tags which were placed in complete dentures so that the data could be collected using a hand-held reader.

Material and Method

- Conventional complete denture
- Microchip (measuring 8.5mmx2.2mm).
- Carbide bur

Denture marking with a microchip: A square shaped microchip,

measuring 8.5mm x 2.2mm (fig.2) was used to modify the data in some instances as, e.g., a change in room number for hospitalized or Institutionalized patients.



Fig 1: Microchip board

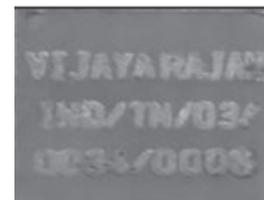


Fig 2: Microchip

The data are stored on the chip itself, and does not appear to be altered by standard Methods of disinfection, such as ultrasonic cleaners and solutions of 1% hypochlorite, 4% Chlorhexidine, and 4% sodium perborate.⁷

The dentures have been processed according to the manufacturer's instructions.

Stage 1: Prosthesis was disinfected, cleaned and dried before starting the incorporation process.

Stage 2: A depression (0.7mmX12mmX3mm) was cut slightly wider than the size of the Identifier on the external posterior palatal surface of the maxillary denture using carbide

Bur (Fig.3). This dimension was required to incorporate the chip without structurally Weakening the denture. Denture surface was roughened around the channel with the Carbide bur.



Fig 3: Slot preparation

Stage 3: Microchip was incorporated such that its long axis were placed parallel to occlusal plane (Fig.4). Clear, auto-polymerizing acrylic resin was sprinkled around but not on the microchip (Fig.5). Denture was processed in a pressurized container with warm water (100°F, 20psi) for 15 to 20



Fig 4: Incorporation of microchip



Fig 5: Addition of clear acrylic

minutes.

Stage 4: Excess acrylic resin was removed with an acrylic trimming bur, thereby denture was finished and polished. Care was taken not to touch the surface of the microchip.

Stage 5: A radiograph of the microchip implanted dentures was taken. The microchip is visible even when it was embedded in pink acrylic resin (fig.7).



Fig 6: Denture with microchip



Fig.7 Radiographic view

Discussion

The object of this article is to demonstrate the feasibility in the manufacture of a dental prosthesis with an incorporated microchip, the technical procedures for its incorporation in the denture resin and its working principles. There are several advantages in using this labeling system. The dentist without requiring special training or a dental technician can easily set the tag in the denture, since every dental surgery is equipped to carry out prosthetic adjustments and has autopolymerizing acrylic resin. Because of the microchip's size there is no real weakening of the denture as would be expected with metallic markers. Should the patient need laboratory relines or rebases there is no need to remove the device from the denture before relines/rebases and finishing procedure. Finally, it is cost-effective.

Conclusion

In the last 2-3 years microchip has been applied in areas

which were not considered suitable. Trials to evaluate potential applications in health care are ongoing in areas such as, access control, patient identification, material identification, protection of expensive equipments, location of patient, protection against counterfeit drugs. There are other possible applications of this technology are proposed in the forensic field. Hence edentulous patients in some disasters make not be recognized wherein microchip incorporated into the complete denture would act as a source of information.

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Study on Extraction of Caffeine From Tea Leaves (Camellia Sinensis)

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Abstract

Caffeine, a psychoactive drug, a methylxanthine alkaloid and polar compound was extracted from tea leaves by organic solvent method. After this, solid impurities were removed by **Gravity Filtration** while the solvent (DCM) was removed by **Steam Distillation** at 200°C. The crude caffeine was obtained and it has to be confirmed with two chemical tests as **Murexide Identification Test** – murexoin purple colour formation; caffeine salicylate formation & collection by vacuum filtration – melting point, 137°C was checked via Mel – Temp apparatus. After confirmatory test, the crude caffeine has to be purified by vacuum sublimation at 190°C where the caffeine sublimes at 178°C and melts at 238°C which was checked by, Mel – Temp apparatus. To assess the purity of caffeine, crude caffeine, sublimed caffeine and standard caffeine samples were subjected to TLC analysis and it was determined by calculating their R_f values and comparing them with standard R_f value range of caffeine, 0.3 – 0.7. The quantification of extracted caffeine was estimated by, UV – Vis spectrophotometric method at 274 nm, by calibrating a graphical representation of the O.D values recorded.

We conclude that, many ADD / ADHD people function well enough using caffeine to make it through life. They can easily afford the cost of caffeine and avoid paying for expensive ADD / ADHD prescription drugs. Also, their use of caffeine does not have to be supervised by a health professional. Importantly, for some, ADD / ADHD caffeine users do not have to carry the burden of the diagnosis of having a mental disorder.

Key Words

Gravity filtration, Steam distillation, Murexide Identification Test, Mel- Temperature, TLC.

1. Introduction

Caffeine : A psycho Btimulant Drug

Caffeine belongs to a family of naturally occurring compounds known as "xanthine". Caffeine is chemically 1,3,7-trimethylxanthine ($C_8H_{10}N_4O_2$), polar, heterocyclic, purine and a basic compound. Caffeine acts as a "stimulant". Caffeine, depending on the source plant, is considered as a "psychoactive drug".

Caffeine's Origin and Occurrence

Caffeine are of plant origin, contain basic nitrogen, often have a complex structure and usually have physiological activity.

Tea and coffee have been popular beverages for centuries, primarily because they contain the stimulant, caffeine. It stimulates the heart, respiration, the CNS, and is a vasodilator (relaxes the blood vessels) as well as a diuretic (increases urination).

Mechanism of Action

Caffeine readily crosses the blood–brain barrier that separates the bloodstream from the interior of the brain. Once in the brain, the principal mode of action is as non-selective antagonists for the adenosine receptors.

1. Material and Methods

Sample Collection

- Tea leaves (Camellia sinensis) : young, fresh and hand-picked leaves were collected from Kunnoor estate, Ooty, Tamilnadu.

Reagents Required for Caffeine Extraction from Tea Leaves

- 5% Sodium carbonate was dissolved in 250 ml of DI distilled water.

Reagents Required for Organic Solvent and Mixed-Solvent Method

- 80% DCM:
- 20% Sodium chloride: (used to dissolve the emulsion layer)

Reagent Required to Remove the Water Molecules from Organic (DCM) Solution

- Anhydrous Magnesium sulphate

Reagents required to wet the filter paper (whatman no.410) to perform gravity and vacuum filtration

- 70% Ethanol / Ethyl alcohol (100 ml)

Reagents required to perform the confirmatory tests for caffeine

- 70% Salicylic acid:
- Petroleum ether (or) mineral oil (or) ligroin:
- 30% concentrated nitric acid:
- 1% potassium chlorate:
- 1% Ammonium hydroxide:

Mixture required to perform Vacuum Sublimation

- Dry ice:

Reagents needed to make 20% Silica gel:

- 20% Silica gel

Reagents Required to Make the Eluting Solvents to Run the TLC Plate

- Preparation of solvent in the ratio of (95:5)

Reagents Needed to Make Iodine Chamber

- Iodine chamber (beaker with closed chamber)

Reagents Required to Perform the Quantification of Caffeine by UV – Vis Spectroscopy

- Standard caffeine solution (100 ml)
- 70% Concentrated Hydrochloric acid
- 70% Concentrated Sulphuric acid

Methods

Extraction of Caffeine from Tea Leaves by, Organic Solvent (DCM) Method

Extraction of caffeine from tea leaves can be performed by several methods as follows

- DCM (or) Methylene chloride processing
- Ethyl acetate processing
- Carbondioxide processing
- Water processing

The yield of caffeine from tea leaves was high (90%) when extracted with DCM organic solvent method.

Procedure for Solid – Liquid Extraction

- Wash the young and fresh leaf, buds parts of tea leaves (500 g) with distilled water for about three times.
- The washed tea leaves are allowed to shadow dry for 1 week.
- The dried tea leaves (with 70% moisture) was crushed .
- Weigh the mass of dried green powder.
- An equal amount of dried green powder was placed in separate two tea bags and tightly closed with the rubber bands.
- Place these two tea bags in a 500 ml weighed (tared) beaker.
- Add 5 g of 5% Sodium carbonate and pour 250 ml of distilled water.
- Boil the mixture gently on a hot plate for 15 minutes at 100°C, stirring every minute with a stirring rod.
- Let the tea mixture cool to about 20°C, then filter by filter paper and collect the aqueous tea solution and also gently squeeze the tea bags to liberate the rest of the tea solution in a beaker.
- Take this aqueous tea solution into ten 15 ml centrifuge tubes and spin at 3000 rpm for 10 minutes in order to separate the contents of tea solution according to their density.
- Pour the cooled, centrifuged tea solution into a separatory funnel and add 15 ml of DCM.
- Swirl the two layers for 2–3 minutes, inverting and opening the stopcock to release vapor

pressure and ventilate the funnel.

- Allow 2 minutes for the layers to separate, and drain the organic (DCM) layer into a 50 ml Erlenmeyer (conical) flask.
- If an emulsion is present, add 20% saturated Sodium chloride solution and swirl well by using glass rod.
- Add 15 ml of fresh DCM to the Sep – funnel, and repeat the extraction process.
- Allow 2 minutes for the layers to separate, and drain the organic layer into the Erlenmeyer flask containing the DCM solution from the first extraction.
- Pour the tea solution (aqueous layer) out of the top of the funnel into a beaker.
- Rinse the separatory funnel with distilled water. Pour the combined DCM solutions back into the funnel and add 20 ml of distilled water. Repeat the extraction process and drain the lower DCM layer slowly into a clean, dry 50 ml Erlenmeyer flask.

Procedure for “Solubility Test” (to Confirm the Collection of Organic Solution)

- The suspected solutions in beakers, were taken in two test tubes named A and B, and add few drops of distilled water and record the observation.

After the collection of organic phase solution containing caffeine with other impurities has to be subjected to the drying agent (Anhydrous Magnesium sulphate) for the removal of water molecule; gravity filtration by using fluted filter paper in order to remove large – sized (> 0.8 micrometer) impurities; steam distillation for the purpose of removal of organic solvent, DCM.

Procedure

- Add Anhydrous Magnesium sulfate to the DCM solution slowly and leave it for 5 – 10 minutes.
- Weigh a dry 50 ml RB flask.
- Place a fluted filter paper in a dry conical funnel and filter the drying agent from the DCM solution, collecting the filtrate in the tared 50 ml RB flask,
- Assemble a steam distillation apparatus at 200°C to distill the DCM from the solution.
- Continue the distillation until a dry greenish – white residue forms on the bottom of the flask.
- Weigh the RB flask and determine the mass of the crude caffeine and calculate the percent recovery.
- Cork the flask for next analysis at room temperature itself.

Confirmatory tests for caffeine by chemical identification methods; vacuum filtration method; by using Mel – Temp apparatus

The greenish – white residue collected after distillation process has to undergo two confirmatory chemical tests to identify the presence of caffeine in the recovered greenish – white residue as framed below

Procedure

For the formation of caffeine derivative – caffeine salicylate

- Add 5 g of crude caffeine and 3.7 g of 70% Salicylic acid into the RB flask, followed by 2 – 3 ml of DCM and heat the mixture for 10 minutes.
- Remove the RB flask from the heat and add Petroleum

ether drop wise until a solid white precipitate just begins to form. Now add DCM in drops so has to just dissolve the precipitate.

- Let the solution cool very slowly to RT⁰ and then put it on ice to aid the, crystallization.
- Vacuum filter the crystals using a Buchner funnel and rinse with Petroleum ether.
- Leave the solid in a tared beaker, cover with a filter paper and leave it in a cupboard to dry.
- Find the mass and melting point of Caffeine salicylate.
- Set the temperature as 117 - 1420c since the expected melting point of caffeine salicylate is 137⁰c.
- Record the temperatures at which melting begins and at which the last crystal disappears, this is the melting point range.

Murexide Identification Test

- Add few crystals of suspected crude caffeine crystals (1 g) with 3 – 4 drops of 30% Concentrated Nitric acid, in a test tube.
- Add 5 – 6 drops of 1% Potassium chlorate and then evaporate to dryness for 5 minutes.
- Add 2 drops of 1% Ammonium hydroxide and then record the observation of color change.

Purification of Crude Caffeine by Vacuum Sublimation Method

Procedure

- Place a 250 ml suction flask with crude caffeine (150 mg) at bottom and with Neoprene adapter on the top of the flask and insert a test tube (13X100 mm) inside which is wrapped with parafilm at three – fourth distance from the bottom of the test tube.
- Place this setup on a hot plate and connect the side arm to the vacuum (or) gas line.
- Gently turn on the vacuum and fill the inner test tube (cold finger) with crushed dry ice.
- Start heating the assembly at 190⁰c and observe how the caffeine sublimes and collect on the cold finger.
- When no more deposition of product is observed, remove the flask from the hot plate.
- Carefully, take out the cold finger and scrape off the product (pure caffeine) onto a weighing paper.
- Check the melting point of sublimed caffeine (238⁰c) by Mel – temp apparatus (set the temperature as 218 - 243⁰c).
- Record the mass of sublimed caffeine and calculate its percent recovery.

To Assess the Purity of Sublimed Caffeine by TLC Analytic Method

After the purification of crude caffeine, an organic compound by vacuum sublimation, the rate of purity of the sublimed caffeine can be determined by TLC analytic method,.

Procedure

- **Preparation of TLC plate**
- Take a 5X10 cm glass (TLC plate) and wipe with 70% Ethanol.
- Using a glass marking pencil draw lines, 1.5 cm from top (solvent front line) and bottom (spotting of samples) of the plate.
- Pour the 20% Silica gel slurry over the TLC

plate uniformly (thickness of 0.25 mm) and activate it by keeping in hot air oven at 110⁰c for 15 minutes.

- Add 4-5 ml of Ethyl acetate and 50% Acetic acid solvent mixture in the ratio of 95 : 5, to the developing chamber, cap the chamber and shake it vigorously.

Spotting of samples

- Divide the TLC plate with a line at back – side of the plate into three equal parts.
- Dip a clean micro capillary tube into the crude caffeine solution and place a spot on the bottom line of the TLC plate.

Making the distance travelled in TLC plate

- Remove the plate from the chamber with a pair of tweezers and immediately mark the solvent front with a glass marking pencil before the solvent begins to evaporate.

Visualization of spots under iodine chamber

- Now, the air – dried TLC plate was kept in a closed Iodine – crystal chamber for about 10 minutes.
- Remove the plate and mark the spots obtained and calculate the R_f by measuring from the starting line to the middle of the spot.

Quantification of Amount / Level of Caffeine Present in the Extracted Organic Solution by UV-Vis Spectrophotometric Method

To quantify the amount of caffeine in concentration form as ppm can be achieved by, working with an electromagnetic spectrum namely, UV – Vis spectrophotometer .

Procedure

- Add various concentrations of working standard solution from 1 ml to 6 ml by pipetting out the solutions to the respective test tubes S₁, S₂, S₃, S₄, S₅, S₆, T₁) and made upto 6 ml with distilled water simultaneously.
- A blank was also made with 6 ml of distilled water.
- To these test tubes (B, S₁, S₂, S₃, S₄, S₅, S₆, T₁), add 0.1 ml of Concentrated 70% Hydrochloric acid, 0.1 ml of Concentrated 70% Sulphuric acid and 0.1 ml of Lead acetate solution.
- Mixed well and kept in the boiling water bath for 15 minutes.
- The color intensity was measured .

Result and Discussion

2.1 Extraction of caffeine from tea leaves by organic solvent (DCM) method.

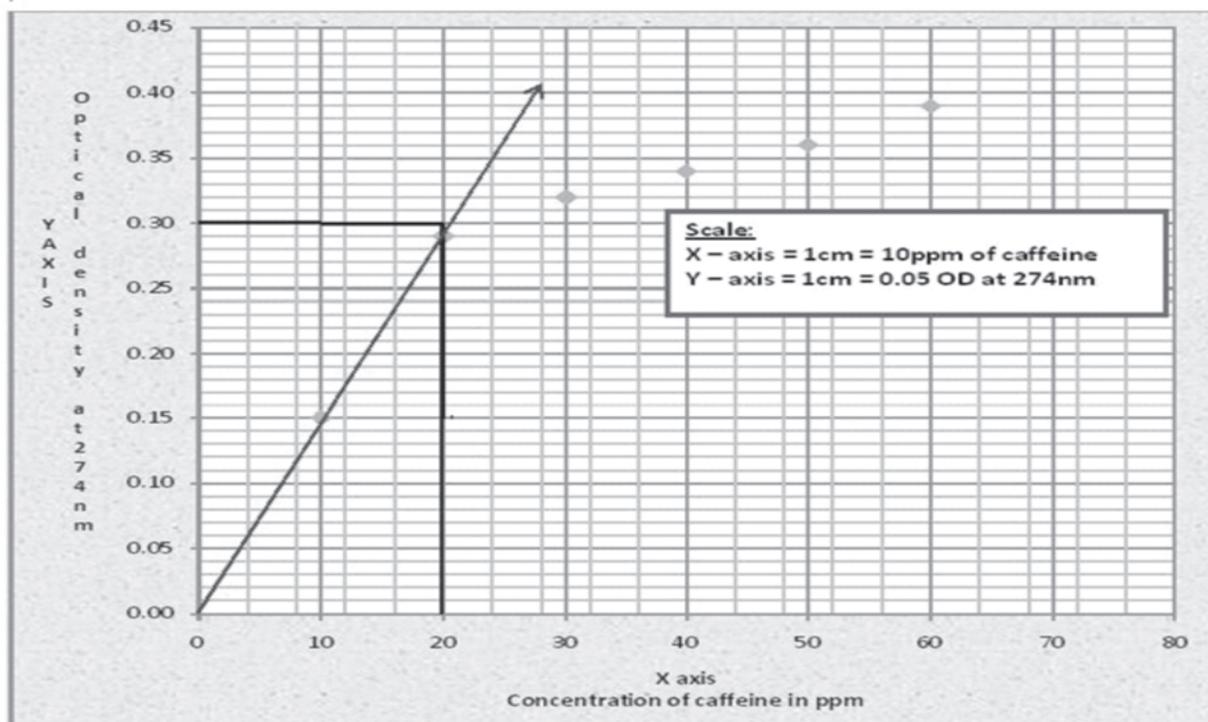
Solubility Test

- Test tube A was found to be the organic solution and test tube B was found as aqueous solution.

Table 2:

Tubes	Concentration of caffeine (in ppm)	Working standard solution (in ml)	Volume of water (in ml)	Volume of concentrated 70% HCl(in ml)	Volume of concentrated 70% H ₂ SO ₄ (in ml)	Volume of lead acetate solution (in ml)		O.D at 274 nm
B	-	-	6	0.1	0.1	0.1	Kept	0.00
S ₁	10	1	5	0.1	0.1	0.1	in	0.15
S ₂	20	2	4	0.1	0.1	0.1	Water	0.29
S ₃	30	3	3	0.1	0.1	0.1	Bath	0.32
S ₄	40	4	2	0.1	0.1	0.1	For 15	0.34
S ₅	50	5	1	0.1	0.1	0.1	Minut	0.36
S ₆	60	6	-	0.1	0.1	0.1	es	0.39
T1	-	2	4	0.1	0.1	0.1		0.30

Quantification of caffeine in an extracted solution by UV – Vis spectrophotometer



5.2 Drying of Organic Solution by the Addition of an Drying Agent

- Appearance of **snow globe effect** was found which indicates that the Anhydrous Magnesium sulphate was binded to water molecules present in the organic solution and formed as **crystalline hydrate**.

5.3 Removal of Impurities by Gravity Filtration Method

- The DCM filtrate appear in **light greenish solution**.

5.4 Removal of DCM Solvent by Steam Distillation

- A **greenish – white residue** was found in the RB flask after **distilling** the solvent, DCM at 200°C.
- This residue was referred to as **crude caffeine - 280 mg (28 g)** which was used for the subsequent procedures. The **greenish – white color** is due to the presence of trace amount of chlorophyll pigments.

5.5 Confirmatory Tests for Caffeine by Chemical Identification Tests

- Caffeine Salicylate crystals formation (Caffeine's derivative)
- The white crystals were observed after vacuum filtration. The melting point of these crystals was found as 137°C which correlates the melting point of caffeine salicylate.

Murexide Test for Caffeine

- The appearance of **purple color** solution was observed and it indicates the presence of caffeine

5.6 Purification of Crude Caffeine by Vacuum Sublimation Method

- The **crude caffeine** was found to sublime at 178°C and it was deposited over the cold finger part of a sublimation apparatus. The cold finger tube was taken out and the purified caffeine was scrapped off carefully in a weighing sheet and its mass was found to be, **140 mg (14 g)** from this, small amount was taken to check its melting point and was found to be **238°C** (standard caffeine melting point).

5.7 To Assess the Purity of Sublimed Caffeine by TLC Method

- **Brown – coloured spots** were viewed after the incubation time about 10 minutes, where the spotted, runned with samples TLC plate was placed in a closed Iodine chamber. The standard R_f value of caffeine is **0.3 – 0.7**. Hence, the authentic caffeine sample showed its R_f value as 0.7 which accurately matches the standard R_f value; while the sublimed caffeine was also found within the range of standard R_f value of caffeine as 0.65 but the crude caffeine showed its R_f value as 0.73 which exceeds the standard R_f value of caffeine due to the reason of presence of impurities like trace amount of tannins, chlorophyll, etc., in it.

5.8 Quantification of Caffeine (Extracted) by UV – Vis Spectrophotometric Method.

- The appearance of **deep – yellowish brown color** which is needed to quantify the caffeine by, UV – Vis Spectrophotometer.

5.8 Quantification of Caffeine (Extracted) by UV-Vis Spectrophotometric Method

Table 2 : Tubes Concentration of caffeine (in ppm) Working stand-ard solution (in ml) Volume of water (in ml) Volume of concentrated 70% hydrochloric acid (in ml) Volume of concentrated 70% sulphuric acid (in ml) Volume of lead acetate solution (in ml) O.D at 274 nm

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Recognizing and Intervening in Domestic Violence: A Proactive Role of Dentistry

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Abstract

Domestic violence is a health care problem of epidemic proportion causing not only immediate trauma but also contribute to a number of chronic health problems. It is worldwide in distribution and most common victims are women and children. Indian society leaves it cocooned by feelings of guilt and embarrassment. It is national shame for any country and this can be fostered with combined collaboration and communication. The typical and well patterned non-accidental injuries in head, neck and maxillofacial regions are routinely recognized by dentists. Therefore, a registered dentist can recognize and intervene in domestic violence and/or may act as collaborative partner along with other health care workers.

Introduction

Domestic violence is a pattern of assaultive and coercive behaviors, including physical, sexual and psychological attacks that adults or adolescent use against their intimate partner or children. It exists in every community and effects people regardless of race, ethnicity, class, sexual and gender identity, religious afflictions, age, immigration status and ability. It is a health care problem of epidemic proportions that causes not only immediate trauma but also contribute to a number of chronic health problem, including depression, alcoholism, drug-abuses, sexually transmitted diseases such as AIDS/HIV, and often limits the ability of victims to fight with other chronic illnesses. Despite these facts, a critical gap remains in the delivery of health care to victims, with many providers

discharging the case with only the presenting injuries being treated, leaving the underlying cause unaddressed¹. It is reported that females are the victims in most situations of domestic or intimate-partner violence (85%)². Domestic violence is often a silent cycle of physical, emotional and verbal abuse that leaves victims feeling trapped and helpless. It is rampant in Indian society—a look at any daily news paper is probably the best witness. In lack of organized study and reporting, really no one knows how many instances of family violence go completely unnoticed. In India, the main causes of domestic violence seem to be financial dependence, social conditions, personal beliefs and slow institutional responses. The psychiatric establishments believe it a better sense of reality of battered women than those who batter them³. Indian society in particular, makes domestic violence invisible and leaves it cocooned by feelings of guilt and embarrassment. Some evidence supports that 2 of every five women live in abusive relation⁴. Particularly women and children, being unable to flee stay in an abusive relation. The evidence exists that a significant proportion of all female homicide victims are killed by their intimate partner⁵.

Domestic-Violence and Children-Health

The primary forms of violence and abuse against children are neglect, exploitation and Physical, sexual or emotional abuse which have devastating consequences for victims, both

immediately and long-term. A child can be a witness or a victim of family violence. As a witness, children are most likely than others to exhibit behavioral and physical health problems including stress-related disorders, depression, anxiety and violence towards peers⁶. They are also more likely to attempt suicide, abuse drugs and alcohol, engage in teenage prostitution, commit sexual assaults, crimes and run away from home⁷.

It is noticed that almost fifty-percent of the men who assault their women partner, also assault their children⁸. Violence against child is completely illegal and medical professionals, health workers with other social activists have a duty to report suspicious

Cases of child abuse to relevant authority. United State's Advisory Board on Child Abuse and Neglect declares it a 'Nation's shame' and suggests that domestic violence may be a single major precursor to Child-abuse and Neglect-fatalities⁸.

Domestic-violence; Dentist's assessment, recognition and intervention The assessment, recognition and intervention of domestic-violence is both, a diagnostic as well as therapeutic measure. Seventy-five (75%) percent of the physical injuries of Domestic violence occur in the head, neck, and/or mouth (face) region⁹. Furthermore, non-accidental injuries are typical and well patterned¹⁰. Because, a dental professional frequently deals with the injuries occurring in the maxillofacial, head, and neck region, he can comfortably assess and recognize the injuries of domestic violence in these areas¹¹ (Table-1).

Table one: Recognizable Injuries of Domestic-Violence

(By Dental Professionals)

- Intra-oral bruises from slaps or hits.
- Patterned bruises on neck from attempted strangulation such as thumb bruise, Ligature marks, or scratch marks.
- Petechiae-bruising in face, mouth or neck by attempted strangulation.
- Soft and hard palate bruises indicates forceful sexual acts.
- Fractured teeth, nose or facial bones.
- Signs of healing fractured wound in panoramic radiographs.
- Abscessed or non-vital teeth caused by blows to the face.
- Torn-frenum, and Bite-marks.
- Hair-loss from pulling, black eyes, ear bruises or lacerations to the head.
- Injuries to arms, legs and hands noted during dental visits.

Identification and diagnosis of domestic violence (intimate partner) relies on patients disclosure that is either patient initiated, or as a result of appropriate inquiry. Dental clinicians also identify domestic violence through pattern recognition of key historical or physical findings that appear consistent with domestic violence. Identification itself has a powerful treatment effect against negative stigma associated with victimization¹².

Most of the victims of domestic violence don't know where to turn or how to get help. Study reports show a significant number of victims (70-81%) of domestic violence like to talk to their health care providers privately^{13,14}.

A typical appointment to dentist is of 45-60 minutes as

opposed to 7-10 minutes with their physicians. A longer treatment hour establishes trust with the patients. So, even when victims of violence avoid seeking medical attention or more to other physicians and hospitals, they maintain their routine and emergency dental appointments¹⁵. Very often these patients just wait for someone to ask question. Reports indicate that almost 10% of victimized Women consult their dentist for physical assaults in domestic violence¹⁶.

Dental Neglect could be an indicator of domestic violence¹¹. Patients experiencing domestic violence may be restricted by their abuser from seeking dental or medical care.

Non-treatment or lack of treatment of facial injuries and infections are critical and that could travel through the facial planes of the body towards heart.

Strangulation is indicative of a high level of domestic violence that can escalate to death quickly. The dental professionals may observe visible strangulation mark such as injuries, ligature marks, scratches, abrasions, scrapes and bruises from thumb or fingers on neck, face, mouth or eyes. Symptoms of voice change and breathing problems initially appear mild but may kill the victim within 36 hrs or later. Such cases demand quick identification, intervention and referral for medical evaluation and treatment to save a life^{17,18}. By assessing domestic violence and child-abuse, dentists can assist the victims in getting help before life threaten injuries occurs. Dental professionals can and do help victims by asking about violence during comprehensive dental examination, performing brief safety assessment, documenting abuse in dental chart, and making referrals to domestic violence experts. The victims of domestic violence need a space to talk it over with an emphatic listener who does not blame them. The simple act of asking about violence, responding with compassion and validating the victims experience is a powerful intervention. It is noticed that without intervention, the violence usually escalate in both frequency and severity resulting in repeated visit to the health care system¹². Emerging researches also indicate that domestic-violence interventions reduce health care costs by 20 percent¹⁹. Early identification and treatment of victims and potential Victims benefits health care system in long run. Past clinical studies reveal that a 2-Minutes screening for early detection of abuse and additional 10-minutes intervention is highly effective in increasing safety of victims²⁰.

Documentation is an important part of chart, records and mandated reports(if state law requires anyone to report). It can be an important court document. Objective observations and description supplemented with narrative descriptions and statements, measurements, drawings or photographs speak for itself. The dental chart reflects collected information and data regarding incidence of trauma, and I.O.P.A. and panoramic x-rays reveal pre & post-trauma comparison. Plaster/stone models and casts reflect pre-trauma conditions and that could be compared with colored photography of injuries.¹¹

Documentation assessment of domestic violence can be done simply by using rubber-stamp on clinical records or by adding a small abbreviated table i.e.

Assessment: O yes-O no
O DV, +O DV, ? DV

Virtually all jurisdictions worldwide impose civil or criminal penalties for failing to report suspected cases of family violence, child abuse or neglect. In many countries registered dental professionals and their assistants are mandated by law to report injuries suspicious of abuse and neglect in children, dependants and elderly²¹. In India, numbers of officially recorded child murders has steadily risen over the years and 60% of those charged are parents of the murdered children(logics being intimacy sexual desire, identity formation, personal habits, marriage, money, house works and child care, unemployment or under-employment)²². The study reports show a proportional rise in domestic violence in India with education²³ Section 498A of the Indian Penal Code that deals with Family Violence in totality have provision for 3-yrs imprisonment or fine or both²⁴. Domestic

Violence Act 2005, Section 3 of Indian Judiciary refer perpetrators as "the respondent"²⁵. Unfortunately the attitude which makes domestic violence an invisible factor in India's social fabric vitiates not only societal response but also institutional responses. Judicial records show very low conviction rates in the case of domestic violence. Lengthy court proceedings, inordinate delays in investigation and irrational procedures in Indian judiciary system are serious deterrents for women to approach courts²⁶. At many situation dental professionals have played an important role as collaborative partner in domestic violence recognition²⁷. Therefore, it is extremely important to dentists to know there state's law and how criminal justice system deals with the issue. All dental offices should also have available the current phone numbers and addresses of Domestic Violence Services Agencies. So that they could properly and adequately inform their patients. Because domestic violence is a serious issue where individual's family information and privacy is attached, the intervention must be clear cut, un-interrupting, well documented and careful. Indian Judiciary system authorizes a Protection officer who deals with the cases of domestic violence reported through a Magistrate or Police officer or Registered Voluntary organization.

Therefore, dental professionals can work both within profession and with other health care workers to increase the awareness of how to detect and respond to family violence, especially oral abuse and neglect, and join the community effort. Family violence and abuses are national shame for any country and this can be fostered with combined collaboration and communication.

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Sudden Natural Deaths Due to Sub Arachnoid Haemorrhage - A Case Series

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Abstract

Natural deaths form a large substrate of the autopsies conducted by a Forensic Pathologist and the situation where they deal exclusively with trauma and crime is professionally unhealthy. Involvement with natural deaths which are sudden, unexpected, clinically unexplained or otherwise obscure is quintessential for the cross fertilization of knowledge and ideas. A clear understanding of the morbid anatomy, disease process, and interactions with clinicians is an indispensable benefit not only as an experience but would also be crucial in solving the difficult problems arising in cases which are litigious where trauma is concurrent with a natural disease. Sudden Natural deaths due to Sub Arachnoid Haemorrhage are being discussed from the point of commonest causation of such a haemorrhage i.e. Berry aneurysm, other causes, morbid anatomy in each of these 9 case report series and also the medico legal problems that arose.

Key Words

Sudden natural Death, Sub Arachnoid Haemorrhage (SAH), Berry Aneurysm

Introduction

Virtually all Forensic Pathologists deal not only with homicidal, accidental and suicidal deaths but also with a wide range of deaths from natural causes. Many of these are sudden, unexpected, clinically unexplained or otherwise obscure. Though the spectrums of causes for sudden or unexpected deaths are very many, in this case series only natural deaths following Sub-arachnoid haemorrhage will be discussed.¹

The definition of a sudden death varies according to authority and convention. Death is said to be sudden or unexpected when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness (WHO).² In sudden death, the immediate cause is almost always to be found in the CVS, even though topographically the lesion is not in the heart or great vessels. Massive cerebral haemorrhage, sub-arachnoid bleeding (SAH), ruptured ectopic pregnancy; haemoptysis for example join with the heart disease to contribute most of the vascular system reasons for sudden, unexpected death. Briefly, sub arachnoid hemorrhage was defined as a spontaneous rupture of a blood vessel, most often a cerebral aneurysm or Arterio venous malformation (AVM) leading to bleeding into the sub arachnoid space.³ The lack of knowledge on cause of SAH hampers its effective prevention.⁴

The most frequent extracardiac cause for sudden death arising in the CVS is a rupture of an aneurysm, almost always of the aorta or a cerebral vessel. Spontaneous rupture of an aneurysm of the Circle of Willis at the base of the brain is one of the most common causes of death in young to middle aged individuals, if coronary disease is excluded.

SAH accounts for 3% of all strokes and 5 % of all stroke deaths and significant risk factors are smoking, hypertension and heavy drinking.⁵

Sub-arachnoid bleeding can cause virtually instantaneous death even though the mechanism is obscure. Numerous cases have been described where a previously fit person was seen to

collapse and was apparently dead when attended by onlookers. There might be an element of cardiac arrest in them caused by sudden bathing of the brainstem by the jet of arterial blood impinging on the base of the brain, and as with coronary disease, arterial spasm has been invoked as a cause of sudden death in ruptured berry aneurysm without any proof.

Most cases of SAH have a much larger cause, with clinical symptoms and signs allowing either surgical intervention or often, spontaneous resolution. They can range from catastrophic headache and coma to trivial or misleading symptoms such as general headache, face, eye, neck and back ache and even fever and diarrhoea.³ However in this case series we are limiting with sudden or rapid fatalities.

In the usual case the victim is either found dead with no available history or has died rapidly and inexplicably, or has expired after suggestive symptoms of severe headache, neck stiffness, vomiting, progressive failure of consciousness before dying at a variable period after the haemorrhage and rapid coma. Many also die after physical or emotional exhaustion, especially sexual intercourse or strenuous sporting activity.

Case Series

Salient findings of 09 cases of sudden natural deaths due to SAH that were subjected for autopsy at M.S.Ramaiah medical college, Bangalore are as follows.

Case 1: PM No 152/06, Age – 50years, Sex – Male, Known hypertensive Electrician by profession and was found dead in the bathroom. He had complained of chest pain on many occasions. Time of occurrence is not known as the deceased was alone in the house. Weight of the heart – 350gms, coronaries LAD narrowed by 80%. Cause for SAH: Berry aneurysm (ruptured at the junction of middle cerebral artery and anterior cerebral artery).

Case 2: PM No 209/06, Age – 53years, Sex – Female, Known hypertensive. Housewife is said to have collapsed and was rushed to a hospital where she was declared brought dead, no injuries. Time of occurrence – 5 am HPE: Lungs: congestion, Heart: unremarkable, Brain: SAH Cause for SAH: **Berry** aneurysm ruptured at the junction of middle cerebral artery and anterior communicating artery with multiple other unruptured aneurysms.

Case 3: PM No 447/06, Age – 35years, Sex – Male Software engineer by profession and married for the past two and half months was away on work for two months. On the fateful day upon returning from his foreign visit, is said to have complained of headache and was brought dead. At autopsy massive SAH was noted. 15 days later when the wife and her brother came for cause of death certification, upon questioning the wife revealed that they had sexual intercourse and that he complained of severe throbbing headache during the course of the act and rolled over and became unconscious, with the help of neighbours took him to the hospital and was declared brought dead. At autopsy incidentally semen was present at the tip of penis.

Time of occurrence – 1.30 am Weight of the heart – 400gms, coronaries patent Cause for SAH: physical and emotional

exhaustion (Sexual intercourse)

Case 4: PM No 727/08, Age – 45years, Sex – Male Working in an electric company was found lying on the footpath.

Time of occurrence – 9 pm. Heart weight 300gms, both coronaries showed 50% occlusion. HPE: Lungs: Chronic venous congestion and pulmonary edema, Brain: SAH with Intraventricular extension.

Cause of SAH: **Obscure**

Case 5 : PM No 328/09, Age – 21years, Sex – Female Employed in a weekly magazine complained of chest pain went to a local clinic and later returned to the paying guest hostel. She complained of giddiness and bout of vomiting at 8.30 pm and was rushed to a hospital and was declared brought dead at 9 pm. The parents gave the **history later that her elder sister too had died in a similar fashion.** At autopsy abrasions were present over outer aspect of left elbow and right leg. Time of occurrence– 9 pm Cause for SAH: **Familial predisposition**

Case 6: PM No 369/09, Age – 25years, Sex – Male Cook by profession, found lying in the bathroom and the case was registered as suspicious death (? assault), at autopsy there were no injuries, but there was SAH with ventricular extensions. The patient had complained of giddiness for the past few months. Time of occurrence– 5.30 pm. HPE: Brain: AV malformations with bleed.Cause for SAH with Intraventricular extension: **Arterio Venous Malformation.**

Case 7: PM No 370/09, Age – 55years, Sex – Female, Known diabetic and hypertensive for the past 5 years. A house maid by profession, was found dead in her room by other members of the family Time of occurrence– 6 am. Heart 400 Gms, left ventricular hypertrophy, LAD 80-90% occlusion. Brain covered with SAH diffusely over both the cerebral hemispheres and base of the brain. Cause for SAH: **Systemic Hypertension.**

Case 8: PM No 672/09, Age – 46years, Sex – Male Bank employee by profession is said to have fallen in the bathroom at midnight as informed by wife, he had complained of shooting pain in the head. At autopsy Heart weighs 350gms with 80% occlusion of LAD with SAH. Abrasions were present over right side of chest and right knee. Stomach: Smell of alcohol present. Time of occurrence– 3 am. HPE: Confirmed SAH over the base of the brain and frontal region, intact circle of Willis was identified and a small ruptured Berry aneurysm identified at the anterior communicating artery measuring 0.4cms in diameter.

Cause for SAH: **Berry aneurysm** (ruptured at the junction of middle cerebral artery and anterior communicating artery) precipitated by pre existing heart disease and alcohol consumption.

Case 9 : PM No 753/09, Age-49years, Sex-Male **Occupation:** Labourer. History of headache and vomiting present prior to death. Time of occurrence-12pm. At autopsy-smell of alcohol. HPE: Lungs: Chronic venous congestion and pulmonary edema, Brain: SAH Cause for SAH: **Obscure**

Discussion

At autopsy, the diagnosis of Sub-arachnoid haemorrhage is self evident. The point of bleeding is in the circle of Willis and the densest haemorrhage will be over the base of the brain, especially in the basal cisterns. The blood usually spreads and may cover the cerebral hemispheres, the hind brain and down into the spinal cord.

An aneurysm is present in about 85% of spontaneous SAH, but the remainder reveals no aneurysm, even after exhaustive search, because of the destruction of a small aneurysm at the time of rupture or may be due to a leak from a vessel without an aneurysm as a result of weak point viz angioma, A-V anastomosis or an aberrant vessel in the meninges. As blood in the Sub Arachnoid space seems irritant

even in small quantities, it seems possible that such irrigation of the medulla may lead to a rapid cardio respiratory failure.

Embryonically the circle of Willis condenses out of an irregular embryonic meshwork of arteries over the base of the brain by unwanted vessels undergoing atrophy. At this point where these redundant vessels join the surviving main arteries a 'window' in the elastic and elastic coat is left, usually at the junction of the two vessels. This window is a weak point where rising blood pressure in adult life may begin to form a blow out, which may be single or multiple. At a certain stage, any sudden rise in BP or flow rate may rip the already tense sac and cause extravasation of blood at full arterial pressure into the Sub-arachnoid space.

Where there is no aneurysm, it must be assumed that a weak point in the vessel wall has given way ab-initio, without the prior formation of a sac. Sometimes a buried aneurysm will rupture mainly into the cortex causing a lesion that that may be mistaken for an intracranial haemorrhage.

An important but non modifiable risk factor is familial predisposition to SAH. Between 5- 20 % of cases with SAH have a positive family history.⁶ First degree relatives of patients with SAH have a 3-7 fold increased risk of being stuck by the same disease. It is also associated with heritable disorders of connective tissue, even though Autosomal Dominant Polycystic Kidney Disease is most common.

SAH is another difficult area in which trauma and natural disease interact. When a Berry aneurysm ruptures the allegation is often made that some traumatic occurrence precipitated that event .The problem is to decide whether the trauma itself was a mechanical factor in causing the artery to burst. Thus when an aneurysm ruptures during or shortly after fight or altercation, it is arguable whether a mechanical blow to the head or merely the emotional stress of a dispute is the most potent factor in causing rupture. There has been much medical argument about the role of trauma in causing the rupture, as many would maintain that the aneurysm is so deep seated within the skull that internal pressure from hypertension is far more likely, to be the reason.

A rupture is a relatively common event in the young to middle aged persons who indulge in activities such as jogging, sexual intercourse and sporting exertion, probably because of a transient rise in blood pressure and pulse rate. A potent element may be in the adrenal response, catecholamines pushing up the blood pressure. The time interval is naturally important, though in most instances bleeding occurs immediately or soon afterwards.

Conclusion

- A sudden natural death due to sub arachnoid haemorrhage is a recognized fact.
- The most common cause for SAH is a ruptured berry aneurysm. Though other causes like systemic hypertension, physical and emotional stress, familial predisposition, AV malformation may result in a bleed or at times the cause is obscure.
- In most cases bleeding occurs immediately or soon afterwards following a head ache or a bout of vomiting.
- It affects both the sexes and more so in middle aged individuals.
- Autopsy and histopathological examination is gold standard in ascertaining the cause for SAH and to clear the allegations that are part of such sudden deaths
- Recognition of the signs and other predisposing factors like systemic hypertension, evaluation for the cause of head ache etc is important as in most of the cases the time interval between the symptoms and death was short for timely medical intervention.
- Cross fertilization of knowledge and the ideas of morbid

anatomy and the clinical reality in such cases would be beneficial.

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Pattern of Abdominal Injuries in Cases of Road Traffic Accidents

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Abstract

During this study period 900 cases were brought for post mortem examination out of which 200 (22.22%) deaths were due to road traffic accidents. Out of 200 Road Traffic accident deaths, 60 (30%) cases were with abdomen injuries. The maximum cases of road traffic accidents with abdominal injuries were seen in the age group of 21-30 years (25%), followed by 31-40 years (21.66%). Males (52 cases) outnumbered females (8 cases) and male – female ratio is approximately 6.5 : 1, The maximum number of road traffic accident deaths with abdominal were occurred during night times 26 (43.33%) cases and least cases were recorded during morning time 8 (13.3%) cases. The maximum number of victims were pedestrians 31 (51.7%) cases, followed by motor cyclist in 24 (40%) cases and the least were occupant of light motor vehicle and the most common offending vehicle is Heavy Motor Vehicles in 27 cases (45%), followed by motor cycle in 12 cases (20%). In the 60 cases of road traffic accidents with abdominal injuries it was found that 10 (16.7%) cases are spot death, 4 (6.6%) cases were brought dead to hospital and 46 (76.7%) cases were succumbed to their injuries after some duration of hospital stay. The pattern of external injuries over abdomen i.e., abrasions were present in 27 cases, contusions in 29 cases, lacerations in 16 cases, no external injuries over abdomen in 15 cases. Liver was the common organ involved in majority of victims i.e., 28 (46.7%) cases, followed by spleen in 15 (25%) cases and kidneys in 10 (16.7%) cases. Lumbar spinal column injury was present in 3 (5%) cases. Injury to two intra-abdominal organs were present in 28 cases (46.6%), followed by one organ injury in 14 cases (23.3%) and injury to abdomen alone was found in 12 cases (20%). Associated injuries to two and more than two body regions (head, chest and limbs) were found in majority of cases (50%). The main cause of death was haemorrhagic shock in 31 cases (51.66%) followed by combined effect of head injury and haemorrhagic shock in 26 cases (43.33%).

Key Words

Unnatural deaths, road traffic accidents, abdominal injuries.

Introduction

An accident that takes place on the road involving a vehicle is termed as road traffic accident. Amongst all traffic accidents, road traffic accidents claim largest toll of human life and tend to be the most serious problem world over. Currently motor vehicle accidents rank 9th in order of disease burden and are projected to be ranked third in the year 2020. Nearly three quarter of deaths resulting from motor vehicle crashes occur in developing country¹.

India is the largest country in the South Asian region with all the problems faced by rapidly developing nations, especially increasing motorization. In India, over 80,000 persons die in the traffic crashes annually, over 1.2 million injured seriously and about 3,00,000 disabled permanently. In India, for individuals more than 4 years of age, more life

years are lost due to traffic crashes than due to cardiovascular diseases or neoplasm^{2,3}. The problem appears to be increasing rapidly in developing countries⁴. Injuries due to RTA depend upon a number of factors-human, vehicle and environmental factors play vital roles before, during and after a serious RTA. The important factors are human errors, driver fatigue, poor traffic sense, mechanical fault of vehicle, speeding and overtaking violation of traffic rules, poor road conditions, traffic congestion, road encroachment etc. India accounts for about 10% of road accident fatalities worldwide⁵.

The incidence of Accidental Deaths has increased by 0.4% at National level during 2008 as compared to 2007. During the year 2008 34.5% of accidental deaths are due road traffic accidents. It is observed that the rate of deaths per thousand vehicles has decreased marginally from 1.4 in 2004 to 1.3 in 2008 even as the number of vehicles in the country have increased and the quantum of 'Road Accidents' has decreased. In India about 324 Deaths and 1285 injuries per day are due to Road Accidents⁶.

In Bengaluru, the capital of Karnataka vehicular accidents are the most common contributory factors to the abdominal trauma because of multiplicity of vehicles, viz., power driven as well as body and hand driven running on the same road, increased density of the traffic specially in the peak hours, faulty roads, poor maintenance of the public transport vehicles etc. During the year 2009, 737 deaths were reported within Bangalore as per the statistics of Bangalore city traffic police.

The abdominal region is considered as one of the most vulnerable region of the body and the injuries involving this region are fatal. In most of the cases the clinicians in patients with road traffic accidents concentrate on the injuries to the head and blunt injuries to abdominal region may be missed due to blunt injuries, as no external injuries are observed. In many cases the persons may sustain injuries to this region with or without head injury. So in this study an attempt has been made to highlight the pattern of injuries to abdominal region in deaths due to road traffic accidents and also socio demographic profile of these victims. Hence this study may help clinicians in diagnosing the case at the earliest stage.

Material and Methods

This Descriptive study was carried out at the Mortuary of Department of Forensic Medicine, Kempegowda Institute of Medical Sciences, Bengaluru from January 2007 to December 2008. All Road Traffic Accident cases with abdominal injuries autopsied were included in this 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 road traffic accident was sought from the police personnel investigating the case. Some of the particulars of the victim were also obtained from the direct interrogation with relatives, friends, others along with police. 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.

Results

During this study period 900 cases were brought for post mortem examination out of which 200 (22.22%) deaths were due to road traffic accidents. Out of 200 Road Traffic accident deaths, 60 (30%) cases were with abdominal injuries (Figure -1). The maximum cases of road traffic accidents with abdominal injuries were seen in the age group of 21-30 years (25%), followed by 31-40 years (21.66%) (Figure-2). An early and late age shows minimum cases. Among 60 cases of road traffic accidents with abdominal and pelvic injuries, Males (52 cases) outnumbered females (8 cases) and male – female ratio is approximately 6.5:1 (Figure – 3). The maximum number of road traffic accident deaths with abdominal injuries were occurred during night times 26 (43.33%) cases and least cases were recorded during morning time i.e., 8 (13.3%) cases. Maximum number of victims was pedestrians i.e., 31 (51.7%) cases, followed by motor cyclist in 24 (40%) cases and the least were occupant of light motor vehicle (Table – 1). Heavy motor vehicles are the most common offending vehicle 27 cases (45%), followed by motor cycle in 12 cases (20%) and 9 cases (15%) are from others. In this study 10 (16.7%) cases are spot death and 4 (6.6%) cases were brought dead to hospital and maximum 46 (76.7%) cases were succumbed to their injuries after some duration of hospital stay. The pattern of external injuries i.e., abrasions were present in 27 cases, contusions in 29 cases, lacerations in 16 cases. There were no external injuries over abdomen in 15 cases. Among soft tissues Liver was the common organ injured in majority of victims i.e., 28 (46.7%) cases, followed by spleen in 15 (25%) cases and kidneys in 10 (16.7%) cases (Table-2). Injury to lumbar spinal column was noted in 3 (5%) cases. Injury to two intra-abdominal organs were present in 28 cases (46.6%), followed by one organ injury in 14 cases (23.3%) and three organ injury in 6 (10%) cases. Associated injuries to two and more than two body regions (head, chest and limbs) were found in majority of cases (50%). The cause of death was haemorrhagic shock in 31 cases (51.66%) followed by combined effect of head injury and haemorrhagic shock in 26 cases (43.33%) and septicemia in 3 cases (5%).

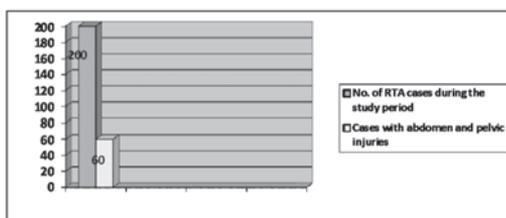


Figure-1

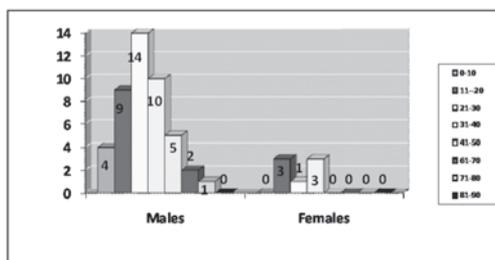


Figure-2

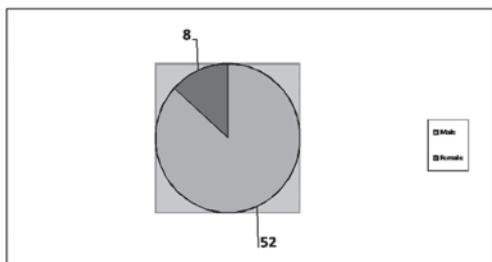


Figure – 3

Table 1: Type of Victims in RTA

Victim position	No. of cases	Percentage
Pedestrian	31	51.7%
Motor cyclist	24	40.0%
Occupant of light motor vehicle	5	08.3%
Occupant of heavy motor vehicle	0	00.0%
Total	60	100.0%

Table 2 : Incidence of Soft Tissue Organs Involved

Organs involved	No. of cases
Liver	28
Spleen	15
Kidney	10
Stomach	1
Small bowel	2
Large bowel	2
Mesentery	3

Discussion

Abdominal trauma is one of the important causes of mortality in road traffic accidents. Its incidence is fast increasing due to various factors relating to modern civilization. A Descriptive study was, therefore, undertaken at the Department of Forensic Medicine, Kempegowda Institute of Medical Sciences Hospital and Research Centre, Bengaluru, to study the pattern of abdominal injuries and various factors related to them in road traffic accidents. This study was done for a period of two years between January 2007 to December 2008. A total number of 60 cases were studied during this period. In case of abdominal injuries, it is very crucial to accurately appraise the full extent of injury involving various organs/structures. The management and outcome of the case depends on the identification of the organ involved in the trauma cases.

In the present study deaths due to road traffic accidents were 200 cases (22.2%) during two years of study period. Out of 200 road traffic accident cases abdomen injuries were found in 60 cases. This may be explained as a road traffic accident constitutes a complex phenomenon of multiple causation. The rise in number of RTA's is due to urbanization and tremendous growth in road transport sector. Population explosion is a catalyzing factor for these numbers of RTA's. Congested roads, inadequate traffic planning, consumption of alcohol, disregard to traffic rules has contributed much for the occurrence of RTA's in our city. Majority of the cases were in the age group of 21-30 years (25%), followed by the age group 31-40 years (21.6%), early and late ages show minimum cases and this is consistent with the studies conducted by other authors^{7,8}. A large number of cases in this age group can be explained by the fact that young persons in this age group are more active, peak of their creativity and have the tendency to take undue risk, thereby subjecting themselves to the hazards of accidents and injuries. The minimum cases are seen in children and later ages i.e., more than 60 years. The reason for this may be that children are taken care of by elders and are less likely to use vehicles. The lower proportion of RTAs in those aged 60 years and above could be due to the generally less mobility of these population groups. Males dominated females in the ratio of 6.5:1. This dominance of males has also been reported by various workers^{9,10}. This dominance of males in readily explainable by the fact that males are more exposed to hazards of roads as they constitute working and earning member in majority of the families, while females usually stay at home and look after the house hold work.

The maximum number of accidents occurred during night times i.e., 26 cases (43.33%), followed by during

evening times i.e., 14 cases (23.4%). The reasons for this high incidence includes-inefficient lighting on the roads, overcrowding, disobeying of traffic rules, inoperability of traffic light signals, drinking, etc. The second peak occurred during the evening time as this is considered as peak hours of traffic rush as most of the people are returning back to their houses from the offices, business premises, colleges and shopping centers. Maximum number of victims were pedestrians i.e., 31 (51.7%) cases, followed by motor cyclist in 24 (40%) cases and the least were occupant of light motor vehicle and this is in consistent with studies conducted by others^{11,12}. This increased fatalities among pedestrians can be explained by the factors like lack of traffic sense, poor lighting of streets, infirmity, crossing roads away from the marked safety zone, inoperability of traffic light signals, drinking etc. In our city number of motor cycle users are more as they are being more economical and suitable to Indian road conditions which are commonly used by middle class community. Heavy motor vehicles are the most common offending vehicle i.e., 27 cases (45%), followed by motor cycle in 12 cases (20%) and 9 cases (15%) are from others which include those vehicles which hit an immovable objects, hit and run cases, fall from moving vehicle and rollover crashes resulting in death of the victim. This is due to increase in the number of heavy motor vehicles (government city buses and others), congested narrow roads and recklessness. In the 60 cases of road traffic accidents with abdominal injuries study it was found that 10 cases (16.7%) are spot death and 4 cases (6.6%) were brought dead to hospital and 46 (76.7%) were succumbed to their injuries after some duration of hospital stay.

The pattern of external injuries over abdomen and pelvis i.e., abrasions, contusions, and lacerations were present in 75% of cases. In case of abdomen abrasions were present in 27 cases, contusions in 29 cases, lacerations in 16 cases. There were no external injuries over abdomen in 15 cases. Over pelvic region abrasions were present in 10 cases, contusions in 18 cases, lacerations in 4 cases and nil injuries in 30 cases. Liver was the common abdominal organ involved in majority of victims i.e., 28 (46.7%) cases, followed by spleen in 15 (25%) cases and kidneys in 10 (16.7%) cases and the similar results were observed by other authors^{13,14}. This may be explained due to its large size, fixed location and solid consistency which make it an easy target for blunt injury to the upper abdomen especially on right side and spleen because of it's thin capsule, weak supporting tissue and friable pulp, is easily susceptible to blunt injury to the left hypochondrium.

Conclusion

Abdominal injuries constitute a potential factor in increasing the amount of morbidity and mortality and therefore proper attention towards their accurate diagnosis

and satisfactory management is mandatory. Blunt force injuries of the abdomen are less common than head injuries, but they may be more difficult to detect initially. Blunt force when applied over abdomen may cause either only external wound, only internal wound or both. Due to soft and yielding nature of the abdominal wall application of even a heavy force may not cause only external wound on abdominal wall but the transmitted force may come serious internal wound. All the patients of head injury admitted with coma and developing shock soon after, must be considered as having intra-abdominal injury until proven otherwise.

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Determination of Sex from Sub Pubic Angle Measured on Pelvic Radiographies

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Abstract

Gender determination problem, is a topic which is always one of the most favored by forensic medicine experts and researchers in the field of Anthropology. In forensic medicine we frequently see the unknown decomposed or scattered bodies that the sex detection is difficult. In cases where we have complete cadaver or skeleton, or skull and pelvic bones can be sent along with, it is not difficult to determine gender. But in many cases there are not the above components to determine gender and then there are specific limits and difficult factors. In these cases, accurate measurement of some bony standards such as sub-pubic angle can help us.

Key Word

Anthropology, pelvic bones, sub-pubic angle, sex determination Corresponding *:TABib994@yahoo.com Tel: 0098-21-66747125 Fax: 0098-21-66747126 Mobile: 00989121087718

Introduction

In this article 298 radiographs of healthy people between 18 to 27 years except sever "OSTEA PROISE" and deformity pelvic bones were evaluated and then sub-pubic angle was measured in every radiography and measured angle with ruler and set- square was registered along with other required information including name, family, case number, date of performing radiograph, patient age and sex in an special form and then data were analyzed by "SPSS 16" ruler and set-square and relation between sub-pubic angle and sex and age were studied. In cases where we have complete cadaver or skeleton, or skull and pelvic bones can be sent along with, it is not difficult to determine gender. But in many cases there are not the above components to determine gender and then there are specific limits and difficult factors. In these cases, accurate measurement of some bony standards such as sub-pubic angle can help us

Material and Methods

In this retrospective study, 298 radiographs of healthy people between 18 to 27 years except sever" OSTEA PROISE "and deformity pelvic bones were evaluated and then sub-pubic angle was measured in every radiography and measured angle with ruler and set- square was registered along with other required information including name, family, case number, date of performing radiograph, patient age and sex in an special form and then data were analyzed by "SPSS 16" ruler and set-square and relation between sub-pubic angle and sex and age were studied.

Results

In this study, sub-pubic angle that determined by ruler and set-square indicated in women is in a range of minimum 101 to maximum 190 degree and its mean is 152.58 degree and its standard deviation is 16.685 degree which is substantially higher. According to the above findings, if the pelvic sub-pubic angle is over 150 degrees, it high probably is belonged to a female and if the sub-pubic angle is less than 101 degrees it more likely is

belonged to a male.

Based on the assessment made, the difference in sub-pubic angle of two genders is significant and can be used in sex determination, not based on non-native evaluation, but based on native researches and studies results.

Sex Determination by the Bone

Sex determination has a special importance in forensic medicine and also in archeology cases for the discovered skeleton or cadaver identification. In Identification, gender determination is statistically the most important criterion, because by the sex determination, half of the possibilities will be removed (1-4) and identification is easier. In many cases, when healthy or corrupted objects are fully submitted, determining shall be easily possible by watching the sexual organs or the deceased clothes, examining internal organs such as prostate and uterus that are resistant against corruption. But if a piece of cadaver or a few numbers of bones are given to a forensic pathologist, gender determination will not be simply obtained.

Identification by the bone remains has two distinct dimensions

- To identify the main criteria such species, race, sex, height, age and time of death (1)
- Comparative Study: it means comparing the properties obtained from the bones with of deceased's possible life-time available data that this information can be obtained by archived records or from deceased relatives.

Degree of Accuracy in the Gender Identification by the Bones

The gender Identification by the bones is very carefully done, especially when the corpse belongs to an adult and all the skeletal bones are available. Problem is when a part of skeleton or some of the bones are available, because Sex determination by one or a few bones would reduce accuracy of detection. Accuracy of gender determination by the bones is presented as the below table:

Pelvic bones are only 98% , skull bones, only 92%, total pelvic and skull bones 98%, long bones alone 80-85%, the total long bone and skull 95% and the total long and pelvic bones 98% it shown on table1. (1-4)

Bones	Determination accuracy
Pelvic bones	95%
Skull bone	92%
Total pelvic and skull bones	98%
Long bones	80-85%
Total long bones and skull	95%
Total long bones and pelvis	98%

Table 1: gender determination

So the most appropriate bone for sex determination in the skeleton, are pelvic bones.

Gender Detection by Pelvic Bones

The most appropriate bone for sex determination in the skeleton, are pelvic bones.

A. Sex Differences in Pelvic Bone Alone

1. Pubic bone: in females and after puberty is broader than males and obturator is triangular in females and the angle below the pubic bone is more open. (2) accuracy is 90%.
3. Sciatica: NOTEH it is shallow and wide in females and narrower and angular in males and in the children are also usable so that is determinable from the fourth month of pregnancy.
4. Pre Auricular fissure: that is obvious in the female due to connection of the anterior sacroiliac ligament and sacroiliac joint.
5. Ischial TUBEEROSITY: that is more turned back in females and is not projected but it is projected in the male.
6. Acetabulum: it is small about 46 mm in diameter in females and its surface is toward the front.
7. Pubic bone connection: it is deep in males and their pubic bone edges are more turned back

B. Sex Differences in the Intact Pelvic Bones

1. Iliac bone: in females is more vertical
2. Sub- pubic angle: it is broad, U-shape in female and the angle is usually less than 90 degree in males is that in some sources it is mentioned less than 70 degrees(6).
3. Pelvic inlet: pelvic entrance is broad in females and is similar to the heart in males. There are different forms of the females' pelvis:
 - Andriod
 - Platypelloid
 - Anthropoid
 - Gynocoid

Pelvis Anatomy

Pelvis is in the lower part of body and includes pelvic girdle and its relevant viscera. Pelvic girdle consists of two pelvic bones on both sides and the sacrum and coccyx bone in back.

Pelvis is different in male and female that is due to their different functions. Narrow pelvis in male is to move more effectively and more efficiently, but in women due to birth canal, pelvis is wider. Women with narrow pelvis have more problems during vaginal delivery.

Hip bone: hip bone, is a big, broad and irregular bone that makes the anterior and lateral pelvic wall and consists of three parts, which were initially separated and then are joined in a cavity called stabulum. These three sections include ileum on top, pubis in front and ischium down and back and this bone with the opposite pelvis bone and the sacrum bones and coccyx form the pelvic belt.

Ileum: forms the upper part of the pelvic bone and includes two parts, wing and a trunk (body) that these two form great sciatic notch in the back. Ileum also is joined the sacrum at the back (3).

Ischium: forms the lower and back of pelvic bone and consists of two part the trunk and ramous. In the back of the bone there is Ishim spine that great sciatic notch is on top of it the small sciatic notch is down of it. In the lower part of ischium, there is ischium Ramos, that along with the pubis lower Ramos and stabulum lower edge, form the obdurate foremen(3).

Pubis: forms the anterior part of the hip bones and

consists of three parts trunk and upper and lower Ramos. Pubis is joined with opposite pubis bone in front.

Joint of these two pubic bones makes an important angle in the front area in pubic symphysis, which forms is formed by both sides of pubic lower edge angle and is called sub-pubic angle(1).

In this study, three factors of age, sex and sub-pubic angle were collected from the patients in RASOUL AKRAM Hospital,

Variable Gender	Scientific- Practical Definition Sex of the Radiograph Holder	Measuring Method Based on the Morphological Characteristics	Scale Male- Female	Variable Type Qualitative, Namely, Independent
Age	Individuals Age Based on the years	Birth year	Year	Quantitative, Continuous, Independent
Sub- Pubic Angle	Angle Degree Between the Pubic Lower Ramos on Both Sides	By Ruler and Set- Square	Degree	Quantitative, Continuous, Dependent

Table 2: Pelvic Radiographs of Case Patient

Tehran, based on pelvic radiographs table(2).

In this study the sex variable was entered based on information of radiography holder.

The second variable was sub-pubic angle that was evaluated based on the degree.

Study Method

This study is retrospective and the purpose of it is to determine the presence or lack of difference in sub-pubic angle of male and female.

Research Population

The study population consisted of adults over 18 years that pelvic posterior Anterior or Anterior posterior radiographs were taken from during the past two years in RASOUL AKRAM Hospital

Sample Numbers

Samples numbers is identified using the following formula: "KORAND" Table and it can be trust according to the actual samples and statistical sample volume with a high degree of 1.

35 persons were determined and about 2000 XR provided by a possible and easy method to increase the accuracy and generalization ability of results that ultimately 298 radiography which had study conditions were chosen and the rest of radiographies were excluded for the following reasons:

1. Non-insertion of the full data on the radiography
2. Poor quality of radiographies
3. Fractures in "SYMPHESIS" pubic region and upper and lower pubic ramous and congenital deformity of pelvic bone.
4. Lateral radiographies
5. graphy of pelvic angle were not appropriate for measurement.

Methods

Graphs were recorded by Marco Imaging Division Lite ruler and software on DVD, then the sub-pubic angle i.e. the angle between the two pubic lower Ramos was measured by the same ruler and set-square in each radiograph and measured angle was registered along with other required information including name, case number, date of performing radiograph, patient age and sex in an special form. The angel was measurement by a single

operator which used ruler and set-square for measuring and for avoiding failure controlled by two other operators.

Data Analysis Method

Data such as age, sex and the sub-pubic angle variables were analyzed by 16 SPSS ruler and set-square and based on ten-year age intervals were divided into seven groups, first group of people are 18 years old and seventh in the last group included people over 77 years.

Gender consists of two groups of men and women. The third variable was the sub-pubic angle that was calculated according to degree and correct numbers and finally this variable relationship was analyzed by age and sex.

Results of the Study

From the 298 studied radiographies, 214 radiographies (71.8percent) belonged to men and 84 radiographies (28.2 percent) belonged to women. All the radiographies related to people over 18 years.

The greatest numbers of radiographies belonged to people 18 to 27 years with 35.2 percent and the lowest numbers of radiographs belonged to people 68 to 77 years. Data were analyzed with the "SPSS 16" ruler and set-square, T-TEST.

This chapter describes the research findings; using appropriate statistics

Gender and the Sub-Pubic Angle Relations

In the following table relative and absolute frequency is shown in men and women whom are classified to seven groups by the sub-pubic angle, to consider the relationship between

Gender of the Sub-Pubic Angle	Male		Female		Total	
	Frequency	Percent	Frequency	Percent	Frequency	percent
60-79	12	5.6%	0	0%	12	4%
80-99	81	37.9%	0	0%	81	27.2%
100-119	77	36%	3	3.6%	80	26.8%
120-139	39	18.2%	20	23.8%	59	19.8%
140-159	5	2.3%	28	33.3%	33	11.1%
160-179	0	0.0%	31	36.9%	31	10.4%
Over 180	0	0.04%	2	2.4%	2	0.7%
Total	214	100%	84	100%	298	100%
Sig=0.000		V Cramers =0.814				

gender and sub-pubic angle (Table3):

Table 3 : relationship between gender and sub-pubic angle (7)

Since the measured sub-pubic angle level is converted to ordinal level and gender determination level is nominal so V Cramer "(ö) *" statistics is used to determine the relationship between two variables. As it can be seen in the above table, significant level (sig) is less than 0.05. Therefore the assumption that there is no relationship between sex and sub-pubic angle (4, 5) * is a popular measure of association between two nominal variables

Is rejected and significant relationship between them is confirmed. The correlation intensity determined by V Cramer shows that the relationship between these two variables (sub-pubic angle and sex) is very strong. If there is a relationship

between gender and sub-pubic angle, the columns related to men and women have slight overlaps and their maximum and mod amounts are in different locations.

Final Conclusions and Recommendations

In this study it was found that although like the previous studies sub-pubic angle is wider in women than men, but the statistic indicators are significantly different.

In this study, sub-pubic angle is in the range of 101 to 190 range in women and the mean is 152/58 and standard deviation is 18/685 that is considerably higher in comparison with men by angle in the range of 64 to 150 and mean as 103/92 and SD as 16/165.(8)

According to the above findings, if the pelvic sub-pubic angle is over 150 degrees most likely it belongs to a female (6), and if the angle is less than 101 degrees it is more likely belonged to a male.

Based on this study finding, in gender identification and related issues the research results can not be reliably used for our country or similar countries without worry of the possibility of being wrong or lack of compatible criterion obtained in other societies, despite differences of race, ethnic and nutritional status, because the criteria obtained in other societies may have not the necessary usage-advance in our societies due to the aforementioned differences, and is not reliable and even False results may be obtained relying on the other researches and ignoring the existing difference and its generalization to our community that can be very serious in the area of forensic medicine(5)

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Confirmation of Cannabis Abuse by GC-MS

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Abstract

Cannabis and cannabis resins contain the substance ⁹-tetrahydrocannabinol (THC). The plant and drug are both regulated by the Drug Enforcement Administration (DEA) of Jordan. The regulations require testing for THC and its metabolites, which can be found in urine. 11-nor-9-carboxy-⁹-THC, also known as THC-COOH, is the primary urinary metabolite of THC.

In this study, a method for confirmation analysis of large number of urine samples previously screened positive for THC using solid-phase extraction (SPE) and Gas Chromatography-Mass Spectrometry (GC-MS) analysis is developed. The results of the analysis of standard reference material and actual samples are presented and discussed. The developed method is sensitive enough to assess relevant THC-COOH levels in human urine for forensic investigations.

Key Words

SPE, GC-MS, THC-COOH, Urine.

Introduction

Cannabis (also known as marijuana) and cannabis resins are smoked with tobacco or ingested^[1-3]. Once administrated, ⁹-tetrahydrocannabinol (THC), the primary psychoactive compound in cannabis is metabolized to generate its hydroxylated and carboxylated metabolites of which, 11-nor-⁹-tetrahydrocannabinol-9-carboxylic acid (THC-COOH) is the major metabolite excreted in urine^[4&5]. Although only a few cannabinoids are detectable in the urine, detection of THC-COOH is considered as a confirmatory test for cannabis exposure^[1&6].

Analysis of THC-COOH in urine has been established as an effective approach for monitoring marijuana exposure^[7-9]. The drug assays utilized liquid-liquid or solid-phase extraction methods followed by analysis using capillary gas chromatography-mass spectrometry (GC-MS)^[4, 8-13]. GC-MS has been widely used to study the effectiveness of various analytical parameters including sample pretreatment, extract derivatization and MS mode of operation^[5, 12 &14].

In the present study, urine samples with positive THC immunoassays are analyzed. The analysis includes solid-phase extraction method and GC-MS procedure operating in the electron impact and scan acquisition range from 200 to 500m/z. The analytical procedure is utilized to confirm positive immunoassay results in forensic samples.

Material and Methods

The work described in the present study is based on the results of analyses of urine samples provided by DEA, Amman-Jordan from a number of subjects, mostly adolescents suspected of drug abuse. Urine samples were received in labeled sterile plastic containers. In most cases, the samples obtained were processed for drug testing on the same day. If not, the samples were stored at 4°C until extraction and analysis.

All reagents used were of analytical or HPLC grade. Solid-

phase extraction columns (ISOLUTE[®]) were supplied from International Sorbent Technology Ltd. Mid Glamorgan U.K. ACON[®] - *One Step Multi-Drug Screen Test Panel* were obtained from ACON Laboratories, Inc. CA, USA. Based on the regulation of DEA, and as primary indications of cannabis exposure, an individual's urine is presumed positive for THC-COOH by immunoassay cutoff level of 50ng/ml urine.

Gas Chromatography

Gas Chromatography-Mass Spectrometry (GC-MS) was carried out on a Hewlett-Packard 5890 Series II gas chromatograph interfaced with 5972 MSD. Chromatographic separation was achieved on HP-5MS fused silica capillary column (W&J 30m ´ 0.25mm ´ 0.5mm) and helium 99.999 was used as a carrier gas (1ml/min).

Samples (volume 1-2ml) were injected with an injection port temperature of 260°C. The column oven temperature was programmed from initial temperature of 180°C (held for 1min) at 20°C/min to 280°C (held for 1min). The detector temperature was 280°C. Mass spectrometer was operated in positive electron ionization mode (EI) and scan mass spectra 200 to 500 m/z were obtained.

Sample Pretreatment

Solid-phase extraction procedure was processed on spiked and subject's samples and carried out using ISOLUTE HAX (100mg/3ml) column. The extraction of 11-nor-9-carboxy-⁹-THC involved the following steps:

I. Base hydrolysis of Glucuronides

1ml of urine sample was pipetted into a glass tube with screw cap top. For spiked sample; 50ng of 11-nor-⁹-THC-9-COOH (50µl of a 10µg/10ml Methanol) was added to the sample followed by 100µL of 10M NaOH solution. The solution was vortex mixed and heated in a 60°C water bath for 20min then cooled. 200 µl of Glacial Acetic Acid (200µL /mL urine) and 0.5ml of 0.2M Acetate buffer (pH 4.0) were both added to each hydrolyzed sample and mixed.

II. Column Conditioning

The column was conditioned with 2ml methanol followed by 2ml DI water and finally with 2ml acetate buffer. The column was not allowed to dry before the addition of the hydrolyzed sample. The vacuum was then adjusted in such away to achieve a flow rate of about 1.5ml/min.

III. Apply Sample

The hydrolyzed sample was then allowed to pass through pretreated column at 1-2ml/minute.

IV. Column Washing

The column was rinsed with 1ml of 40% acetone followed by 1ml acetonitrile: water (15: 85) containing 2% triethylamine

(TEA) and finally dried by suction through the manifold at 15mm Hg vacuum for 1min.

V. Sample Elution and Extract Drying

The column was eluted with 1ml ethyl acetate: isopropanol (85: 15). The fraction collected was evaporated to dryness at < 40°C under N₂.

VI. Derivatization

The dried extract was dissolved in 50µl acetonitrile followed by addition of 50µl BSTFA containing 1% Trimethylchlorosilane (TMCS). The tube content was mixed and flushed with nitrogen before it was transferred into GC vials. The sealed vial was incubated at 70°C for 20 min and cooled. 1 to 2µL of the final product was injected onto GC/MS.

Results and Discussion

This study was done to generate a standardized protocol for detecting THC-COOH in urine samples. Urine is generally accepted as the sample of choice for drugs-of-abuse testing. Urine drug testing is reliable, economical, widely utilized, and strictly regulated [15]. Immunoassays were used as preliminary screening procedure to identify presumably positive THC-COOH urine samples. Samples were presumed positive by immunoassays at a cutoff concentration equal to 50ng THC-COOH/ml urine or at concentrations exceeded the threshold proposed by DEA. Urine with positive immunoassay was further processed to sample pretreatment by solid-phase extraction and analysis by GC-MS. The selectivity and sensitivity of GC-MS analysis implemented in this study has achieved the correlation with the immunoassay findings and the analysis results confirmed the positive immunoassay screening results for THC-metabolite in urine. Forty one out of fifty urine samples presumed positive by immunoassays were confirmed positive by GC-MS analysis. Nine samples with negative immunoassays were reported negative and not tested further.

GC-MS analysis has indicated the presence of a specific peak at retention time around 6.6 which was recorded and considered as a positive confirmation for THC-COOH. The identity of the analyte was confirmed by matching its MS spectrum to the MS spectrum of the derivatized standard [previously confirmed by matching with 11-nor-9-carboxy-⁹-THC (TMS) found in MS library data system]. All urine samples analyzed by GC-MS were found to contain the same peak (Figure1). Mass spectrum of THC-COOH extracted from actual urine sample is shown in Figure2. The spectra provided qualitative indications that the "SPE-GC-MS analysis" scheme is a viable approach for the intended purpose. The scan range 200-500m/z was chosen to preserve the spectrum abundance details for ⁹-THC-COOH's primary peak ions at m/z = 371, 473, and 488. Extraction efficiency was studied to evaluate the effectiveness of the entire analytical protocol.

Extraction Efficiency

Solid-phase extraction procedure utilized a column from ISOLUTE. Recovery efficiency of the extraction column was studied by comparing the amount of the THC-COOH (observed at the final GC/MS-measuring step) in two samples containing the same amount of the analyte. 50µl of THC-COOH (in methanol concentrated stock) was spiked into a drug-free urine blank (Sample 1), while the same amount of stock was spiked into an empty tube at the same time (Sample 2). Sample 1, was first subjected to the solid-phase extraction process to the step ready for derivatization. Sample 2, was evaporated to dryness and processed in parallel for the derivatization and GC/MS analysis procedures. The amount of THC-COOH spiked into both the tubes

equivalent to 50ng/mL. The result derived from GC-MS analysis was 39.25ng/mL, which represents a recovery of 78.5%. Urine samples for suspected marijuana users have also been analyzed and found to generate reliable results.

In summary, the protocol developed in this study, in terms of the method of solid-phase extraction and GC-MS analysis provided a viable approach for the analysis of THC-COOH in urine for monitoring marijuana exposure.

Conclusion

The analytical method described in this study is suitable for THC-COOH extraction from urine by SPE and detection by GC-MS. A reproducible, sensitive, and selective method for the analysis of carboxy -THC in human urine using GC-MS is developed. A run time of 7 minutes per sample and ability to use MS library searching for confirmation allow for high throughput of bioanalytical samples and makes full use of the GC-MS system. This analytical method has been successfully used for the routine analysis on forensic samples.

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Figure Legends

Figure 1: GC chromatogram for derivatized THC-COOH from a urine extract.

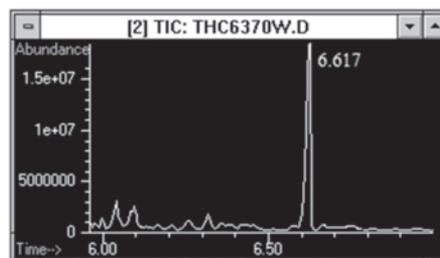
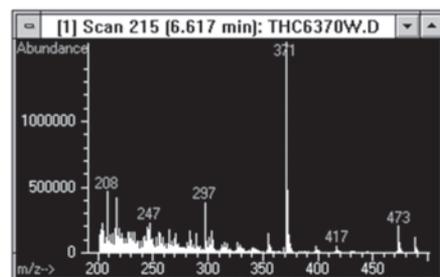


Figure 2: Mass spectrum of derivatized THC-COOH found in an actual urine sample.



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Morphometric Study of Orbital Cavity in the South Indian Population

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Abstract

Dried, non-pathological 118 crania were studied for measurement of orbital cavity measurements were taken with the help of divider, sliding caliper, and inch tape. 99% crania were dolichocephalic with mean value 72.66 cm ± 2.38. The mean value of right orbital index was 92.31 mm ± 6.24 and left orbital index was 97mm ± 7.2 both indices fall under hypsiconch (megaseme) Non-metrical variations were (A) at supra orbital margins incidence of (1) supra orbital notch 32.6 %, (2) supra orbital foramen 20.8% (3) supra orbital canal 19.4% (4) closed supra orbital foramen 45.2% (5) supra orbital notch 5.20% (6) supra orbital foramen with canal 4.51%, (7) supra orbital notch and foramina 2% (B) at infra orbital margins the incidence of infra orbital foramina 34.7% (9) infra orbital canal 17.3%, (10) Infra-orbital notch 13.8% (11) infra orbital notch with foramina 12.1%, (13) infra orbital foramina with canal 6.25%, (14) Accessory infra orbital foramina 4.51%, (C) incidence of accessory foramina (1) In the right orbit the single accessory foramina were 62%, double 34% and multiple were 2% and (2) in the left orbit single accessory foramina were 81% double 17% and multiple were 1% were observed. These values differ with previous workers of north India and foreign countries. It could be due to environmental genetic or different dietary habits. This study will certainly help the craniofacial anthropometry which is an important tool used in genetic counseling, reconstructions surgery, radiological and forensic medicine⁽¹⁾

Key Words

- Cranial Index (2) orbital index (3) Hypsiconch (4) Non-Metrical (5) adaptation

Introduction

Variation in the shape of orbital cavity bound to occur because of multiple ossification centers in the skull. As each ossification centre expresses their own morphological individuality with astonishing persistence, even though the bones which they represent have long ago ceased to be of any functional importance. As Bony orbit is formed by seven bones (maxillary, palatine, frontal, sphenoid, zygomatic, ethmoid and lacrimal bones) and has ten openings or communications. Moreover shape of the orbit change with age at birth rounded, and quadrilateral or pear shaped in adult because of development of brain and mastication moreover volume eye and protrusion of eye from the orbit also influence the size of the orbit independently.⁽²⁾

Orbital cavity related to anterior and middle cranial fossa, temporal fossa, middle Meatus of nasal cavity maxillary sinus, and other air sinuses. Thus it is very important for surgeons, radiologist, clinician and medico-legal experts also.

Evolutionary point of view the orbital cavity is most primitive characteristic in the early hominoids (Tarsii fomes or tarsius) because they were nocturnal and had great forward looking and eyes were enormous⁽³⁾. As evolution proceeded orbital cavity changed its shape and size as adaptation to erect posture because orbital cavity lies lower in mammals than primates. The orbital cavity and temporal fossa are continuous, there is no bony lateral wall. And in many mammals like cat, pig lateral part of the orbital margin is missing but lines of force transmissions are different

as well⁽⁴⁾. In human position of orbits relative to the wider zygomatic arches.

Material and Methods

118 adult crania from JJM Medical College and S.S. Institute of medical science and research centre Davangere (Karnataka) were studied. Measurements were taken with the help of divider, sliding caliper, and inch tape. And following measurements were taken

Cranial index (Glabella to opisthocranium and supra mastoid crest to another supra mastoid crest). Facial index (Nasion to gnathion)

Total facial height (From basion to Bregma).

$$\text{Orbital Index} = \frac{\text{Orbital Height}}{\text{Orbital Width}} \times 100$$

- Megaseme (large) = the orbital index more than 89 or over is characteristic of yellow race.
- Mesoseme (inter mediate) – orbit index between 83 to 89 – which is characteristic of European 87, English-88.4
- Microseme (small) less than 83mm characteristic of black races⁽⁵⁾.

Results

Table No 1 : Shows maximum cranial length mean value 190.95mm ± 3.73 (SD=1.90) and maximum cranial breadth mean value was 138.74mm ± 2.46 (SD=0.74). Maximum racial width (Bizygomatic width) mean value was 133.70 ± 1.77 (SD=0.90). The mean value of total facial height was 119.78mm ± 1.58 (SD=0.81). The mean value of maximum right orbital height was 39.52mm ± 1.73 (SD=0.88). Mean value of left orbital height was 39.58mm ± 2.32 (SD=1.18). The mean value of maximum orbital breadth of right side was 42.84mm ± 3.23 (SD=1.19). The mean value of maximum orbital breadth of left side was 40.83mm ± 2.33 (SD=1.19).

Table No 2 : Shows mean value of cranial index 72.66 cm ± 1.74 (SD=0.89). Mean value of right orbital index was 92.31mm ± 5.99 (SD=3.06). Mean value of left orbital index was 97.02mm ± 7.20 (SD=3.67).

Table No 3 : Shows correlative study of right orbital index with left orbital index which was highly significant (P<0.01).

Table No 4 : Incidence of non-metrical variations at the supra orbital margin. It had highest percentage of supra orbital notch (32.6%) but least percentage of supra orbital notch (2.08%) supra orbital foramina was (20.8%) while supra orbital canal was 19.4% closed supra orbital canal was 15.2%, supra orbital foramina with canal 4.51% was observed.

Table No 5 : Shows incidence of non-metrical variation at the infra orbital margins was highest incidence 34.7% and infra orbital canal was 17.3%. Infra orbital notch was 13.8% infra orbital notch with foramina was 12.1%. Infra orbital fissure was 7.63% Infra orbital foramina with canal was 6.25% and least incidence was accessory orbital foramina 4.51%.

Table No 1: Showing the Mean Values of various parameters of orbital cavity

Parameter	No of skull	Mean Value (mm)	SD	95% C.I.
Maximum cranial length	118	190.95	1.90	(187.22,194.68)
Maximum Cranial Breadth	118	138.74	0.74	(137.28,140.20)
Maximum Facial Width (Bi-zygomatic width)	118	133.70	0.90	(131.94,135.47)
Total Facial Height	118	119.78	0.81	(118.20,121.36)
Maximum orbital Height Right	118	39.52	0.88	(37.78,41.25)
Maximum Orbital Height Left	118	39.58	1.18	(37.27,41.90)
Maximum Orbital Breadth Right	118	42.84	1.19	(40.50,45.17)
Maximum Orbital Breadth Left	118	40.83	1.19	(38.51,43.16)

Table 2 : Correlation between cranial index and orbital index

Indices	No of skull	Mean	SD	95%C.I.
Cranial index	118	72.66Cm	0.89	(70.92,74.40)
Index Right Orbital	118	92.31mm	3.06	(86.31,98.30)
Index Left	118	97.02mm	3.67	(89.82,104.22)

Table 3 : Correlation between right and left orbital index

Correlation between right and left orbital Index	T Test	P Values
0.87	19	P<0.01 Highly significant

Table 6 : Incidence showing the accessory foramina in both orbits

Orbit	Single Foramina		Double Foramina		Multiple Foramina		Total	
	No	%	No	%	No	%	No	%
Right	42	62.68%	23	34.32%	2	2.98%	67	100%
Left	57	81.43%	12	17.15%	1	1.42%	70	100%
Both	110	78.57%	28	20%	2	1.43%	140	100%

Table No 6 : Shows the incidence of accessory foramina. Single foramina on right side were 62.6% and left side were 81.4% and both sides were 78.5%. Double accessory foramina on right side were 34.3% left side were 17.15% and both side were 20%. Multiple accessory foramina on right were 2.98%, on the left 1.42% and on both sides 1.43%.

Table 7 : The present study of cranial index $72.66\text{cm} \pm 2.38$,

There is statistically highly significant correlation observed between right and left orbital index.

Table 4: Incidence of non-metrical variations at the supra orbital margins of both orbits. Total No of skull - 118

No of orbits	Variations Observed	No of Orbits	Percentage Incidence (%)
236	Supra Orbital Notch	77	32.63%
236	Supra Orbital Foramen Closed	49	20.83%
236	Supra Orbital Foramen Supra Orbital Canal	36	15.27%
236	Supra Orbital Notch	46	19.44%
236		12	5.20%
236	Supra Orbital Foramen with Canal	10	4.51%
236	Supra orbital Notch and Foramen	5	2.08%

Table 5 : Incidence of non-metrical variations at the infra orbital margin at both orbits.

No of Orbits	Different Variations	Number of	Percentage of Incidence (%)
236	Infra Orbital Foramina	85	34.72
236	Infra Orbital Canal	43	17.36
236	Infra Orbital Notch	34	13.88
236	Infraorbital Notch and Foramina	30	12.15
236	Infraorbital Fissure	18	7.63
236	Infraorbital Foramina and Canal	15	6.25
236	Accessory Infra Orbital Foramen	11	4.51

Table 7: Table showing comparison of cranial index and orbital index of previous workers

Name of worker	Year	Region of Crania	Cranial index (cms)	Orbital index (cms)
Turner	1906	Therg	72.90	85.50
Turner	1906	Tamil	81.00	---
Turner	1913	Bhil (India)	72.90	---
Tidsley	1921	Indian	75.80	86.30
Tidsley	1921	Marwar (Indian)	74.60	84.40
Shukla	1960	Indian (Type I)		
		(Type II)	72.20	86.40
		(Type III)	72.60	85.90
		(Type IV)	72	87.30
		Indian	71.30	86.90
Chaturvedi	1963		70.75	87.34
Harneja P.	1979	UP India	74.35	88.00
Jaysingh et al	Present study	South India		
	2011		72.66	94.66

and right orbital index $92.31\text{mm} \pm 6.24\text{mm}$ left orbital index $97\text{mm} \pm 7.2$ was compared with previous workers.

Table No 8 :

The present studied orbits with foramina 55% compared with findings of previous workers. It was quite higher than Asian

Table 8 : Comparative study of incidence of orbital foramina and groove by previous workers

Name of worker	Region Number of orbit		Orbits with Foramina		Orbits with Groove	
			Number	%	Number	%
Royle (1973)	Asia	64	18	28.1	22	34.7
Sante Neto (1984)	Brazil	100	06	6.0	45	45
Neelam Vasudev (1993)	North India	530	332	62.5	70	13.2
Present Study (2011)	South India	236	160	55.5	31	10.7

and Brazil orbital study (28.1%, 6.1%) respectively but lesser than north Indian study (62.5%).

The present study of orbits with groove was 10.7% which was quite lesser than Asia (34.4%) Brazil (45%) and north India (13.2%).

Discussion

In the present study 118 crania were studied. The cranial breadth was 190.95mm \pm 3.73 (SD=1.90) and maximum breadth was 138.7mm \pm 2.46 (SD=0.74). (Table No 1). Which was calculated to 99% of Dolichocephalic crania (72.66cm \pm 1.74) (SD=0.89) and 0.85%. Mesocephalic crania. These findings indicate that, the crania of the south India have adopting tendency because in 17th century Indian cranial index was 75cm to 79cm which fall under mesocephalic group on the other hand English crania of 17th century were less than 75 which were Dolichocephalic group ⁽⁶⁾ and Dravidians of south India were brachycephalic (more than 80cm) with curly hairs⁽⁷⁾, hence orbital facial index, facial index also changed to adapt the environmental stimuli.

The mean value of orbital height of the right side was 39.52 \pm 1.73 (SD=0.88) and mean value of left orbital height was 39.58mm \pm 2.32 (SD=1.18). The mean value of maximum orbital breadth of the right orbit was 42.84mm \pm 3.23 (SD=1.19). The mean value of maximum breadth of the left orbit was 40.83mm \pm 2.33 (SD=1.19) (Table No 1). These calculation of the present fall under Hypsiconch (above 85mm).

In the present study the orbital index of right orbit was 92.31mm \pm 5.99 (SD=3.06) and left orbital index mean value was 97.02 mm \pm 7.20(SD=3.67) (Table No 2). These findings differ with north Indian study of adult orbital index which was 88.7 \pm 7.01 right orbits and 87.3 \pm 7.74 left orbits⁽⁸⁾. The present study also differ with findings of British adult orbital index which was 89.7 \pm 2⁽⁹⁾ and Tamil (sudra) had 81.7mm orbital index⁽¹⁰⁾ but more or less in agreement with malwans orbital index which was 95.19 mm \pm 4.56⁽¹¹⁾.

In the present study correlation between right orbital index and left orbital index shows highly significant p value (P<0.01) (Table No 3) indicates that studied crania were normal, non-pathological. Non metrical variations (Table No 4, Table No 5, Table No 6)

The various incidences in supra orbital margins and infra orbital margins. The variations like notches fissures, foramina with canals. Single accessory foramina double accessory foramina multiple accessory foramina are treated as epigenetic traits. As two orbital cavities are situated on either side of the sagittal plane of the skull between the cranium and face. Thus situated, they encroach about equally on these two regions⁽¹²⁾. Developmentally eye ball, its nerves, blood vessels, coverings are the part of the brain and orbital cavity is a protective shell of the eyeball. As somatic growth is faster than neural development hence orbital cavity has to provide not only space for eye ball and passage to the nerves, blood vessels of the eye ball for proper development

and normal function of eye ball hence it has to provided extra space in response to the demand of eye ball development which may result in to accessory, non-metrical characters like accessory foramina, ridges, canals, notches and Fissures etc. which are also called as adaptations. It was also believed that, variations were result of variations in the size and shape of the crania and genetic tendency to influence the development of these traits⁽¹³⁾. The variations in the incidence of accessory foramina indicate racial differences⁽¹⁴⁾ and due to complex multi genetic control⁽¹⁵⁾ hence different configuration of superior orbital fissure was observed in same races.⁽¹⁶⁾ Moreover to maintain the co-ordination between rotating head because axis of the orbit is directed backwards and inwards and slightly upwards from the centre of anterior opening of the optic foramina. The optic nerve lies practically in the line of the axis⁽¹⁷⁾ and to maintain the accuracy of visual field hence these variations could be to smoothen and proper functioning of visual pathway. Supraorbital margin and infraorbital margin is greatly influenced by masticatory system. Owing to the greater expansion of brain and reduction in the size of mandible⁽¹⁸⁾. Supraorbital margin or brow ridges were single bar of bone in African apes and pneumatic in Neanderthals, but in human major portion is solid bone to protect the eyes⁽¹⁹⁾ In addition to that roof of the orbital cavity also provide support for the frontal lobes of the brain, and infraorbital margin have extreme forward position to support occlusal load of the dentition inits entirely. Hence these non-metrical variations (Table 4, 5, 6) could be probably to facilitate the support for the developing frontal lobes of the brain and protect the eye ball from masticatory stress. moreover environmental factors could be stimulating environment or suppressing environment Hence it can hypothesized that these variations could be due to overcame suppressive or stimulating environment because bone is such a dynamic tissue which adapts with changing environmental stimuli and overcomes biomechanical stress. Hence race is an ongoing process.

Megaseme or Hypsiconch orbital index is usual characteristic of yellow races but due to adaptation it has become characteristic of south India adult population.

Conclusion

This morphometric study has Dolichocephalic crania with Hypsiconch (Megaseme which orbital index is above 89mm or above) and non-metrical variations at supra orbital margins and infra orbital margin, accessory foramina like single double and multiple. These characteristics appear to be different from north Indian and other countries. Hence these anatomical values of south Indian population certainly help surgeons, medico-legal expert, radiologist, and anthropologist.

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Case Study: A Mysterious Train Hijack

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Abstract

A suburban train (electric motor unit, EMU) was allegedly hijacked by a young man from Chennai central railway station on 29th April 2009 at 5am in the morning. He had started the train from the Chennai central railway station which was stationed at that time. He accelerated its speed and had driven the train in a wrong track i.e. the track which is meant for the downward (returning) trains. But within a distance of about 3 kilometers the train had collided with another goods train which was stationed in the same track of the Vyasarpadi (next station for stoppage from the central station railway station). The alleged hijacker lost his life with multiple injuries while attempting to escape from that train just before the collision with the goods train. The case was resolved on the basis of the external findings of the victim's body and other circumstantial evidences. Though the victims' body was intact the identity of the victim is still unknown.

Key Words

Train, hijack, collision, injuries

Introduction

In general , the case of hijacking a train is hardly heard about. But such incidents usually occur in air traffic i.e hijacking of aero planes are not unusual. In such incidents there would be a motive for a ransom or threats or some favours in reply to the captivity of sorts. But this is a peculiar case of hijack in which there was no matter of captivity and ransom or any demands or any other foul play. In this case, the alleged hijacker , having known thoroughly about the operation of the train had started the train and had run the train for a distance of 3 kilometers in a speed of ninety kilometers per hour (as per the records of the speedometer provided by the railway authorities) .He had tried to escape when he noticed another train stationed in the same track. But he failed in his attempt as he died due to multiple injuries sustained while jumping off the train. This has happened just before the collision of both the trains. The motive behind such hijack is still a mystery

Case Report

This particular incidence took place on 29th April 2009 at 5am in the early morning. A youth in his mid twenties had purportedly taken the train (electric motor unit) from the central railway station , Chennai. The suburban trains generally connect most parts of the city with a running frequency of one service every two minutes.

This incidence had taken place in the heart of the Chennai city but in the early hours when there were few passengers travelling in that train. The train has a scheduled departure of 5 am .The alleged hijacker had started the train from the cabin from the central railway station at 4.58 am . The assigned (authorized) driver as a routine had halted the train and presumably had gone for relaxing and refreshing himself. In the mean time the alleged hijacker had taken the train (as the key was left in it) and started the train in a normal course but speeded up the train after some time. The alleged hijacker / perpetrator

had made the train run in the downward track instead of the up track as he does not know about these finer details. The train was moving at the speed of 90 km/hr within 3 minutes. This was evident from the record available from the railway authorities through the speedometer recordings. The next railway station was the Vyasarpadi station where he is supposed to have noticed another goods train stationed in the same track. This has prompted him to take immediate action of escaping from the train as the collision was imminent. But it was too late (as the speed was around 90kms/hr as found from the recording of the speedometer) and the train collided with the goods train causing extensive damages. This has resulted in the death of four passengers who have got entangled in the bogies that have been crushed.

Findings

It can be concluded that the train was taken by the alleged hijacker and was running at a higher speed in the wrong track. As the perpetrator had noticed another goods train stationed in the same track he had tried to escape as the collision of both the trains was imminent. It is presumed that the alleged hijacker had tried to escape by jumping off the train just before the collision. This is evident from the paint flakes of the body of the train present over the upper part of the body of the deceased. But the speed of the train was so high that the person could not sustain the momentum and was rolled, dragged and hit by the poles present in the platform. This has resulted in multiple injuries sustained over the body of the victim. This is evident from the type of injuries sustained by him as seen in the photograph 1.. He had suffered multiple injuries all over the body. The alleged hijacker had been inflicted with multiple lacerated wounds (photos showing injuries). This was due to the momentum with which he had fallen off the train; he had sustained injuries over the left part of the body predominantly. The left arm has been almost dismembered due to the effect of having hit by a pole (present in the platform) with much higher velocity ^{1,4}. The lower part of the leg/ lower limb had also been severely lacerated (up to bone deep). (photographs 2&3)

So it is possible to conclude that he had only taken the train from the railway station and had sustained injuries and died when he tried to jump off the train to escape just before the collision with another train stationed in the same track. Another important conclusion is that the alleged hijacker was having a thorough knowledge about the operation of the engine of an electric train. Though the photograph of the intact body and face of the deceased is available still the identity is unknown.

The authors had visited the scene of occurrence of the accident with the police and railway authorities. They had even gone in the train to assess the exact nature of the operation of the engine of the train. The railway authorities had provided the record of the speedometer. The crime scene analysis was done after having seen the photographs of the deceased, the photographs of the mangled remains of the engines of both the trains involved in the accident and the visit of the scene of the occurrence of the accident site. The

engine of both the trains had showed extensive damages.

Figure 1: Multiple lacerated injuries in the left shoulder, neck and arm



Figure 2 : Photo showing multiple abrasions, lacerations with the presence of paint flakes stuck in upper parts of the body



Conclusion

The possible conclusion could be arrived based on the types of injuries sustained by the deceased who has alleged to have hijacked the train. There are injuries over the left shoulder joint and the forehead. These injuries would have been sustained by him, while he tried to jump off the speeding train. He would have got hit by the pole present in the plat form. The injuries in the forehead also should have been the result of the same. There are severely lacerated wounds on these areas would have been due to the pole hit



Figure 3:photo showing extensive abrasions over the back



Figure 4 : Photo showing a passenger got trapped in the mangled bogies



as the injuries are suggestive of that^{2,4}.

Conclusion

The person whose body was found in the platform had allegedly hijacked the train had sustained injuries and died while trying to escape from the running train when it was about to collide with another train which was stationed in the same track.

Though it is being concluded in the above mentioned

manner, there were many queries raised. All those questions were properly answered as follows.

The injuries over the back are mainly abrasions and lacerations sustained due to the dragging effect on the hard rough surface as a result of fall from the speeding train. The wounds show the direction of the dragging of the body. The distance that the body has been dragged shows the extent of the severity and the speed of the train with which the person had jumped off^{1, 2,4}

There were few queries put by the police authorities investigating this case over the particular deceased who has allegedly hijacked the train and got killed in the collision. The possibility of the person having fallen down from the foot over bridge cannot be taken to consideration. This can be ruled out based on the fact that the person if at all fallen from the top would have been crushed to death within the dismantled bridge.

The other query put was that the deceased would be a genuine passenger of the train. But this also could be ruled out as the genuine passenger would not come out of the compartment and jumped off the train when the train was in motion. No passenger would be under such an impression that the train was hijacked and is going to meet with an accident. There are other passengers who have got entangled and crushed to death as seen in the photographs.

Another question raised was that the deceased might have been a bystander in the platform of the Vyasarpadi railway station. But this cannot be accepted as the bystander in the platform would not have been thrown to such a long distance due to the effect of the collision. The injury pattern does not show the possibility of such an eventuality and possibility.

The foot over bridge that has been dismantled shows the extent of the force and kinetic energy with which the trains had collided.



It been displaced in an upward direction as per the theory of momentum ,i.e., whenever a speeding object collides with another object , the entire kinetic energy would be transferred to the other object and that results in the upward displacement of the objects . This sort of the displacement had resulted in the crumbling of the bridge (foot over bridge).So such an eventuality could not be considered^{3,4}

There are few important features for the personal identity of the deceased such as a tattoo in his right arm with his name (presumed to be his) Nagaraju written in telugu. (as seen in photograph 4)There was a poor dental hygiene and the socio economic status was found to be lower with the external attire (the way he had dressed up i.e. without a shirt but with pant and undergarment)⁴

This episode reminds the phrase “as you sow so shall you reap”.

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Dowry Death: Increasing Violence Against Women

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Abstract

A retrospective study of dowry deaths was conducted at Department of Forensic Medicine, Kempegowda Institute of Medical Sciences and Research Centre, Bangalore over a period of five years (January 2005-December 2009). Out of the total 2145 autopsies conducted in the mentioned period, 121 cases (5.6%) were reported to be dowry deaths. The multiple factors leading to dowry deaths were examined. It was observed that the majority of the affected women (58.7%) were in the age group of 18-25 years. Death occurred mostly within 1-2 years of marriage (30.6%), followed by (22.3%) within 2-3 years of marriage. Majority of the victims were matriculates (62%) followed by graduates (20.7%). Most cases, that of (60.3%) cases belonged to lower middle class and (22.3%) cases belonged in lower class. The commonest method employed was hanging seen in (66.9%) cases followed by poisoning in (18.2%) cases and burns in (9.9%) cases. It was observed that majority of the death occurred were suicidal (85.1%) in nature followed by (11.6%) accidental and (3.3%) homicidal deaths.

Key Words

Women, Marriage, Violence, Dowry death

Introduction

Dowry can be defined as a gift given in cash or kind by the bride's family to the bridegroom's family. In majority of cases it is demanded by the groom's family or given as a precondition for a marriage. Subsequently, dowries become continuing series of gifts endowed even after marriage on every occasion. In middle class families specially, a woman's status in the society is decided on her ability to give birth to sons and to bring in handsome dowries to her husband's family. When dowry expectations of the bride groom's family are not met, the young bride may be killed or abetted to commit suicide.

Dowry deaths have increased alarmingly thus endangering women in the society. This social evil has significantly been causing an increase in female infanticides, early marriage; violence against women, psychological torture, suicides, bride burning, murder of married women, desertion by their husband, and deaths of young brides. It is an important cause of anxiety and worry for the judiciary, police, government, law enforcing bodies and medico legal experts.

In spite of the Indian government banning practices of dowry harassment, extortion and demands through its provisions of the Dowry Prohibition Act enacted in 1961 and amendment of this act in 1983, dowry deaths continues to escalate and the important action in this scenario is to immediately halt and curtail the dowry menace.

This study analyses the multiple causation and numerous factors influencing dowry death which is rampant across all sections of the society, having devastating impact on women's lives.

Material and Methods

This retrospective study was conducted in the Department of forensic medicine, Kempegowda Institute of medical sciences

and research centre, Bangalore for a period of 5 years from January 2005 to December 2009. This study includes dowry deaths in the jurisdiction of south Bangalore division and surrounding areas. Magistrate's Inquest, postmortem reports, suicide notes if any, hospital treated records and chemical analysis report were scrutinized to study multiple parameters of death due to dowry harassment. The main parameters include age, socioeconomic status, educational qualification, duration of married life, methods employed and manner of death. Death of women due to natural causes, road traffic accidents and homicides unrelated to dowry harassment were excluded in this study.

Results

During the study period, out of the total 2145 cases of unnatural deaths autopsied, 121 cases [5.6%] were reported to be dowry deaths.

Age: As illustrated in (Table-1) the highest incidence of dowry death, 71 cases (58.7%) were seen in the age group of 18-25 years, followed by 41 cases (33.9%) in the age group of 26-30 years and the least and 9 cases (7.4%) in the age group of 31-35 years.

Duration of Married Life : In 37(30.6%) cases, death occurred within 1 to 2 years of marriage, followed by 27(22.3%) cases within 2 to 3 years of marriage. In 22(18.2%) cases, deaths were reported within 1 year of marriage and no cases were reported after 6 to 7 years shown in (Fig-2).

Educational Qualification : 75 (62%) victims were matriculates, followed by 25(20.7%) victims being graduates. 18(14.9%) cases were non-matriculates and 3(2.5%) cases were illiterates displayed in (Fig-1).

Socioeconomic Status : Majority of, 73(60.3%) cases belonged to lower middle class, followed by 27(22.3%) cases belonging to lower class and 20(16.5%) cases, to higher middle class. The least incidence was seen in higher class 1(0.8%) case shown in (Table-2).

Methods Used : Most number of deaths were reported due to hanging seen in 81(66.9%) cases, followed by 22(18.2%) cases owing to poisoning, 12 cases (9.9%) due to burns and least, 3(2.5%) cases due to fall from height shown in (Fig-3).

Manner of Death : Majority of the deaths that occurred, were suicidal in nature seen in 103(85.1%) cases, followed by accidental in 14 (11.6%) cases and homicidal in 4(3.3%) cases shown in (Fig-4).

Table 1 : Age Distribution

Age	2005	2006	2007	2008	2009
18-25yrs	13	11	17	12	18
26-30yrs	4	7	7	11	12
31-35yrs	1	2	1	5	0
36-40yrs	0	0	0	0	0

Discussion

Dowry menace is present across all religions, castes, populations and sections of the society.

With the increase in the economy of the country, a

Fig 1 : Educational Qualification

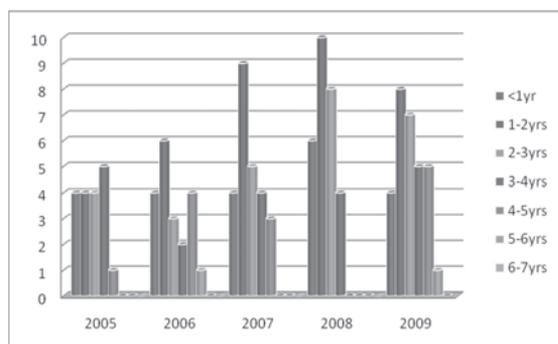
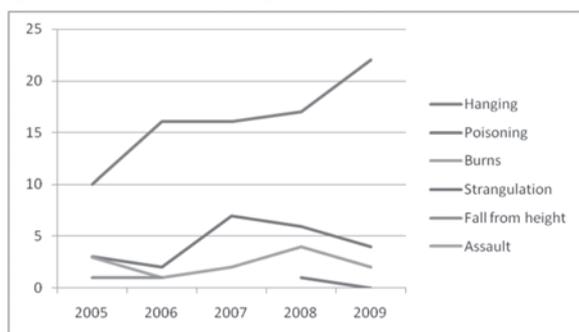


Fig 2 : Duration of Marriage



competition has set in to acquire wealth and prosperity by all means. This is particularly influencing India's growing middle class. Lavish dowry payments in cash or kind are an easy way to attain wealth and increase a family's stockpile of luxury items and brand-name goods.

Table 2 : Socio Economic Status

Year	Lower Class	Lower Middle	Higher Middle	Higher Class
2005	9	9	0	0
2006	6	11	3	0
2007	5	18	2	0
2008	4	20	4	0
2009	3	15	11	1

The mindset of parents, once a girl is born in the family, is to save money for dowry and get the young girls married away as soon as possible. Education of girl child, gender equality, right in property of daughters and many other issues do not appear in the list of priorities. Most marriages are arranged, with proposals referred from relatives and friends or a response to advertisements in newspapers. Though caste,

Fig 3 : Methods Employed

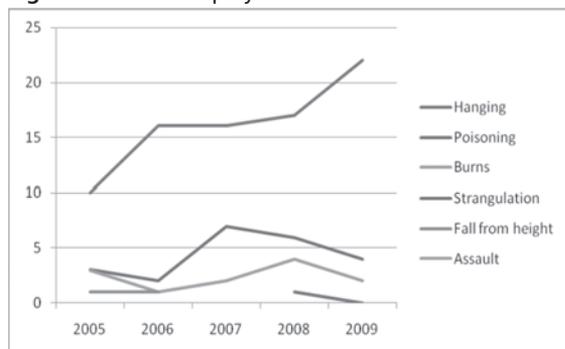
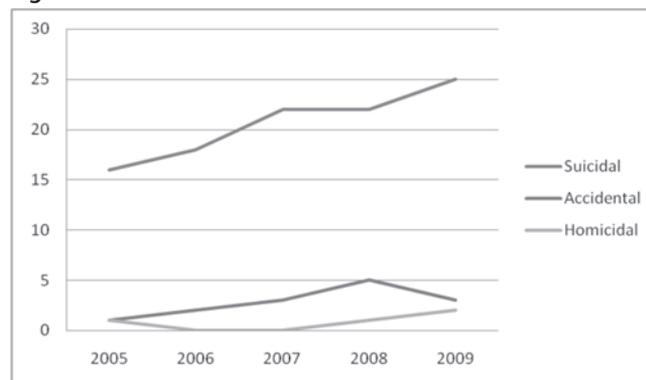


Fig 4 : Manner of Death



religion, birth star, status influence the decision on the alliance, money always is central to the transactions between the families of the bride and groom. The consequences of this include early marriages, child marriages, illiteracy in women and divorces. This also is a significant reason for maximum incidence of dowry deaths in the age group of 18-25 years. Similar studies were seen in Sharma.B.R¹, Virendra Kumar².

Women in the age group of 18-25 years are young, vulnerable and ambitious and are at the verge of exploring and understanding life. Their minds are not well matured to cope up with the problems of life. Soon after marriage the bride is expected to reside with her husband and his family, performing all duties and responsibilities, fulfilling all their wishes and desires. Failure to do so results in the bride facing physical, mental and emotional trauma from her husband and her in laws. This evidences the increasing deaths in young females within 1 to 2 years of marriage. The findings were similar with Sharma.B.R¹, Srivastava.A.K⁴.

Most brides do not want to address the torture and harassment to their respective families, friends or lodge any sort of complaint with the police. The principal reason is the fear in the bride's mind of being abandoned by her family and friends, social stigma against such women and extreme family pressure. A married daughter who wishes to complain or desires to return to her parent's house is unwelcomed and does not receive love, honor and respect that she enjoyed earlier. Also, the future marriage prospects of her siblings are also affected.

With many ways to end life, victims commonly choose hanging, due to its easy availability, accessibility, simple procedure, immediate and surety of death. Increased cases of poisoning may be attributed to the factors like effortless access to highly toxic pesticides, access to over the counter medication and a belief that it gives less suffering and one can have a peaceful death. Similar studies were conducted by Srivastava.A.K⁴. This study is in contrary to the studies done by Sharma.B.R⁵

Conclusion

The study proves the failure of the dowry prohibition act, in controlling and lessening the dowry deaths. The important measures to curtail dowry deaths is emphasizing on information, education and communicational activities to enhance anti dowry philosophy in the minds of people. An effective development of a gender-neutral body of property and inheritance law would be vital. Effectively using media, drama, music, movies, books, audiovisual aids, radio and television programs to educate and popularize the ill effects of dowry is also vital. Interviews, group/panel discussions, meetings, seminars, conferences, internet discussions to develop creative ways of fighting dowry system would be a good initiative to eradicate the dowry evil.

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Pattern of Childhood Injuries in a Rural Area of South India

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Abstract

Background: According to World Health Organization Report 2002, injuries were the sixth leading cause of morbidity and mortality in childhood. **Objectives:** To assess the pattern of childhood injuries in the study area and to measure the injury rate among children under 18 years of age. **Study Setting:** Cheralapally village of Nalgonda district of Andhra Pradesh. **Materials and Methods:** A community based retrospective study was conducted by involving 141 households from 1480 households of the village, by systematic random sampling method. A total of 313 children in the selected households under 18 years of age, after obtaining informed consent from their parents, were enrolled in the study. A semi-structured questionnaire which was pre-tested was used to gather data by one-to-one interview of mother of the child. **Results:** Overall injury rate found to be 307 per 1000 child yrs. Significant number of subjects reported injury to lower limb 43 (44.8%). Open wound 41 (42.7%) was the commonest type of injury observed. Fall as mechanism of injury was reported by 72 (75%) subjects followed by Road traffic accidents (RTI) 12 (12.5%). **Conclusion:** childhood injury pattern observed in the study exposes the vulnerability of children less than 18 years of age regarding injuries.

Key Words

Childhood, Injury rate, Pattern.

Introduction

Child injuries are growing public health problem worldwide. Every year injury and violence kill approximately 95, 0000 children (aged less than 18 years) and injure and disable tens of millions more as discussed in the recent World Report on Child Injury Prevention^[1]. Though child survival initiatives have been highly successful, further improvements in the child health will require broad programs for injury reduction and control. Putting into practice what is known about reducing child injury will help meet the Millennium Development Goals^[2]. This study was conducted to assess the pattern of childhood injuries in under 18 children of study area.

Materials and Methods

The present study was a retrospective community based study conducted in Cheralapally village, a rural field practice area of the department of community Medicine, Kamineni Institute of Medical Sciences, Narketpally, Andhra Pradesh. The study was conducted during March 2009 to September 2009. The population of Cheralapally village is 6825 with 1480 households. Out of the total households 141 households were selected by systematic random sampling method, by including every 10th household. A total of 313 children in the selected households under 18 years of age, after obtaining informed consent from their parents, were enrolled in the study. A semi-structured questionnaire which was pre-tested was used to gather data by one-to-one interview of

mother of the child. A maximum of 2 visits were made at an interval of 1 week for collection of data. **Inclusion criteria:** - Injury included all recallable bodily injury to the children 18 years of age which are unintentional and those that resulted into work loss for parents or absenteeism of children from school/college or seeking medical care for children^[3, 4 and 5].

Exclusion Criteria

Mental or minor injuries which are not recallable at the time of interview. The mothers of the subjects were requested to recall injuries for a period of one year preceding the interview^[3, 4 and 5]. Information was sought from mother of the child regarding history of child injury, the site, nature and mechanism, after obtaining informed consent. A detailed clinical examination of the subjects was done to assess the present status and site of injury. Data was compiled and analyzed and incidence was calculated and presented as per 1000 child years.

Results

Out of the 327 subjects approached for the study 313 subject's parents had given consent with response rate of 95.7%. Mothers of the 313 subjects were interviewed. Majority of the children 186(59.4 %) were boys and 127 (40.6%) girls. A total of 96 major injuries were reported in one year by 90 children; of these, 59(65.6%) were boys and 31(34.4%) were girls. Table I presents age and gender distribution of subjects with their injury rates per 1000 child year. The incidence of major injury in the study children was found to be 307 per 1000 child years. Maximum injuries reported in 5-9 years age group children (34.2%), followed by 10-14 years age group (32.3%). Injury rate was more in case of boys (33.3%) as compared to girls (26.7%). Table II provides the details of site, nature and mechanism of injury. Most common anatomic region affected was lower limb (44.8%), followed by upper limb (28.1%). It was observed that multiple anatomic regions were affected as a result of road traffic injuries in case of five subjects. Multiple nature of injuries seen in seven subjects. Most common nature of injury was open wound (42.7%). Most common mechanism of injury was found to be fall (75%), followed by Road traffic injuries (12.5%). Total days lost due to temporary disability are found to be 476 days as reported by 15 subjects of which 14 subjects have sought treatment.

Since there were repetitive injuries in five people, injury events (96) were considered for calculations and not the number of children injured (90).

Discussion

Despite recent progress in understanding the broad patterns, the precise magnitude of Injury-related morbidity is not known for many individual countries. Present study is an attempt to identify the magnitude of problem and pattern of childhood injuries by doing community survey. Our findings pertaining to injury rate are comparable with the study done by M. Shivamani et al among 0-14 year children in rural block of Tamil Nadu, India. By cross-sectional survey method the overall injury rate reported by them was 341.89/1000 child yrs with more injuries reported in males as compared to females^[6]. Our study the overall injury

rate was 307/1000 child years with injury rate more in boys (333.33/1000 child yrs) as compared to girls (267.71/1000 child yrs). Study done by Dr. Varma et al for world health organization in Delhi reported annual incidence of injury of 90.7 per 1000 population in 0-5 year age group [4].

Our study found that 44.8 % injuries affected lower limb, head and neck was affected in 26 % injuries. Study done by Varma also reported that lower limbs were affected in 37.4% subjects and upper limbs in 27.3% subjects. [4]. Also A. J. Singh and A.Kaur in their study about trivial injuries in a rural area of Ambala observed that hands/figures (45.42%) and toes/feet (35.33%) were the most affected parts of the body [7]. Present study majority i.e.42.7 % subjects the nature of injury was open wound. Cuts and laceration accounts for 18.6% injuries and 9.4 % subjects it was fracture. Nath and Naik in their study among under-fives reported 11.8% wounds were of cuts and laceration in nature [8]. World report on child injury prevention reveals that cut/bite/open wound seen in 25.3% injuries and fracture seen in 21.1% of injuries among the children reported to emergency departments in low income countries during 2007 [1]. Falls was reported as mechanism of injury in case of 75% injuries and Road traffic injuries responsible for 12.5% of injuries in our study. World report on child injury prevention reveals that RTI rank 10th in case of burden of disease among children. Community based

programmes and should be delivered through primary health care approach.

2. Collection, compilation and dissemination of data pertaining to childhood injury should be done by establishing childhood injury information system.
3. Information, Education and communication activities regarding prevention of childhood injuries needs to be carried out by involving teachers, mahilla mandals, community leaders along with health care providers.

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Table I: Age and Gender Distribution of Children and their Injuries (n=313)

Age Gr (yrs)	Number of Children	Number of Injuries in a Year	Injury Rate/1000 Child Years
0-4	49	11	224.48
5-9	73	25	342.46
10-14	167	54	323.35
15-18	24	06	250.00
Gender			
Male	186	62	333.33
Female	127	34	267.71
Total	313	96	306.70

surveys from Asia found that for every child who died as a result of traffic injury 254 presented to a hospital facility. As per the data from 28 countries global school survey presented in the world report on child injury prevention, falls are the leading causes of non-fatal injury [1]. Hospital based study done by A Shanon et al in eastern Ontario found falls as a leading cause of injury in 37.7% (1088) of injuries and motor vehicle accident was reported in 2.4% (69) injuries [9]. Hospital based study done by sumit verma et al observed that most common nature of injury was fracture (32%), followed by Bruise (17.3%), Laceration (15.5%), open wound (14.2%). Similar to our study this study also reported fall (64%) as most common mechanism of injury followed by Road traffic injuries (16.4%) and blunt trauma (8.8%) [10].

Conclusions

In our study, the overall injury rate was 307/1000 child years. Fall was reported as most common mechanism of injury (75%), followed by road traffic injuries (12.5%). Significant number of children developed temporary disability. Childhood injuries are the cause of additional economic burden on the families in the form of loss of daily wages and cost of the treatment. Prevention of childhood injuries will help in achieving the Millennium Development Goals.

Recommendations

1. Childhood injury prevention activity needs to be inculcated with the existing mother and child health related

Table II : Characteristics of childhood injury among the study subjects

Characteristics	Number	Percentage
A) Site (n=96)		
Head & Neck	25	26
Upper Limb	27	28.1
Lower Limb	43	44.8
Thorax/Abdomen	04	04.2
Total	*99	*103.1
B) Nature (n=96)		
Fracture	09	09.4
Bruise	13	13.5
Laceration/cut	18	18.6
Open wound	41	42.7
Concussions	01	01.0
Sprain/Dislocation	09	09.4
Abrasions	11	11.4
Total	*102	*106
C) Mechanism (n=90)		
Fall	72	75
RTI	12	12.5
Blunt Trauma	07	07.3
Burns	05	05.2
Total	**96	100

*= Multiple response

**Five children received injuries multiple times.

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Dimorphism of Maxillary and Mandibular Canine Teeth in Establishing Sex Identity

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Abstract

Teeth form an excellent material for anthropological, genetic, odontologic and forensic investigations. Amongst all the teeth, the canines are found to exhibit greatest sexual dimorphism. The present study was performed on 150 healthy volunteers (75 males, 75 females) of 17 - 21 years of North Indian origin with the aim to investigate whether any correlation existed between odontometric measures including maxillary and mandibular canine measures, and sex determination. The mesiodistal and buccolingual measurements were subjected to statistical analysis using the t test to determine whether significant differences exist between tooth sizes in males and females. Mean value of mesiodistal and buccolingual measures of maxillary and mandibular canines was higher in males than females and the difference was statistically highly significant (p value < 0.001). The right and left maxillary and mandibular canine measures among genders showed no significant difference. Our study conclusively establishes the existence of a definite statistically significant sexual dimorphism in maxillary and mandibular canines. It can be concluded that odontometric measures of canines are a quick and reliable method for sexual identification when a standard for the population is available. This method can be used as adjunct to other available tools for sex determination.

Key Words

Maxillary canine, mandibular canine, sexual dimorphism.

Introduction

Identification of human remains during mass disasters is usually hindered by the state of the soft tissue. With relevant expertise, it is carried out on bones and teeth.^[1,2] Teeth are an excellent material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations because the dentition is often preserved, even when the bony structures of the body are destroyed. It is so being that they are the hardest, chemically the most stable tissues and protected by the bone jaw. It has the ability to resist, better than any other skeletal structure, the destructive action of the medium in which they are found.^[3] These exhibit the least turnover of natural structure and are readily accessible for examination. In the body they are selectively preserved and fossilized, thereby providing by far the best record for evolutionary change. Their durability in the face of fire and bacterial decomposition makes them invaluable for identification.^[4] Identification of sex in damaged dead bodies is an essential step for medico-legal purposes. "Sexual Dimorphism" refers to those differences in size, stature and appearance between male and female that can be applied to dental identification because no two mouths are alike.^[5] The use of dental morphology to determine sexual dimorphism is a procedure established in anthropological and biological studies.^[6] The size of the teeth is of great importance not only to indicate

the different activities related to the occlusion or determine the frequency of dento-tooth anomalies applied to the orthodontic treatment, but also to establish sexual dimorphism.^[7] The knowledge of coronary dimensions for the identification of sex when skeletons are found becomes relevant, especially when anatomical parameters are not reliable for identifying a particular subject. The existence of sexual dimorphism in permanent teeth is a known phenomenon, as observed in several investigations.^[8,9] Males possess larger tooth crowns than females in contemporary human populations. This may be due to a longer period of amelogenesis for both deciduous and permanent dentitions in males.^[10] Of all the teeth in the human dentition, the canines are the least frequently extracted teeth (possibly because of the relatively decreased incidence of caries and periodontal disease). Also, canines are reported to withstand extreme conditions and have been recovered from human remains even in air disasters and hurricanes. Controversy exists regarding the degree of sexual dimorphism between mandibular and maxillary canine teeth in different ethnic groups. Tooth morphology is also known to be influenced by cultural, environmental, and racial factors.^[11] The purpose of this study was to assess the dimorphism of human permanent maxillary and mandibular canines in a North Indian population.

Material and Methods

The study comprised 150 North Indian subjects, 75 males and 75 females in the age group of 17-21 years. This age group was selected, as all permanent canines are fully erupted and attrition is minimal in this age group^[12]. Subjects with following status of teeth were included in the study; healthy state of gingiva and periodontium, caries free teeth, absence of tooth anomalies such as form, structure, and development, good quality of study models and no record of restoration or stripping of canine teeth. The significant exclusion criteria employed for selection of the study sample were the presence of partially erupted/ ectopically erupted teeth, patients with dental/occlusal abnormalities (such as rotation, crowding, occlusal disharmony, etc.), teeth showing physiologic or pathologic wear and tear (e.g., attrition, abrasion, abfraction, erosion), and patients with deleterious oral habits (like bruxism). Plaster models of the maxillary and mandibular arches from alginate impressions in these patients were obtained. The greatest mesiodistal and buccolingual width of all four canines was measured with the help of an electronic Digital calliper accurate to 0.01mm resolution [Figures 1 and 2]. All the measurements were done by single examiner to eliminate inter-operator error. Measurements were recorded on an Excel spreadsheet and subjected to statistical analysis using 't' test.

Figures

Figure 1: Measurement of mesiodistal dimension of canine with digital calliper (0.01 mm calibration).



Figure 2: Measurement of buccolingual dimension of canine with digital calliper (0.01 mm calibration).



Findings

The results comparing the mesiodistal width of maxillary canines in both male and female are depicted in Table 1. The right and left maxillary canine's width in both males and females were comparable and can be said to be bilaterally symmetrical. The mesiodistal dimensions of the maxillary tooth crowns were found to be higher in males compared to females. When the mean width values for left and right maxillary canine were compared between males and females, the females showed less value and the difference was found to be statistically significant ($P < 0.001$). The width of the mandibular canine was also almost bilaterally symmetrical in both the males and females. When comparing the mean width values for left and right mandibular canines between males and females, the females showed less value and the difference was found to be statistically significant ($P < 0.001$). Table 2 depicts comparison between the buccolingual widths of maxillary and mandibular canines in both males and females. When comparing the mean width values for left and

Tables

Table 1: Mean values of mesiodistal dimensions of canines with application of t test

	Gender	N	Mean	Std. Deviation	t	Significance
MD13	Male	75	7.92	0.45	3.974p<0.001	Highly significant
	Female	75	7.62	0.47		
MD23	Male	75	7.89	0.45	4.029p<0.001	Highly significant
	Female	75	7.60	0.43		
MD33	Male	75	6.98	0.42	4.245p<0.001	Highly significant
	Female	75	6.68	0.42		
MD43	Male	75	6.97	0.42	3.784p<0.001	Highly significant
	Female	75	6.71	0.42		

Table 2 : Mean values of buccolingual dimensions of canines with application of t test

	Gender	N	Mean	Std. Deviation	t	Significance
BL13	Male	75	8.35	0.43	4.479p<0.001	Highly significant
	Female	75	8.03	0.45		
BL23	Male	75	8.30	0.45	3.906p<0.001	Highly significant
	Female	75	8.02	0.43		
BL33	Male	75	7.37	0.42	3.903p<0.001	Highly significant
	Female	75	7.10	0.43		
BL43	Male	75	7.42	0.42	3.813p<0.001	Highly significant
	Female	75	7.14	0.46		

right maxillary and mandibular canines between males and females, the females showed less value and the difference was found to be statistically significant ($P < 0.001$).

Discussion

Dental anthropology is an important aspect of physical anthropology. Teeth are a very stable substance within the body, and are often the best-preserved portion of the body in archaeological and forensic cases. In many cases, teeth are the only evidence that can be used for analysis. Especially in forensic cases, teeth can be the deciding factor in identification of individuals. In archaeological cases, dental anthropology can reveal much important information about individuals and populations. One of the important pieces of information gathered from tooth analysis is the sex of an individual. There are several different ways to extract this information from human remains; however, it is crucial for anthropologists to understand how to extract the same information from teeth. This paper focuses on sex determination through the topic of sexual dimorphism, specifically tooth size. The use of mesiodistal diameter of the canines in the present study was justified as most of the available measurements used for sex determination concern mesiodistal crown diameters of the permanent dentition and their sexual differences are most attractive to investigate. As

it has been determined previously, males have larger teeth than females.^[13-16] There are many reasons for this conclusion. A popular theory has been to ascribe this to their function, which on evolutionary basis differs from other teeth. The notable difference between canine in determining sex was noted to be due to the influence of the Y chromosome which was not uniform in all teeth. On the other hand the X-linked genetic influence on tooth width was rather uniform for all teeth.^[13] Considering the fact that there are differences in odontometric features in specific populations, even within the same population in the historical and evolutionary context, it is necessary to determine specific population values in order to make identification possible on the basis of dental measurements. This study was intended to analyze the sexual dimorphism in the maxillary and mandibular canine in a North Indian population. From these findings, it can be inferred that there exists a definite statistically significant sexual dimorphism in the maxillary and mandibular canines. It is consistent with the findings of Hashim and Murshid who conducted a study on Saudi males and females in the age group of 13-20 years and found that only the canines in both jaws exhibited a significant sexual difference while the other teeth did not.^[17] A study by Kaushal et al, found a statistically significant dimorphism in the mandibular canines in 60 subjects in a North Indian population, where the mandibular left canine was seen to exhibit greater sexual dimorphism. They also concluded that if the width of the canine is greater than 7mm, the probability of the sex of the person under consideration being male was

100%.^[18] In a Saudi Arabian sample of 503 school students, Al-Rifaiy et al, found the mean values for left and right maxillary and mandibular canine mesiodistal width was less for females than males but were not statistically significant.^[19] Garn et al studied the magnitude of sexual dimorphism by measuring the mesiodistal width of the canine teeth of an Ohio Caucasian population and concluded that the magnitude of canine tooth sexual dimorphism varied among different ethnic groups.^[13] Boaz and Gupta by evaluating dental cast of 100 South Indian patients (50 males and 50 females) in the age group of 14 – 20 years have observed mean canine widths in males in females. In contrast to our observations, they observed that the mean values of mesiodistal widths of right and left canine are greater in females than in males. However, in their study they have noted no statistical significance to the observed difference between males and females for mesiodistal measurements of each of the mandibular canines.^[20] In the present study comparison of right canine width with left canine width in males have showed no difference and a similar observation is noted in females when right canine width is compared with left canine width. Thus, it can be clearly stated that the canine width of either side both in males and females depicts no significant differences. Our findings are well supported by other workers who have also observed no significant difference in canine width of either right or left side.^[18-24]

Conclusion

The method of using maxillary and/or mandibular canine odontometric measures is advantageous as it is inexpensive, requires no elaborate apparatus and is suited for situations where large numbers of samples have to be analyzed for gender estimation. In addition, the measurements are rapid, involve simple mathematical calculation and preclude employing highly skilled personnel. The method incorporates minimal interobserver discrepancy and bias as the anatomical landmarks and measurements are well-defined and standard. This is acceptable in situations when the DNA technology is inaccessible or jaws are the only remnants available for investigations. Our study conclusively establishes the existence of a definite statistically significant sexual dimorphism in maxillary and mandibular canines and can be used as an adjunct with other parameters for the determination of sex in cases of highly mutilated and damaged bodies where jaws are at hand.

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Unexpected Lithium Toxicity in Patient with Weakness and Neurologic Disorders

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Abstract

Aim: 75% of patients who are treated with lithium for a long time develop toxicity during their therapy. We report here a case of lithium toxicity that presented with neurologic symptoms.

Case study: A 46-year-old woman presented to our ED with disorientation and urinary incontinence . She had ataxic gait and speech disorder from four days later and fine tremor and mild edema in both hands and feet with a maculopapular rash in her feet. We requested serum level of lithium and it was 1,88meq/l. 8 hour after hydration with NS, serum level of lithium was 0.9meq/l and the level of conscious and other abnormal signs and symptoms were improved.

Conclusion: Recognizing lithium toxicity maybe challenging, and It may be difficult to distinguish between lithium toxicity and other organic diseases.

Lithium toxicity should be considered as a DDX of AMS and weakness in patients who have psychiatric disorders.

Introduction

Lithium is an approved drug for the treatment of psychiatric disorders.(1) up to 75% to 90% of patients who are treated with lithium during their therapy develop toxicity(2). Lithium toxicity may result from acute intentional overdose or in those who are taking lithium long term (3). Decreases in glomerular filtration or volume depletion are a important cause in cases of chronic toxicity. We report here a case of lithium toxicity that presented with weakness and neurologic symptoms.

Case Study

A 46-year-old Iranian woman presented to our ED with memory loss, decreased mental concentration, disorientation and incontinence of urination. She was ill and fatigue. Her son explained that she has had aggressive behaviors and hallucination and nausea and vomiting of four days ago. She had ataxic gait and disorder in speech. Physical examination disclosed mild tenderness in abdomen without rigidity. She had fine tremor in her hands and mild edema in hands and feet with maculopapular rash in feet. She had past medical history of DM ,IHD, HTN and psychiatric disorder that due those used metformin, ASA, atenolol, fluoxetine, lithium, alprazolam. Her vital sign was normal only she was mild dehydrated. on admission , laboratory test was notable for leukocytosis of 15,700 cells/mm³,with differential 69% neutrophils and 25% lymphocytes.k=5,1meq/l , Na=131meq/l , ca=8,8mg/dl , blood sugar=240mg/dl , TSH increase, T4 decrease, BUN=28mg/dl , Cr=1mg/dl , and basic metabolic panel, liver function test , were normal. Her ECG showed increase in QTc interval and sinuse bradychardia. brain CTscan was done and it was normal. we requested serum level of lithium and it was 1,88meq/l. after than patient admitted in toxicology unit and hydrated with normal salin and observed.8 hour later rechecked serum level of lithium, it was 0.9meq/l and improved level of conscious and other abnormal signs and symptoms.

Discussion

After oral ingestion of therapeutic doses of lithium, it is rapidly and completely absorbed, but delayed absorption may occur when ingestion of a large number of sustained-release tablets occur (4). Risk of lithium toxicity increases when it is combined with other medications (such as SSRI /NSAIDs/ACE-I/ Benzodiazepines) or when changes occur in fluid and electrolyte status (such as sodium and water loss due to heat or exercise, vomiting, diarrhea, diaphoresis, and decreased oral intake). Diabetes mellitus, Infection, Surgery may lead to lithium retention. In 35% to 90% of treated patients adverse effects occur (5). The most common of them are hand tremor, polyuria due to loss of urinary concentration ability, and rash. Hand tremor occurs in up to 65% of patients. Neurologic side effects include memory loss, decreased mental concentration, and fatigue. Ataxia and dysarthria can develop and often improve with cessation of therapy. GI side effects, including nausea, vomiting, diarrhea, bloating, or generalized abdominal pain that occur in both acute and chronic toxicity. Cardiovascular changes in ECG are U waves, flattened or inverted T waves, and ST segment depression. bradycardia, QT interval prolongation, bundle-branch block, and junctional dysrhythmias, have been reported in up to 20% to 30% of patients. Other side effect with long-term lithium therapy are **Fatigue/Dysarthria/Muscle weakness/Hypothyroid effect , Maculopapular rash/Edema of hands and feet/Leukocytosis.** Patients may have slowing of cognitive function , visual and tactile hallucinations. Establish IV access, initiate cardiac rhythm monitoring (recording a 12-lead ECG), and order laboratory analysis of blood and urine are necessary. a complete medical history and assess baseline neurologic function is necessary. IV administration of NS is important, because nearly patients with toxicity have sodium and volume deficit. 2-L IV bolus of NS given over 30 to 60 minutes and followed by a 200 mL/h continuous IV infusion(5) .Whole-bowel irrigation in cases in which sustained-release lithium products have been ingested is helpful(6). indications for hemodialysis : serum lithium levels of >4 mEq/L in acute overdose (3.5 mEq/L in chronic toxicity), little change in lithium level after 6 hours of IV saline therapy, or sustained lithium levels of >1.0 mEq/L after 36 hours. The goal of hemodialysis is to reduce the serum lithium level to <1 mEq/L. If serum level of lithium rise to >1 mEq/L after 8 hours, hemodialysis should be reinstated.

Conclusion

Recognizing lithium toxicity maybe challenging, particularly in patient with chronic toxicity. It maybe difficult to distinguish between lithium toxicity and other organic diseases. Therefore lithium toxicity should be included in the differential diagnosis of altered mental state and weakness in patients who have psychiatric disorders and use neuroleptic agent when it is combined with other medications.

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Profile of Burn Cases at Government Medical College and Hospital, Chandigarh

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Abstract

Despite the great advances in the treatment of Burns Cases, they remain one of the most distressing injuries for any patient and amongst the most challenging ones for the medical care giver. A prospective study was conducted to assess the causes, magnitude and profile of burns cases coming to Government Medical College & Hospital, Chandigarh. During the one year study period a total of 116 cases of burns were admitted, with the overall male to female ratio of 1: 1.42. Forty-six percent cases were seen in the 21-30 years age group, 48% were from the rural and urban background, each; 90% females were married. Maximum number of cases in females, 14 (21%), occurred in February, and of males 9 (19%) in November. Maximum cases in males (11; 23 %) were in 31-40% TBSA, and in females (27; 23%) in >80% TBSA. Ninety-two percent cases suffered accidental burns, and the peak time of incidence was 6.00-9.00 pm, Kitchen (71%) was the most common place where these burn injuries were suffered especially among the female patients (81%).

Key Words

Epidemiology; Burns; Burn injury; TBSA; Chandigarh; India

Introduction

In developing countries like India, with limited resources and a large population, the incidence of burns is enormous when compared to the facilities available for their management.¹⁻⁶ For enhancing the early effective management of burn patient load every institute must devise policies according to the local needs apart from the usual universally accepted treatment protocols.^{1, 2, 7-9} This study was conducted to assess the causes, magnitude and profile of burns cases coming to Government Medical College Hospital, Chandigarh.

Material and Methodology

The present one year prospective study was conducted in the department of Forensic Medicine and Toxicology, Government Medical College Hospital, Sector 32, Chandigarh. All hospital admitted cases of burns with either more than 48 hrs of admission or with fatal outcome were the subjects of the study. Information regarding the date, time and place of the incident, age, gender, marital status family status and place of residence of the victims, extent and time of burn injury etc, was gathered and detailed history taken from the patient/ relatives.

Observations

Age and gender: Among the 116 Burns cases, males accounted for 48 (41.4%) cases, while females numbered 68 (58.6%), with the overall male: female ratio being 1: 1.42. Maximum cases [54 (46.6%)] were seen in the 21-30 yrs age group, with 43.8% males and 79.4% females; but within

this decade, the male cases were concentrated in 26-30 years and in 21-25 years for females. (Table1)

Table 1: Age and Gender-wise Distribution of cases:

Age(yrs)	GENDER		Total(n= 116)
	Male (n=48)	Female (n=68)	
0-15	2 (4.2%)	1 (1.5%)	3 (2.6%)
16-20	3 (6.3%)	11 (16.2%)	14 (12.1%)
21-25	7 (14.6%)	20 (29.4%)	27 (23.3%)
26-30	14 (29.2%)	13 (19.1%)	27 (23.3%)
31-35	11 (22.9%)	12 (17.7%)	23 (19.8%)
36-40	2 (4.2%)	4 (5.9%)	6 (5.2%)
41-50	6 (12.5%)	4 (5.9%)	10 (8.6%)
51-60	3 (6.3%)	3 (4.4%)	6 (5.2%)
>60	0 (0%)	0 (0%)	0 (0%)
Total	48 (100%)	68 (100%)	116 (100%)

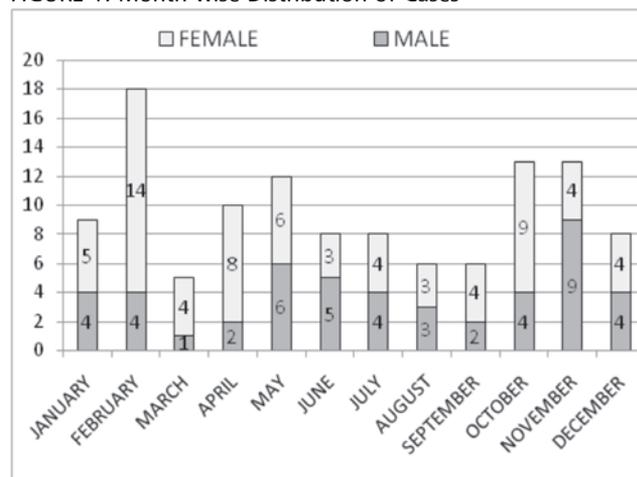
Rural/ Urban Distribution of Cases: Fifty-six (48.3%) cases were from the rural background, while 49 (42.2%) were from urban areas and 11 (9.5%) from slums of Chandigarh. Among the males, 75% were married and of these 31% lived in rural, 35% in urban areas, while 8% were from the slums. Ninety percent of the females were married and of these 44% lived in rural, 36% in urban and 9% in slum areas. Sixty-five percent of both males and females lived in nuclear families. (Table 2)

Table 2 :Marital and Family Status Vs Urban – Rural distribution

Residence	Males (n=48)			Females (n=68)		
	Total	Married	Nuclear	Total	Married	Nuclear
Rural	22 (45.8%)	15 (31.3%)	11 (22.9%)	34 (50%)	30 (44.1%)	22 (32.4%)
Urban	22 (45.8%)	17 (35.4%)	17 (35.4%)	27 (39.7%)	25 (36.8%)	16 (23.5%)
Slum	4 (8.3%)	4 (8.3%)	3 (6.3%)	7 (10.3%)	6 (8.8%)	6 (8.8%)
Total	48 (100%)	36 (75%)	31 (64.6%)	68 (100%)	61 (89.7%)	44 (64.7%)

Month-Wise Distribution of the Cases: Maximum number of overall cases, 18 (15.5%), were seen in the month of February; for females, maximum 14 (20.5%) were in February and for males, 9 (18.7%) in the month of November. The least number of cases, 5 (4.3%) were witnessed in March. (Figure 1)

FIGURE 1: Month-wise Distribution of Cases



Time of Burn Incident Wise Distribution of Cases

Maximum number of cases occurred during the time interval of 6-9 PM, 26 (22.4%) cases, both in the case of males, 13 (27.1%) and females, 13 (19.1%); followed by the time interval of 6-9 AM, 20 (17.2%) cases. No case was seen in the time interval of 3-6 AM. (Figure 2)

Place of Burns: Eighty-one percent females (55) suffered burns in their in-laws house, as compared to 19% (13) in their parental home, while 29% (14) males suffered burns at the work place. Cooking related fire incidents in the kitchen comprised 71.5% (83) of the total cases with 84% (57) amongst females and 54% (26) in males. (Table 3)

Majority of the burns, 92% (107), were accidental in nature with 92% (44) of males and 92% (63) of females. Seven percent

Figure 3: Distribution of cases on basis of delay in reporting to hospital

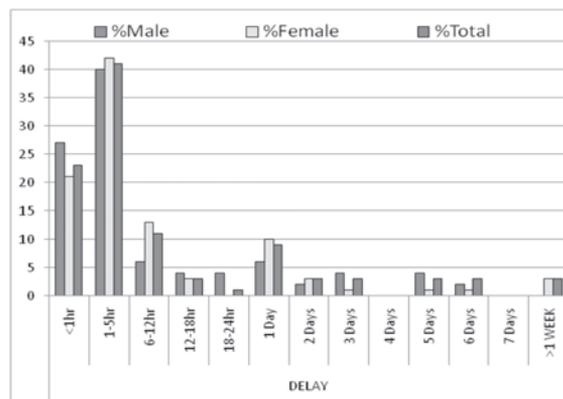


Table 3 : Distribution of Cases as per Place of Burns

Gender	Place of Burn incident							
	Kitchen			Other room			Work Place	Fields
	In-laws	Parental	Total	In-laws	Parental	Total		
Male (n=48)	11 (22.9%)	15 (31.3%)	26 (54.2%)	1 (2.1%)	7 (14.6%)	8 (16.7%)	14 (29.2%)	0 (0%)
Female (n=68)	49 (72.1%)	8 (11.8%)	57 (83.8%)	6 (8.2%)	3 (4.4%)	9 (13.2%)	0 (0%)	2 (2.9%)
Total (n=116)	60 (51.7%)	23 (19.8%)	83 (71.5%)	7 (6.0%)	10 (8.6%)	17 (14.7%)	14 (12.1%)	2 (1.7%)

Table 4 : Distribution of Cases as per Type of Burns

Type Of Burn	Gender		Total (n=116)
	Male(n=48)	Female (n=68)	
FLAME	37 (77.1%)	67 (98.5%)	104 (89.6%)
SCALD	4 (8.3%)	0 (0%)	4 (3.5%)
ELECTRICAL	5 (10.4%)	1 (1.5%)	6 (5.2%)
CHEMICAL	2 (4.2%)	0 (0%)	2 (1.7%)

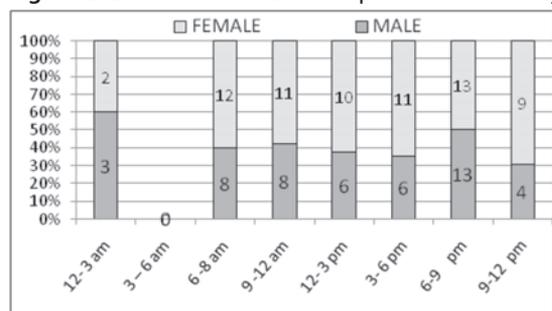
(8) burns were suicidal with 6.3% (3) of males and 7.3% (5) of females. The single case (2.1%) of homicidal burns was observed in males.

Ninety percent (104) cases of flame burns were recorded with 77% (37) of males and 98.5% (67) of females. Scalds contributed 3.5% (4), electrical 5.2% (6) and chemical burns 1.7% (2) of cases. (Table 4)

Delay: Twenty-three percent (27) cases had less than 1 hour delay in reporting to GMCH emergency and 41% (48) came within 6 hrs of burn event that is 67% (32) males and 63% (43) of females reached health care facilities within the golden period for successful management of burns. (Figure 3)

Body surface area involved (TBSA): Twenty-three percent (27) cases suffered burn injury to more than 80% of TBSA which was largely due to the higher incidence of female cases 21 (31%) in this TBSA range. Forty-four percent of males suffered burns

Figure 2: Distribution of Cases as per Time of the Day



to less than 40% TBSA as compared to only 19% females in this TBSA range. (Table 5)

Table 5: Total Body Surface Area involved Vs Gender

TBSA%	MALES(n=48)	FEMALES(n=68)	TOTAL(n=116)
<30 %	10 (20.8%)	6 (8.8%)	16 (13.8%)
31-40%	11 (22.9%)	7 (10.3%)	18 (15.5%)
41-50%	9 (18.8%)	9 (13.2%)	18 (15.5%)
51-60%	6 (12.5%)	7 (10.3%)	13 (11.2%)
61-70%	3 (6.25%)	11 (16.2%)	14 (12.1%)
71-80%	3 (6.25%)	7 (10.3%)	10 (8.6%)
>80%	6 (12.5%)	21 (30.9%)	27 (23.3%)

Figure 5: Mean TBSA Involved with Age and Gender

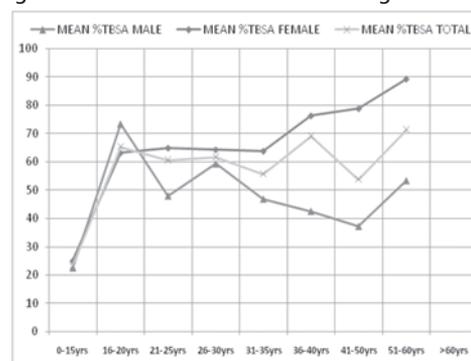
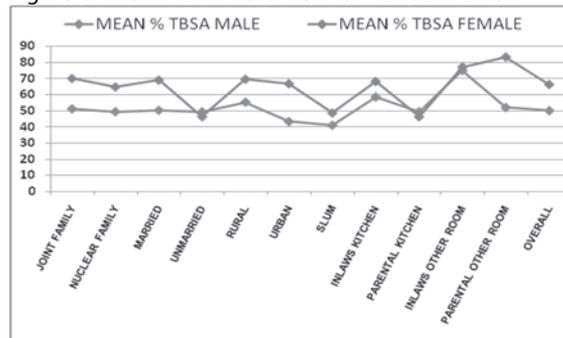


Figure 6: Mean TBSA Recorded for Various Factors



Discussion

The epidemiology of burns may vary from one part of the country to another as it depends on various local factors.^{1,7-11} Burn injuries and their related morbidity, disability, and mortality represent a public health problem of increasing importance in developing countries.¹¹⁻¹⁵

This analysis of burn patients concerned 116 patients admitted during a one-year period to the burn ward of GMCH Chandigarh, India.

Almost 66% of patients were between 21 and 35 years of age, which is similar to other studies.^{1,16-19} This is the productive age when they are generally active and are exposed to hazardous situations both at home and at work. In this study, children less than 15 years of age contributed to 2.6% of total cases which is similar studies of Chandigarh area.^{1,16-17}

More than 59% of the burn injury admissions were females with an overall male to female ratio of 1: 1.4. This finding is similar to studies undertaken in various hospitals all over India and outside.^{1,3,16} This could be attributed to the male dominant society and females' close proximity to fire throughout the day and night.

In the present study, most of the burn victims (51% of total and 88% of females) were housewives. Similar findings have been observed in a studies conducted by other workers.^{1,3,16-19} This is explained by the vulnerability of housewives to burn injuries due to the close proximity to fires while cooking.

Eighty four percent of burn injuries in females occurred in kitchen while cooking and only 9% in non cooking activities whereas in males, 54% sustained burns while cooking, 17% during non-cooking related and 30% of burns occurred at workplace. This figure is comparable to other reports from developing countries, including India.^{1,3,19} This indicates that home is a dangerous place for burn injuries to occur as appliances are continuously being used for cooking, heating, and lighting purposes without proper precautions.

Seventy-two percent of the burn victims were from urban areas and about 48% from rural areas. Other similar Indian studies report higher percentage of cases from rural area. This could be attributed to the different demographic profile of Chandigarh as is also recorded by studies of this region.^{1,3,16-18,21-22}

Among the males 75% were married and of these 31% lived in rural, 35% in urban and 8% in slums. Ninety percent of the females were married and of these 44% lived in rural, 36% in urban and 9% in slums. Sixty-five percent of both males and females lived in nuclear families. These findings are similar to other studies of the region.^{1,3,16}

The colder months from October to march contributed 57% (66) of cases. Maximum number of overall cases 18 (15.5%) were seen in the month of February followed by 13 (11.2%) each in October and November. This corresponds to the other studies of the region.^{1,3,16}

About 24% of burn injuries occurred between 6 pm and 9 pm and another 20% between 6 am-9am. This correspond to the cooking time in households especially the working class in Chandigarh.^{1,3,16}

Twenty-three percent (27) cases had less than 1 hour delay in reporting to GMCH emergency and 41% (48) came within 6 hrs of burn event that is 67% (32) males and 63% (43) of females reached health care facilities within the golden period for successful management of burns. Eighty per cent of the admissions occurred within the first 24 h, which was much higher than in previously reported series of the region¹⁶, but is similar to other studies.^{1,3}

Flame was responsible for the majority of burns (90%), which was similar to other studies^{2,3} while scalds (3.5%) and electrical burns (5.2%) and chemical (1.7%) were much lower

than the rates reported in those studies. Accidental burn injuries accounted for 92% of cases, a similar rate to other studies^{2,3} while suicidal burns amounted to 7% of cases, which was less than in these reports.

Twenty-three percent (27) cases suffered burn injury to more than 80% of TBSA which was largely due to the higher incidence of female cases 21 (31%) in this TBSA range. Forty-four percent of males suffered burns to less than 40% TBSA as compared to only 19% females in this TBSA range

Conclusion

The study of epidemiological factors of burn injury which vary in different countries have a great role to play from planning to implementing of regional programs for efficient management of burns. This study provides an overview of the hospitalized burn victims at the Government Medical College Hospital, Chandigarh, India.

The extremes of age are at a lesser risk as compared to the age group of 21-35 years and winter is the most common season for such burn injuries.

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Study of Abdominal Injuries in Deaths Due to Road Traffic Accidents

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Abstract

Deaths due to trauma are increasing at an alarming rate in India in recent years. Majority of the deaths are due to road traffic accidents though other causes of trauma are also important. The injuries as a result of accidents have potentially serious consequences resulting in disability, morbidity or mortality. Mortality in our country is higher compared to other developed countries. In Bangalore industrialization and modernization is moving ahead at a high speed. In this study of abdominal injuries in road traffic accidents, an attempt has been made to highlight the various causative factors, to suggest preventive measures so as to save precious human lives from these man made calamities.

Key Words

Abdominal injuries, Road traffic accident, autopsy.

Introduction

Birth and death are two extremes of the life and death is the ultimate truth. But unnatural death is known for its immense striking power and is always a surprise. Death due to road traffic accident is one of the common forms of unnatural death and its history is as old as the invention of the wheel. The first death due to motor vehicle was registered in 1896 in United Kingdom and the first one in United States of America in 1899. ¹ Though India has just two percent of the total number of vehicle in the world, it accounts for nearly 68% of total road accidents ². The number of people killed per 10,000 vehicles in India is 80 as compared to 1 in developed countries. As described by WHO road traffic accidents are one of the major causes of disability and death all over the world and abdominal injuries are frequent causes of death ³.

Need for the study

Abdominal injuries due to road traffic accidents are of particular interest from the Forensic Medicine standpoint for several reasons. It is frequently seen, that a fatal abdominal injury is sustained even without the occurrence of visible external injury. In this study of abdominal injuries in road traffic accidents an attempt has been made to look into the various factors that leads to these accidents and suitable measures can be undertaken to prevent such road traffic accidents.

Aims and Objectives

To study the various aspects of abdominal injuries in fatal road traffic accidents

To determine age and sex incidence

To determine the common organs involved and the pattern of injuries

To study the prevalence of abdominal injuries in relation to various factors such as age, sex, epidemiological factors, socio-economic status, time of occurrence etc.

Material and Methods

Selection of cases

Material for the present study were collected from the Medico legal autopsies showing abdominal injuries carried out the mortuary of MS Ramaiah Medical College, Bangalore during the period from Jan 2003 to Dec 2003. Total numbers of cases studied were 100 and relevant statistics were drawn from these cases.

Criteria for Selection of Cases

Inclusion Criteria

All cases of abdominal injuries that have definite history of Road traffic accident.

All cases that show multiple injuries to the body along with abdominal injuries due to Road traffic accident.

Exclusion Criteria

Decomposed bodies in which organs are liquefied and bodies with no specific history were not being included in the study.

Dismantled and dismembered bodies of which the abdominal organs are missing were not included in the study.

In all cases a detailed Post Mortem Examination were carried out as mentioned in Otto Saphire.⁴

Results

Observations of 100 autopsies with evidence of abdominal injury with a known method during the period Jan 2003 to Dec 2003 were carried out and various statistical results were drawn from them.

During the study period of one year total of 600 autopsies were conducted at MS Ramaiah Medical College Bangalore, out Table No.1 Showing age wise distribution:

Age group in years	Males	Females	Total (%)
0-10	5	5	10
11-20	17	0	17
21-30	28	0	28
31-40	18	2	20
41-50	14	2	16
51-60	6	1	7
61-70	2	0	2
71-80	0	0	0
81-90	0	0	0
Total Cases	90	10	100

Table No 2 : Showing Sex Incidence:

S.l No	Sex	Number of Cases	Percentage %
1	Male	90	90
2	Female	10	10
	Total	100	100

of which 176 cases were of Road traffic accidents. Among them 100 had sustained injuries to abdomen.

Table 3. Information regarding the place and time of accident

Aspects	Category	Respondents Number	Respondents Percentage
Place of accident	highway	54	54.0
	Other ways	46	46.0
Time of accident	6-9 Am	11	11.0
	9-12 Noon	17	17.0
	12-3 Pm	16	16.0
	3-6 Pm	11	11.0
	6-9 Pm	17	17.0
	9-12 Am	19	19.0
	12-3 Am	5	5.0
	3-6 Am	4	4.0
Information-furnished by	police	95	95.0
	others	5	5.0

Table 4. Survival period and treatment

Aspects Survival period	Category	Subject Number	Subject Percentage
	Spot	66	66.0
	Less than 12 Hrs	29	29.0
	More than 12 Hrs	5	5.0
Treatment			
	Treated	16	16.0
	Untreated	84	84.0

Discussion

Abdominal injury is one of the important causes of mortality in accidents. Its incidence is fast increasing due to various factors relating to modern civilization. The fast increasing incidence can be explained by lack of proper planning and failure to develop infrastructure to cope with

Table 5. Victims vs Offending Vehicles N= 100

Offending Vehicle	Category of the Victim				Total (%)
	Two wheeler Rider/pillion	Three/Four Wheeler Occupant	Pedestrian	Bicyclist	
Jeep	6	2	2	0	10
Tempo/Van	0	2	2	2	6
Bus	10	1	10	1	22
Truck/Lorry	10	2	10	2	24
Car	10	6	1	0	17
Two wheeler	10	10	1	0	21

$$X^2_{cal}=40.97^* \quad X^2(0.05, 15df) = 25.00$$

Table 6. Visceral Injuries with various organs involved

Organ Involved	Cases (%)	Organ Involved	Cases (%)
Diaphragm	20	Spleen	40
Peritoneal Hemorrhage	54	Gall Bladder	8
Retroperitoneal Hemorrhage	23	Pancreas	7
Stomach	7	Adrenals	6
Kidney	22	Omentum	5
Small intestine	9	Urinary bladder	1
Large intestine	8	Uterus	1
Mesentery	35	Ovary	
Liver	46		

Table 9. Associated injuries in abdomen injury cases

Associated injuries	Cases (%)
Abdominal injuries	29
Abdomen + head injuries	20
Abdomen + Chest injuries	9
Abdomen + limb injuries	10
Abdomen + Injury to more Than Two Regions	32
Total number of cases	100

Table 10. Skeletal injuries

Bones involved	Cases (%)
Lumbar spine	7
Sacrum	5
Hip bone	17
Ribs	30

Table 7. Organs involved: Age wise distribution (N=100)

Organs	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	X ² Value
Diaphragm	1	3	6	4	3	3	0	0	0	4.00 ^{NS}
Peritoneal Haemorrhage	7	7	15	9	12	2	2	0	0	18.11*
Retroperitoneal Haemorrhage	2	1	7	7	4	2	0	0	0	9.09 ^{NS}
Stomach	0	2	2	2	1	0	0	0	0	2.29 ^{NS}
Kidney 2	3	5	8	3	1	0	0	0	0	8.54 ^{NS}
Small intestine	1	2	3	2	1	0	0	0	0	1.56 ^{NS}
Large intestine	1	2	2	2	1	0	0	0	0	0.75 ^{NS}
Mesentery	1	2	2	0	0	10	0	0	0	25.6 ^{NS}
Total	15	22	42	34	25	18	2	0	0	

*= significant, NS= Non significant

Table 11. Skeletal injuries: age wise distribution

Bones	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	X ² Value
Lumbar spine	1	2	2	1	1	0	0	0	0	0.86 ^{NS}
Sacrum	1	2	1	1	0	0	0	0	0	0.60 ^{NS}
Hip bone	2	3	6	4	1	1	0	0	0	6.65 ^{NS}
Ribs	0	0	5	10	10	3	2	0	0	9.67*

the hazards of modern civilization.

Incidence and Problems

Factors contributing to increased number of fatal accidents in Bangalore include multiplicity of the vehicles running on the same road, overcrowding and to large extent lack of traffic sense mainly amongst bus and truck drivers. Pedestrians crossing the roads at their own will especially at busy traffic points have also contributed to increased fatalities.

Epidemiological Factors

Age of the victim

In the present of abdominal trauma victims, it was observed that majority of the cases were in the age group of 21-30 years. Similar findings have also been reported by Srivastava⁵, NS Patel¹, Srivatsa & Gupta⁶, NK Aggarwal⁷, BR Sharma et al⁸. Large number of cases in this age group can be explained by the fact that young persons are at the peak of their creativity and have tendency to take undue risk.

Sex of the Victim

In the present series it was observed that males dominated females, similar findings have been reported by Aggarwal and Aggarwal⁹, David & Sundaram¹⁰, Srivastava⁵, NS Patel¹, KK Banerjee et al¹¹, NK Aggarwal⁷. This dominance of males is readily explainable by the fact that males are more exposed to hazards of roads as they constitute working and earning member in majority of the families.

Type of victims in vehicular accident cases

In the present series majority of the victims of vehicular accidents sustaining abdominal trauma were among two wheelers. Similar study was reported by Kaare Solheim¹², David Sundaram¹⁰, NS Patel¹, KK Banerjee et al¹¹. This steep rise in the deaths of the motorcyclists is due to an alarming rise in the population in this metropolitan area and lack of convenient public transport system in Bangalore City.

Diurnal Variation in Vehicular Accident Cases

In the present series maximum No of vehicular accidents occurred at night time between 9 PM to 12 AM accounting for 19% of the cases. Similar study was reported by NS Patel¹, NK Aggarwal⁷, Agnihotri¹³, Virendra Pal Singh et al¹⁴. The reason for this high incidence of accidents at night includes inefficient street lights, disobeying of traffic rules, drunk and driving etc followed by 6 PM to 9 PM and 9 AM to 12 PM each accounting for 17% of the cases. Similar study was reported by JI Tonge et al¹⁵, PM King¹⁶. This time period represents peak hours of traffic rush.

Survival Period

In this present study, spot death accounted for 66% of the cases. Remaining 29% of the cases survived less than 12 hrs and 5% survived more than 12 hrs. This emphasizes the fact that these victims need on the spot emergency medical care and rapid transportation from the incident site to the hospital. Study done by S Sevitt¹⁷, Srivastava⁵, NS Patel¹, Srivastava and Gupta⁶, KK Banerjee et al¹¹ tallied with the study.

Frequency of multiple intra abdominal injuries

In its present series majority of the victims had multiple intra abdominal injuries. Similar study was reported by Kaare Solheim¹², Aggarwal and Aggarwal⁹, David & Sundaram¹⁰, JI Tonge et al¹⁵, PM King¹⁶. Injuries to the Liver accounted for 46% of the cases. Similar findings were also reported by Gisane and Bull¹⁸, Sevitt¹⁷, Tonge et al¹⁵, PM King¹⁶, Srivastava⁵, KK Banerjee et al¹⁴, A Sinha et al¹⁹, JR Garrison²⁰, Kimberlay et al²¹, BBL Aggarwal²², BR Sharma⁸, Polson and Gee²³,

Gradwohl²⁴, Tedeschi²⁵, Di Maio²⁶, JK Mason²⁷. Majority of the cases had involvement of right lobe of liver at its anterior surface and showed deep lacerations. Piece meal pulpy liver was noticed in 11.36% of the cases. Injury to the spleen comprised of 40% of the cases, similar findings were reported by Gisane and Bull¹⁸, William and John²⁸, S Sevitt¹⁷, PM King¹⁶, BBL Aggarwal²², Haruf RC²⁹. In the present study majority of the spleen injuries were found associated with rib fractures which tallied with the opinion of Gordon and Shapiro³⁰.

Recommendations and Suggestions

Preventive measures of all the epidemic disease is based on the cause. Similarly for reducing fatalities among the victims of road traffic accidents, it is essential to study the cause, which revolves around the epidemiological triad i.e. Host (Driver), Agent (Vehicle), Environment (Roads).

In this study it has been observed that not only human errors but other factors were also responsible for the fatal traffic accidents, though it is very difficult task to control the human errors involved, efforts made in this direction can definitely reduce the morbidity and mortality. The following preventive aspects, if followed may help to control human errors involved in fatal road traffic accidents.

- Proper education of road users especially pedestrians regarding road crossing and use of foot paths
- Strict enforcement of traffic rules and regulations, awarding severe punishments for offenders, jay walkers and for speedy driving.
- Strict enforcement of rules during issuing of licenses to drivers and making medical examinations and fitness certificate compulsory during the renewal of driving license.
- Educate the general public to use of seat belt, management of victims of road traffic accidents in the form of good number of accident relief unit which includes ambulances and medical and paramedical personnel who are well trained if provided will be highly rewarding.
- The machines (vehicle errors) that contribute for the fatal road traffic accidents can be checked by
- Making it compulsory regarding use of devices which controls the over speeding (Speed governors) in all motor vehicles.
- Periodic checking and maintenance of vehicles in proper condition. Following preventive measures can check the environmental factors involved in fatal road traffic accidents.
- Providing proper foot paths and zebra crossings for pedestrians, road humps/ speed breakers at appropriate places where people and vehicles collect in large number.
- Proper maintenance of road with better road lightening, better traffic signal lights and batter indicators on road.
- Advertisements and movie posters distract the attention of drivers and thus it should not be displayed where vehicle traffic is more.
- Strict vigilance must be followed and proper regulations of traffic must be done during peak hours of increased pedestrian movements and excessive vehicular traffic.

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Bomb Blast Injuries-An Update for Forensic Pathologist and Clinicians

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Abstract

Bomb Blast injuries produces extensive damage to the body and are now frequently encountered because of terrorist attacks. Following article is a mere attempt to understand pattern, pathophysiology and nature of injuries suffered by different organs/organ systems so that proper diagnosis, medico legal and postmortem reports can be made to help the patient and law enforcing agencies.

Key Words

Injuries, Bomb, Explosions.

Introduction

Bomb blast injuries are commonly encountered injuries these days involving major organs of the body thereby producing life threatening injuries. No country of the world whether affluent, developed countries like U.S.A (catastrophic explosions of aircraft into 3 buildings on September 11, 2001 in New York City and Washington DC), Britain(The 2005 London subway bombings) are spared but involves developing countries especially within Southeast Asia where frequent bombings occur in Israel, Iraq and Pakistan, India involving the major tourist cities such as Bangkok (January 2007), Bali (October 2002 and October 2005), Jakarta (August 2003, September 2004) and Mumbai (26 November 2008).

Terrorist may mix the nuclear materials with the explosives known as a "dirty bomb" – a radiological dispersion device to add trouble for the emergency responders¹. With the ever increasing threat of terrorist attacks, the duty rests on medical personnel to be conversant with the types of injuries resulted from bomb blasts, especially about the injuries sustained as a result of radiation and/or chemical contamination of explosion as they causes severe threat not only to victims but also to the health care providers and their diagnostic & management challenges. These terrorist attacks poses a challenge to health care providers as well as law enforcement agencies by producing simultaneously a large number of patients thereby causing political turmoil in that country.

Classification of Explosive: ^{2, 3, 4}

1. High-order explosives (HE) produces shock or blast wave followed by negative pressure (suction) wave. The leading edge of a blast wave is known as blast front. When a blast front reaches a victim, it causes an enormous almost instantaneous rise in pressure. Both the positive overpressure and the negative under pressure are capable of causing significant primary blast injury.

2. Low-order explosives (LE) cause deadly injuries but very unlikely produce unique primary blast injuries because of slow release of energy. There is always some overlap between LE injuries & HE secondary, tertiary and quaternary mechanisms and these are produced due to ballistics (fragmentation), blast wind & thermal.

The HE "blast wave" (over-pressure component) should

be distinguished from "blast wind" (forced super-heated air flow). The latter may be encountered with both HE and LE.

Explosives are Further Classified According to their Source⁴

1. **Manufactured weapons** are quality-tested, produced in bulk, issued to military and are exclusively HE based.

2. **Improvised weapons** lack quality-testing, produced in small quantities and the devices used for it are outside its intended purpose. Such types of bombs are used by terrorists may be composed of HEs, LEs or both.

Pathophysiology

Shock wave progresses concentrically from source of explosion as a sphere of compressed and rapidly expanding gases which displaces an equal volume of air at a very high velocity causes damage to body when it travels through the tissues/hollow organs of different densities thereby producing differential pressure forces resulting in motion, stretching and ultimately leading to tearing. This distortion at tissue/tissue interfaces results in subserous/submucosal hemorrhages and also damage at gas-tissue interfaces. Low to moderate pressure shock waves passing through solid organs of homogenous densities do not cause significant effects though injuries are produced.³

Mechanism of Injuries ^{3, 4, 5}

Primary blast injuries results from the impact of the over pressurization wave with body surfaces and is characteristic of high-order explosives (HE) e.g. blast lung (pulmonary barotraumas)

Secondary blast injuries are responsible for majority of casualties and as a result of flying debris, broken glass, loose pieces and bomb fragments e.g. penetrating ballistic. Penetrating thoracic trauma, including lacerations of the heart and great vessels, is a common cause of death in secondary blast injuries.

Tertiary blast injury results from individuals being thrown by the blast wind due to high energy explosion e.g. fracture and traumatic amputation

Quaternary blast injury It includes not only all explosion related injuries, illnesses or diseases that are not due to primary, secondary, tertiary but also exacerbation or complications of existing conditions e.g. burns (flash, partial, and full thickness).

Discussion

Selected Blast Injuries

Respiratory system ^{2, 3, 6, 7, 8, 9}

- **The Blast lung (Pulmonary barotraumas)** among initial survivors is the direct consequence of the HE over-pressurization wave, includes sudden severe pulmonary contusion (causing instant fatal respiratory failure), systemic air embolism, and free radical-associated injuries such as

thrombosis, lipoxxygenation, and disseminated intravascular coagulation (DIC).

- **Symptoms** include dyspnea, cough, hemoptysis, or chest pain following blast should raise the suspicion of blast lung.
- **Signs** include **triad** of apnea, bradycardia, and hypotension may be present at the time of admission or late up to 48 hours.
- **"Butterfly"** pattern on chest X-ray is the characteristic of blast lung so a chest X-ray is always recommended for all exposed persons.
- Damage to the alveolar septae leads to alveolar rupture.
- Tearing of pulmonary tissue results in **pulmonary lacerations, haemothorax or pneumothorax** (any combination).
- Large tears of the bronchi or lungs may create **bronchopleural fistulae** with unilateral or bilateral tension **pneumothoraces**. Air escaped into pulmonary tissues results into **pseudocyst** formations known as **pneumatocoeles**.
- **ARDS** a result of direct lung injury or of shock from other body injuries and **air embolism** (air entry into the pulmonary circuit can cause an arterial air embolism with lodging of the emboli in any organ and subsequent distal ischemia) are dangerous complications making such patients a therapeutic challenge especially when implementing positive end expiratory pressure (PEEP) and intermittent positive pressure ventilation (IPPV) because in the presence of low blood pressure such ventilation modalities predispose to arterial air embolism which carries a high mortality risk.
- **Diffuse lung damage** can cause delayed effects even after two days.
- Pulmonary blast injury carries the highest mortality and morbidity and consumed the most resources in the major bombings. **Ear**^{10, 11, 12, 13}
- **Deafness** (no longer considered a strong indicator of blast injury)
- **Petechiae** of the tympanic membrane or haemotympanum.
- **Rupture/ perforation of Tympanic Membrane**

It was an old belief that otoscopic examination of the tympanic membrane is a marker to find out the hollow organs injuries in bomb blast victims because the tympanic membrane can be ruptured with the increase of as low as 5 psi above normal atmospheric pressure and the threshold for lung injury is 100 kPa (15 psi) where the tympanic membrane routinely ruptures but this is not now considered a marker as proved by the Israeli experience. Leibovici et al found 31(16%) victims out of 193 patients who sustained primary blast injuries had both ear and pulmonary injuries. 142 (74%) had only tympanic membrane perforation, 18 had pulmonary blast injury but no eardrum perforation and 2 had only intestinal blast injury as shown in table 1. ¹⁰ Same was seen in the Madrid train bombings where 4

Table 1

No. of Patients(193)	Ear injuries	Pulmonary injuries	Intestinal Injuries
31	+	+	-
142	+	-	-
18	-	+	-
2	-	-	+

out of 17 (24%) critically injured patients had intact tympanic membranes. ¹¹

Intact eardrum do not mean the absence of serious organ injury especially when the patient was wearing some type of hearing protection as is common in certain types of military or law enforcement operations.

- Fracture/ dislocation of ossicles
- Cochlear damage
- Foreign body in ear
- Bleeding from paranasal sinuses
- Long-term ENT sequelae— vertigo/ tinnitus, dizziness and ear pain

Central Nervous System^{2, 14, 15, 16, 17, 18}

Mechanism

Head injuries are due to direct or indirect impact resulting into both hidden brain damage(concussions) as well as potential neurological consequences(coup-contra coup brain injuries) and are the combination of all blast effects i.e. primary, secondary, tertiary and quaternary blast mechanisms. Primary Blast Injuries to the brain is associated with the impaired cerebral vascular function along with compensatory mechanisms for traumatic brain injury. Tissue destruction initiates the synthesis and release of hormones or mediators (reactive oxygen species such as superoxide anion radical and nitric oxide) into the blood which when delivered to the brain change its function. Irritation of the nerve endings in injured peripheral tissue and/or organs also significantly contributes to blast-induced neurotrauma. Since blast injuries are poly trauma in nature so bleeding from injured organs such as lungs or bowel causes a lack of oxygen to all vital organs including the brain. Further the damage of the lungs reduces the surface area for oxygen exchange thereby reducing the amount of the oxygen in the blood hence to the brain.

- **Symptoms:** headache, fatigue, poor concentration, lethargy, depression, anxiety, insomnia, loss of memory for events before and after explosion, impaired sense of reality and reduced decision-making ability or other constitutional symptoms. The symptoms of concussion syndrome and post traumatic stress disorder are similar.
- Unexpected brainedema and cerebral vasospasm
- Closed and open brain injury
- Intracranial, subdural and extradural haemorrhages
- Stroke
- Spinal cord injury
- Air embolism induced injury upon the cerebral circulation

Blast-induced neurotrauma (BINT) in blast victims is underestimated so valuable time is often lost for preventive therapy and/or timely rehabilitation

Eye¹⁹

Abbotts et al found a little evidence of primary ocular blast injury in survivors of explosions. The most damaging threat to the eyes from a blast is from the impact of fragments and debris. Up to 10% of all blast survivors have significant eye injuries.

- **Symptoms:** Eye pain or irritation, foreign body sensation, altered vision, periorbital swelling or contusions
- Hyphaema,
- Subconjunctival haemorrhage,
- Foreign body,
- Lid lacerations
- Retinal detachment,
- Perforations from high-velocity projectiles
- Decreased visual acuity

Thoracic Primary Blast Injury ⁴ produces a unique cardiovascular response which causes death even in the absence of any visible external physical injury. The immediate insult to cardiovascular system as a result of pulmonary blast injury is a decrease in heart rate, stroke volume, and cardiac index. The blood pressure falls within seconds as the normal reflex increase in systemic vascular resistance does not occur. If this response is not fatal, recovery usually occurs within 15 minutes to 3 hours. However even non lethal primary blast injury can impair pulmonary performance for hours to

days.

- Vasovagal hypotension.
- Shock.
- Myocardial infarction from air embolism.
- Circulatory Cardiac contusion.
- Pericardial tamponade even in the absence of penetrating trauma.
- Peripheral vascular injury.

Abdominal Injury^{2, 3, 4, 6}

Primary blast intestinal injury is common as the bowel is filled with air. Intestinal barotraumas is more common in underwater than air blast injuries since air is a poor conductor of blast-wave energy. The colon is most commonly affected though any portion of the GI tract may be injured. Abdominal injuries from explosions may be occult to both solid and hollow abdominal organs so serial examinations are often required especially in closed-space explosions and blast injuries occurring in water.

- **Symptoms:** Abdominal pain, nausea, vomiting, hematemesis, rectal pain, testicular pain, hypovolemia.
- Acute or delayed intestinal perforation/Pneumoperitoneum.
- Visceral contusion and haemorrhage.
- Mesenteric ischemia from air embolism.
- Blunt trauma to the abdomen can cause solid organ injuries like liver, renal and splenic contusion, lacerations and haemorrhage.
- Acute renal failure occurs due to rhabdomyolysis, hypotension, and hypovolemia.
- Testicular rupture
- The abdomen can easily be examined by FAST (focused abdominal sonography for trauma) or computed tomography (CT).

Limb Injury²

- Avulsion/Traumatic amputation/ fractures
- Crush injuries
- Compartment syndrome
- Burns
- Lacerations
- Acute arterial occlusion, air embolism induced injury
- Traumatic amputation of a limb above the wrist or ankle from explosion- an important marker for severe internal injuries is a bad prognostic sign. The detached parts are often become non-viable and unsuitable for re-implantation.

Pregnant patients²

The foetus does not possess gas filled structures thereby protecting from primary blast wave but the primary blast wave gets amplified threefold in an aqueous environment so there are increased chances of potential foetal injury as the amniotic fluid surrounds the foetus. Proper evaluation of pregnant woman should be done and special attention should be given to ultrasonography to rule out any uterine rupture/abruption placenta. Rhogam should also be given to Rhesus negative mothers.

Psychiatric Manifestations (Immediate or Delayed)^{2, 9}

- Anxiety
- Depression.
- Sleep disorders

Conclusions

- Make and follow hospital's and disaster system's plan if multiple casualties.
- Always expect "upside-down" triage the most severely injured arrive after the less injured.
- Double the first hour's casualties for a rough estimation of the total expected acute casualties.
- Display Communications and instructions because of tinnitus and sudden temporary or permanent deafness
- Screen the explosive area to prevent any chemical, biological and radiological (CBR) threats.
- Personal protection equipment such as masks and suits are to be provided to caregivers and rescuers.
- To look for deeply penetrating shrapnel even if minor wounds are there – extremely careful and thorough assessment of the patient is required.
- Explore and proper consultation if foreign material is encountered- foreign material may be explosive materials/ environmental hazard (dirty bomb).
- Patients should require 4-6 hours of observation.
- Increased severity but delay in arrival in bomb explosion cases in closed spaces/structural collapse.
- Radiological imaging of the head, chest and abdomen will be helpful in early identification of injuries as well as any penetration by foreign bodies.
- Primary blast lung and blast abdomen are associated with a high mortality rate. "Blast Lung" is the most common fatal injury among initial survivors and is confirmed by "butterfly" pattern on chest X-ray.
- Initially abdominal injuries are silent. • Isolated TM rupture is not a reliable marker of morbidity.

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Postmortem Study of Injury Patterns in Fatal Road Traffic Accidents in Yavatmal, Maharashtra

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Abstract

Road traffic accidents are the major causes of death worldwide and also contribute substantially to the disease burden in India. The present study was undertaken on 187 victims of road traffic accidents and an attempt is made to measure incidence of road traffic accidents in relation to age, sex, type of collision, type of offending vehicle, time and place of accident and other various epidemiological, medico-legal aspects of vehicular accidents to establish various causative factors, types and distribution of injuries in road traffic accidents by detailed examination of death victims. All the data thus collected was analyzed and presented in this paper.

Key Words

Road traffic accidents, injuries

Introduction

International Classification of Diseases defined traffic accident as "any vehicle accident occurring on the public highway, either originating on or terminating on or involving a vehicle partially on the highway"¹. WHO defined the accident as "an unexpected, unplanned occurrence that may involve injury"². According to World Health Organization's Global Burden of Disease Project for 2004, road traffic injuries will raise to become the fifth leading cause of death by 2030, resulting in an estimated 2.4 million fatalities per year. Road traffic injuries are one of the top three causes of death for people aged between 5 and 44 years. The report also revealed that more people die in road accidents in India than anywhere else in the world³. In India, at least 13 people die every hour in road accidents⁴. Risk taking behaviour of road users, vehicle characteristic, unsafe traffic environment, poor road infrastructure are the main causes for vehicular accidents. The present study aims at studying the pattern and distribution of injuries sustained by victims of road traffic accidents.

Material and Methods

This study was carried out on 187 cases of fatal road traffic accidents brought to the mortuary for autopsy in the Department of Forensic Medicine, S. V. N. Government Medical College, Yavatmal during the period from 1st October 2007 to 30th August 2009. The information regarding age, sex, residence, marital status, date and time of time of accident and death was gathered from relatives, police inquest report, dead body challan and clinical details from hospital records. During autopsy, detailed examination was carried out and data regarding both external and internal injuries was carefully recorded and analyzed.

Observations

1. Age and Sex Group The highest incidence was seen in age group of 21-30 years comprising 28.34% cases. Age groups least affected was 0-10 years (2.13%). Males

comprised a majority and constituted 83.42% with male to female ratio as 5.03:1.

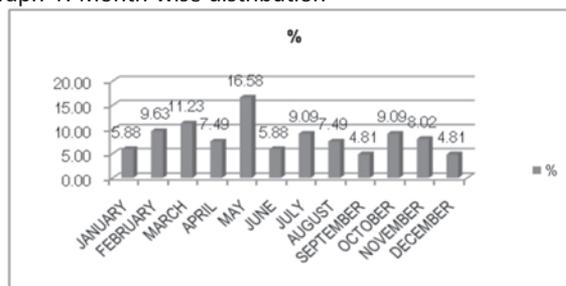
Table 1: Age and sex distribution

Age in yrs	Males (%)	Females (%)	Total (%)	sex ratio
0-10	3	1	4 (2.13)	3:1
11-20	12	4	16 (8.55)	3:1
21-30	48	5	53 (28.34)	9.6:1
31-40	38	9	47 (25.13)	4.22:1
41-50	33	5	38 (20.32)	6.6:1
51-60	15	2	17 (9.09)	7.5:1
61-70	5	2	7 (3.74)	2.5:1
> 70	2	3	5 (2.67)	0.67:1
TOTAL	156(83.42)	31(16.58)	187(100)	5.03:1

1. Month of the Accident

The maximum number of cases occurred in the month of May (16.58%), followed by March (11.23%) and the least in December (4.81%). Combining the above data, maximum cases occurred in summer season (February- May) comprising 44.92% cases and the least in rainy season (21.93%).

Graph 1: Month-wise distribution



1. Time of the Accident

In the present study, most of the incidents occurred between 1200 to 1800 hours, comprising 37.43% of total cases, followed by time interval 6000 to 1200 hours (26.20%). The least number of cases (10.70%) occurred between 0000 to 6000 hours in the morning.

Table 2: Time of Accident

Time of Accident in Hours	Number of Cases	Percentage
00-06	20	10.70
06-12	49	26.20
12-18	70	37.43
18-24	48	25.67
TOTAL	187	100

1. Survival Period and Place of Death

The maximum number of victims (39.57%) died while on the way to hospital, followed by victims died in the hospital (34.76%). The number of victims who died on the spot was 25.67%.

Table 3. Place of Death

Place of Death	Number of Cases	Percentage
Spot Death	48	25.67
On the way to Hospital	74	39.57
In the Hospital	65	34.76
Total	187	100

1. Profile of the Victim

The motor-cyclists were the commonest group of victims, comprising 69(36.90%) cases, out of which 59 were drivers, followed by Light Motor Vehicle users comprising 46 (24.60%) cases of which 43 were occupants. Pedestrians constituted 32 (17.11%) of the cases. Overall, occupants of the vehicles (81) outnumbered the drivers (74).

Table 4: Profile of Victim

TYPE OF VICTIM	DRIVERS	OCCUPANT	TOTAL	PERCENTAGE
PEDESTRIANS	NA	NA	32	17.11
MOTOR-CYCLISTS	59	10	69	36.90
CYCLISTS	6	3	9	4.81
LMV	3	43	46	24.60
HMV	5	12	17	9.09
THREE WHEELER	1	13	14	7.49
TOTAL	74	81	187	100

*LMV : Light Motor Vehicle, *HMV- Heavy Motor Vehicle, NA- Not Applicable.

1. Offending Vehicle

In present study, truck was the commonest offending vehicle being involved in 64 (59.81%) cases, followed by Light Motor Vehicle (15.89%) and buses (9.35%).

2. Cause of Death

The head injury was the commonest cause of death comprising 39.57% cases. In drivers, head injury was the commonest cause of death observed in 42 cases. In occupants of the vehicles, injury to vital organs was the commonest cause of death seen in 33 cases. In pedestrians, shock and hemorrhage was predominant cause of death seen in 12 cases.

3. Site of Injury

Extremities suffered maximum injuries (32.64%), followed by Head, neck and face region (30.93%). Least numbers of injuries were observed on spine (1.33%). Pedestrians, two wheeler and three wheeler users sustained maximum injuries on extremities, followed by on head, neck and face. Four wheeler users had

Table 5. Site of injury

Site of injury	Percentage
Extremities	32.64
Head, Neck, face	30.93
Thorax	17.08
Abdomen	12.33
Pelvis	5.69
Spine	1.33
Total	100

maximum injuries on head, neck and face region, followed by on extremities.

1. Head Injury

The scalp injury in the form of contusions, lacerations, under-scalp haematoma, etc. was the commonest type of injury seen in 129 of the total cases, followed by intracranial haemorrhages comprising 113 of the total cases and skull fractures (95). Injury to brain was observed in 51 of the total cases. Linear fracture of skull was the commonest type seen in 41.05% of the total cases. Least common was the depressed fracture, observed in 14.74% of the total 95 cases. Skull vault fracture was seen in 80 cases. Temporo-parietal region was involved most commonly in 16 (20%) cases, followed by fronto-parieto-temporal region

(17.50%). Parietal bone was the most commonly fractured bone of vault of skull, comprising of 13.75% of total skull vault fractures. The base of skull had maximum fractures at anterior and middle cranial fossae (31.25%), followed by middle cranial fossa (29.17%) and least number at posterior cranial fossa (4.17%).

A combination of subdural haemorrhage with subarachnoid haemorrhage was most commonly observed in 70 (61.95%) of the total cases of intracranial haemorrhages, followed by combination of extradural, subdural and subarachnoid haemorrhage (20.35%). Subdural haemorrhage was the commonest single haemorrhage observed in 6.19% of the total intracranial haemorrhages.

2. Chest Injuries

Rib fracture with lung injury was seen in 66.04% cases of intrathoracic injuries, followed by injuries to lungs without fracture of ribs (12.26%). Injury to heart was associated with fracture of corresponding ribs in 8.49% cases and in 1.89% cases there was injury to heart without corresponding rib fracture. Injury to heart was commonly seen in drivers (5/11), while rib fracture with lung injury was common in occupants (42/70).

3. Abdominal Injuries

Liver was the most commonly injured abdominal organ seen in 28.17% cases and kidney was least commonly involved (4.23%). Maximum number of abdominal injuries was seen in occupants (40/71) and least was in pedestrians (10/71).

Discussion

In this study, Males clearly outnumbered females with male to female ratio as 5.03:1. This is in accordance with the studies by Arvind Kumar et al (2008)⁵ and Y N Singh et al (2005)⁶.

In the age group analysis of the victims, maximum incidence was in age group of 21-30 years and least in group 0-10 years. Similar findings were observed by B H Tirpude et-al (1998)⁷, Harnam Singh et al (2004)⁸, B R Sharma et al (2007)⁹ and Arvind Kumar et al (2008)⁵.

Maximum cases occurred in the summer which is consistent with study by Gautam Biswas et al (2003)¹⁰ and report by National Crime Bureau (2007)⁴.

The maximum numbers of accidents were reported between 1200 to 1800 hours, comprising 37.43% cases, followed by time interval 6000 to 1200 hours (26.20%). The similar trends are seen by Anand Menon et al (2006)¹¹ and Sangeet Dhillon et al (2007)¹².

The maximum number of victims (39.57%) died while on the way to hospital, followed by victims died in the hospital (34.76%) and victims died on spot (25.67%). The present study is consistent with the studies by Akhilesh Pathak et al (2006)¹³ and B. R. Sharma et al (2007)⁹.

The motor-cyclists were the commonest group of victims, comprising 36.90% cases, followed by Light Motor Vehicle users comprising 24.60% cases. Pedestrians constituted 17.11% of the cases. Similar trends were seen by Akhilesh Pathak et al (2008)¹³.

Trucks were the commonest offending vehicle being involved in 59.81% cases, followed by Light Motor Vehicle (15.89%) and buses (9.35%). Similar trends were seen by J Chandra et al (1979)¹⁴, Gautam Biswas et al (2003)¹⁰, B H Tirpude et al (1998)⁷, B R Sharma et al (2007)⁹, Harnam Singh et al (2004)⁸ and Rakhi Dhandona et al (2004)¹⁵.

In present study, the head injury was the commonest cause of death comprising 74 (39.57%) cases, followed by

injury to vital organs observed in 55 (29.41%) cases. J. Chandra et al (1979)¹⁴, and Arvind kumar et al (2008)⁵ in their study found similar trends.

Extremities suffered maximum injuries (32.64%), followed by head, neck and face region (30.93%) and thorax (17.08%). Least numbers of injuries were observed on spine (1.33%). Sangeet Dhillon et al (2007)¹² and Harnam Singh et al (2004)⁸ revealed the similar findings.

Scalp injury was the commonest type of injury seen in 129 of the total 138 cases of head injuries, followed by intracranial haemorrhages (113) and skull fractures (95). Injury to brain was observed in 51 cases. The findings correlate with studies by Akhilesh Pathak et al (2008)¹³ and Sangeet Dhillon et al (2007)¹².

In present study, linear fracture of skull was the commonest. Parietal bone was the most commonly fractured bone of vault of skull. The base of skull had maximum fractures at anterior and middle cranial fossae and least number at posterior cranial fossa (4.17%). Anand Menon et al (2005)¹¹, Akhilesh Pathak et al (2008)¹³ and Abhishek Yadav et al (2008)¹⁶ found the similar findings.

Subdural haemorrhage was the commonest single haemorrhage observed in 6.19% of the total intracranial haemorrhages. The similar trends was seen by Dr. Harnam Singh et al (2004)⁸ and Anand Menon et al (2006)¹¹.

In chest trauma injury to heart was commonly seen in drivers, while rib fracture with lung injury was common in occupants. J. Chandra et al (1979)¹⁴ revealed similar findings.

In abdominal injuries, liver was the most commonly injured abdominal organ seen in 28.17% cases and kidney was least commonly involved (4.23%). Maximum number of abdominal injuries was seen in occupants (40/71) and least in pedestrians (10/71). Similar trends were seen by J. Chandra et al (1979)¹⁴, Dr. A. L. Ghangle and Dr. L. K. Bade (2001)¹⁷ and Chaudhari B L et al (2005)¹⁸.

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A Study on Pattern of Injuries in Railway Deaths

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Abstract

This study was carried out on 97 railway related deaths in order to determine the specific pattern and distribution of wounds. Of the 97 victims, 90 (92.7%) were males and 07 (7.3%) were females. The majority were in the age group of 21-30 years. Most of the victims died as the result of an accident 67 (69%) and 30 (31%) suicide cases reported. 9 victims (9.2%) showed elevated blood alcohol levels on chemical analysis. In 97 railway deaths, 80 (82.4%) victims were Hindu by religion and 17 (17.5%) Muslims. Out of 97 deaths 79 (81.44%) victims were married and 18 (18.5%) victims unmarried. Decapitation and hemi section of the body at the level of thorax were more common in suicidal deaths. Head injury accounted more in accidental deaths.

Key Words

Railway, Suicide, Accident, Injuries

Introduction

In India, railway related deaths are quite common. India has one of the largest railway networks in the world and accidents are not unexpected. 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 inevitable⁽¹⁾. In the absence of a case history, it is difficult to distinguish between death due to crossing a track, suicide, or criminal violence.⁽²⁾ Death associated with railways mostly occurs when a person attempts to cross the track or uses the track as a convenient route for walking. 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⁽³⁾. Trauma related to railway accident victims is usually severe, instantly fatal and extremely mutilating. 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⁽⁴⁾. The present study has been carried out to establish the incidence, pattern and manner in cases of railway related death.

Material and Methods

All the victims who succumb to railway deaths were subjected to post mortem examination in the mortuary Govt general hospital, Gulbarga. In 2732 autopsies performed during a five-year period from January 2005 to December 2009, 97 cases (3.55%) were related to railway deaths. Each death was evaluated and information regarding the age and sex of the victim, pattern of injuries and manner of death was collected from the police records, post mortem reports and case diaries. All data was collected analysed and findings were tabulated. Cases where a train was not involved in the causing death, victims found dead in the railway premises due to natural cause without any external injuries over the body and bodies brought by railway police in advanced stage of putrefaction were excluded from the study.

Results

During the five-year period from Jan 2005- Dec 2009, among

2732 post-mortem cases which came to the mortuary included 97 victims of railway related death.

The overwhelming majority of victims were male 92(92.7%) and 07(7.3%) were female, giving a male to female ratio of 13:1. Most of them were in the age group 21-30 years (Figure 1). The ages of the victims ranged from 13 to 76 years. Most of the deaths 67 (69%) were accidental in nature. 25 out of 30 suicide cases showed decapitation (83.3%) and 5 cases showed hemi section of the body at the level of thorax (16.7%). 9 victims (9.2%) showed elevated blood alcohol levels on chemical analysis and all victims were found to be males. In 67 cases (69%) of accidental deaths which involved multiple injuries splitting the body into several pieces that are soiled by axle grease and dirt from the wheels and tracks (see photograph). Among 97 victims 79(81.4%) were married and 18(18.5%) unmarried. Total number of Hindu victims included 80(82.4%) and Muslims 17(17.5%).

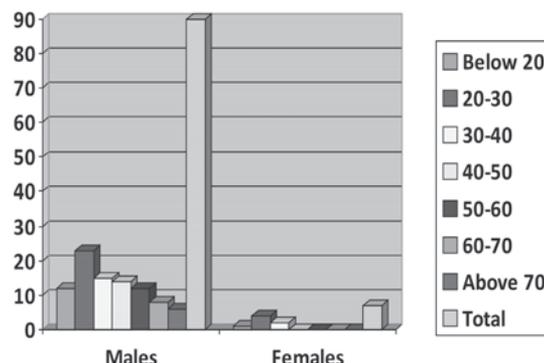
Discussion

Deaths have occurred in association with railways since the inception of the railway industry.⁽⁵⁾ Trains are one of the important modes of transport in our country and have become part of the day-today life of the people.

In the present study, males are the commonest victims of railway related death which is in accordance with the study conducted by other authors.^(2,4,5,6,7,8) Males being the working group prefer railways as the cheap, quick and comfortable mode of transport for travelling from one place to another and are therefore more vulnerable than females. (Table No 1 and Figure No 1).

In our study, the age group most commonly associated Table No 1 and Figure No 1

Age in years	Males	Females
Below 20	12	01
20-30	23	04
30-40	15	02
40-50	14	00
50-60	12	00
60-70	08	00
Above 70	06	00
Total	90	07



with railway related death was between 21-30 years and significantly less in the extreme ages. This age group is more vulnerable, as it is the age for marriage and settlement. 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. ^(2, 6, 9) (Table 1 and Figure1).

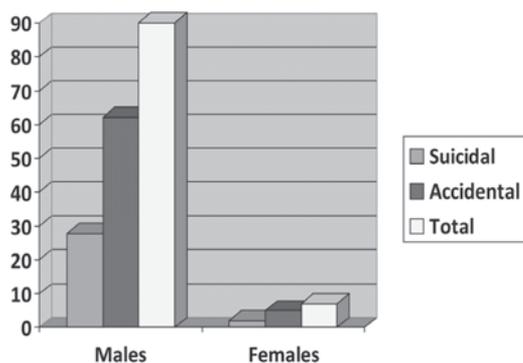
The conclusions regarding the manner of death are based upon the history given by the police, the crime scene investigation and autopsy findings. Accidental deaths outnumbered suicides (Table and Figure no 2). Our findings were similar to the study conducted in Cape Town, South Africa ⁽²⁾, in Jefferson County, Alabama ⁽⁵⁾, and in Charleston ⁽⁶⁾. In spite of various measures taken by the railway department to reduce the railway related deaths like displaying signboards, 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 comply with. Victims when under the influence of alcohol lack self control and capacity to judge, are either unaware of the upcoming train or unable to judge on which track train is moving sustain fatal trauma ⁽¹¹⁾. Many suffer fatal injuries trying to board or while alighting from a moving train resulting in heart rendering scenes. The present study also demonstrates people showing disregard for their personal safety.

While some are caught accidentally, many of the victims with a strong intent and firm mind to end their life lie down

Table 2.

Manner of death	Males	Females
Suicidal	28	02
Accidental	62	05
Total	90	07

Figure 2.



on the railway track committing suicide. Suicidal deaths due to train run over are common in males as they prefer one of the hard methods of committing suicide than females thus exhibiting a greater degree of auto aggressive and self destructive behaviour. Suicidal injuries are extensive due to primary impact. If the person lie down on the railway tracks there may be decapitation, extrusion of organs, amputation of trunk. ⁽¹¹⁾ Amongst 30 suicide cases, 25 had a decapitation and remaining had hemi section of the body at the level of thorax with or without other injuries.

In the railway accidents, most of the victims had fatal injuries over the head which correlates with the findings of other authors. ^(2,8,10) In many cases, fatal injuries mutilated the body and involved more than one body region which is in accordance with Cina et al ⁽⁶⁾ who conducted retrospective analysis of 25 consecutive train/pedestrian fatalities found the cause of death was massive blunt trauma in 88% of cases. This is explained by the fact that an enormous amount of kinetic energy is transferred to the body when a train strikes.

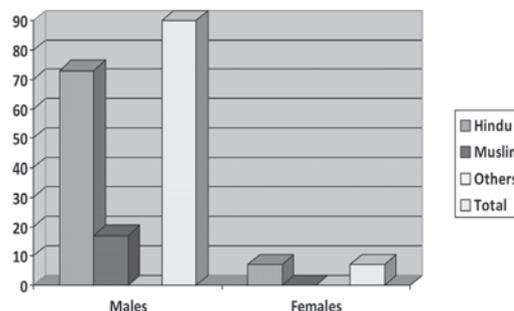
In our study most of the victims who succumbed to death due to railway injuries belong to Hindus followed by Muslims (Table and Fig no 3). This can be explained by higher density of Hindu population in the study region than other

communities.

Majority of the railway deaths in our study were seen in married male individuals who earn bread and butter for their

Table 3 and Figure 3

Religion	Males	Females
Hindu	73	07
Muslim	17	00
Others	00	00
Total	90	07



families.

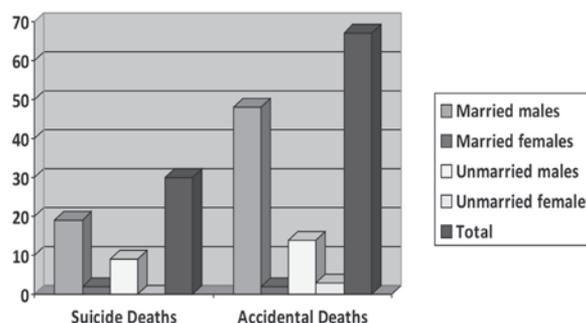
As most of the married males are employed, travelling from one place to another may end up being victims of railway accidents by neglecting the safety norms as mentioned by railway authorities. (Table and Figure No 4)

Definite conclusion concerning the time of suicide and accidents cannot be drawn from our material which is rather consistently distributed without showing any well

Table 4.

Suicide Deaths	Accidental	Deaths
Married males	19	48
Married females	02	02
Unmarried males	09	14
Unmarried females	00	03
Total	30	67

Figure 4.



Defined Cluster

In the present study suicidal deaths are more among married individuals (Table and Figure no 4) emphasizing the role of post



Photograph showing mutilation of the body with extrusion of abdominal viscera's upon impact of high velocity train and skin of lower limbs stained with grease and dirt from track and wheels of train.

marital stress, familial conflicts, impaired social harmony and broken home causing depression and compelling one to end his life.

Conclusion

It can be concluded from the present study that accidental railway deaths in future can be reduced by implementing safety measures such as improved integrated surveillance system and safety engineering techniques, reduced public access to railway tracks by strict vigil, security measures, and better law enforcement at stations. Greater public awareness needs to be created by educating the public about the dangers of railway trespassing. These measures, together with improved railway design may help to reduce the fatalities and financial loss incurred by the Railway department.

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Lip Prints-Effective Tool of Identification and Sex Determination

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Abstract

External surface of the lip has many elevations and depressions forming a characteristic pattern called lip prints, examination of which is referred to as cheiloscropy. This is unique for individuals like the finger prints. The use of lip prints in criminal cases is limited because the credibility of lip prints has not been firmly established in our courts. Present study carried out in M.R. Medical College, Gulbarga includes 66 Males and 58 Females and the materials used are lip stick, bond paper, cellophane tape, magnifying lens. Study is mainly focused on highlighting the unique nature of lip prints useful in personal identification and to find out the most common lip print patterns in study population.

Key Words

Identification, cheiloscropy, sex determination

Introduction

Human identification is a mainstay of civilization, and the identification of unknown individuals has always been of paramount importance to society. [1] By classifying the individuals into groups (e.g. age, sex, race, height), the identification possibilities are narrowed.

The concept of "identity" is a set of physical characteristics, functional or psychic, normal or pathological that define an individual. Identification of humans is a prerequisite for personal, social and legal reasons. [2] Traditional methods of personal identification include anthropometry, dactylography, DNA finger typing, sex determination, post-mortem reports, and differentiation by blood groups etc... Of which Fingerprints and dental record comparison are the most commonly used scientific methods of forensic identification. [2]

Impressions and grooves on labial mucosa called sulci laborum forms characteristic pattern called lip prints and the study of which is referred to as cheiloscropy.

Furrows on the red part of the human lips was first noted and described by anthropologist R.S. Fischer, in 1902. However the practical application of lip prints in the identification was done in the period 1968 to 1971 by Y.T Suchihashi and T. Suzuki. They examined 1364 persons at the department of forensic odontology at Tokyo University and established that lip prints are individual and unique for human being. Lip prints are usually seen in the crime scene and their characteristic pattern helps to trace the involved criminals.

Lip prints were classified using the classification proposed by Suzuki K. and Tsuchihashi Y. in 1970 also known as Tsuchihashi's classification. They classified the natural lip marks/fissures in four types as follows [3]

Type I: Vertical, comprising of complete (end to end) longitudinal fissures/patterns.

Type I': Incomplete longitudinal fissures

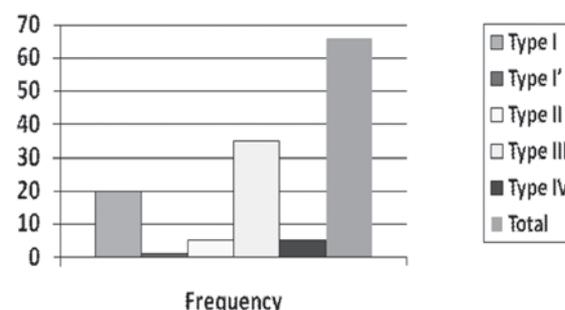
Type II: Branching Y shaped pattern.

Type III: Criss-cross pattern

Type IV: Reticular pattern.

Table 1. Frequency of Lip print pattern in males

Type of Lip Print pattern	Frequency	Percentage
Type I	20	30.30%
Type I'	01	1.52%
Type II	05	7.58%
Type III	35	53.03%
Type IV	05	7.57%
Total	66	100%



Material and Methods

This study was carried out in the Department of Forensic Medicine and Toxicology MPMC, Gulbarga. All the participants were explained about the purpose and procedure of the study. Written informed consent was obtained from each of the participant. Study includes 124 subjects of which 66 are males and 58 females, between the age group of 18-22 years. Individuals without any lesion, whether active or passive on the lips were included in the study. Individuals with known hypersensitivity to lipsticks were excluded from the study. Lipstick was applied evenly on the vermilion border. The subject was then asked to rub both the lips to spread the applied lipstick evenly. The set of lip-imprints were then obtained on a simple bond paper and they were coded based on the name and the sex of the individuals.

For classification of lip print patterns the middle (10mm wide) segment of lower lip is taken as study area as proposed by shivapathasundaram [4] as this part is almost always preserved in any trace. We labeled a particular pattern on the basis of numerical superiority of types of lines present, that is, vertical, intersected, branched or reticular. If more than one pattern predominates it is typed as undetermined.

Table No 3 : Frequency of Lip print pattern in both sex:

Type of Lip Print pattern	Frequency		Total	Percentage
	Males	Females		
Type I	20(16.13%)	27(21.77%)	47	37.90%
Type I'	01(0.81%)	03(2.41%)	04	3.23%
Type II	05(4.03%)	04(3.23%)	09	7.26%
Type III	35(28.23%)	19(15.32%)	54	43.55%
Type IV	05(4.03%)	05(4.03%)	10	8.06%
Total	66(53.23%)	58(46.77%)	124	100%

Results

After interpretation of lip-print patterns, as per Vahanwala-Parekh, [5] sex determination was correctly diagnosed in 66 males and 58 females. The most predominant pattern in the entire study population considering middle segment of lower lip was

Type III (43.55%). This was followed, in order, by Type I (37.90%), Type IV (8.06%), Type II (7.26%), type I' (3.23%). In males, Type III (53.03%) lip pattern was predominantly reported whereas Type I (46.55%) lip pattern was commonly found in females.

Discussion

Lip prints act as a potential technique of identification as they are unique^[4] and do not change during the life of a person. It has been verified that lip prints recover after undergoing alterations like minor trauma, inflammation^[3] and diseases like herpes. The form of the furrows does not vary with environmental factors. It has also been suggested that variations in patterns among males and females could help in sex determination.^[5]

Vahanwala^[5] et al in their study noted type I and type I' are predominant in females which is in accordance with our study results. His study noted Type II, III predominant in males but in our study type III followed by type I was predominant in males.

Shivapathasundaram^[4] in his study concluded that type I and type I' are predominant in females which is consistent with our study results but in contrast the predominant pattern in males was Type IV.

In general, because the lip print is on the zone of transition of the lips, which are extremely mobile, it might differ in appearance according to the pressure, direction and method used while taking the impression, frequently being mistaken for another person. Therefore, the classification of the lip-prints is valuable in reducing the number of items to be compared, and the discernment of identity should be made, as in the case of fingerprints, by finding characteristic points to establish the diagnosis.^[3] Lip print identification methodology, although seldom used, is very similar to finger print comparison.^[6]

Recent studies^{[7],[8]} also point to other possibilities namely, DNA detection in latent lip-prints, where some researchers are trying to relate characteristic lip patterns with a person's gender.^[9] One must also consider the possibility of from cadavers with various causes of death. Utsuno et al.^[10] studied post-mortem changes of lip prints these and concluded that satisfactory identification could be achieved in the cadavers. The main feature for dental identification is the existence of ante-mortem data^{[11],[12],[13]} which cannot be expected in cheiloscopy. Therefore, the only use of cheiloscopy will be to relate lip prints to the lips that produced them.

At the crime scene evidences such as photographs, cigarette butts, drinking glasses, cups, letters, window panes and other items that could bear lip prints should be closely examined. Such a lip print trace can be used for the reconstruction of the events and identifying suspects. These lip prints are characterized by their permanence and hence referred to as persistent lip prints. Even though they are invisible, they can be lifted using substances such as Aluminum powder, Magnetic powder. The edges of the lip has sebaceous glands admixed with sweat glands, thus the secretions of oil and moisture from these enable the development of latent lip prints analogous to latent finger prints.

Although lip prints have previously been used in a court of law, its use is not thoroughly established. The FBI has used this

kind of evidence only in a single case in which lip prints were traced from underclothing in order to obtain a positive identification.

Conclusion

This study along with several other studies proves the uniqueness of lip prints beyond doubt. For the establishment of technique, lip print patterns in the identification of an individual, further studies with larger sample size is required. In order to prove the evidential value of lip prints in the court of law, a standard and uniform procedure has to be developed for the careful collection, development, recording of lip prints and the ensuing comparison.

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A Study of Neck Structures in Fatal Neck Compression

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Abstract

Major proportion of unnatural deaths resulting from asphyxia is due to fatal neck compression. Pressure on the neck may arise from hanging, manual strangulation, ligature strangulation and other means of strangulation such as direct blows, arm locks and a variety of accidental lesions including entanglement of the umbilical cord around neck.

Fracture of hyoid bone and laryngeal cartilages is of practical interest to forensic pathologist as it forms one of the most valuable autopsy finding in deaths due to fatal neck compression. It has a great diagnostic criterion as the gross autopsy findings and radiological findings can be correlated to mechanical injury to neck. Only skillful dissection, radiography of neck structures and appropriate interpretation of findings will serve the purpose. Absence of proper skills and techniques shall lead to post mortem artifacts.

There are lot of discrepancies among various authors regarding incidence of fracture hyoid bone and laryngeal cartilages in various forms of neck compression. Here is a study conducted in the department of Forensic Medicine MRMC, Gulbarga on neck structure specimens sent from various hospitals and primary health centers across the district focused primarily on determining incidence of fracture neck structures and its interpretation in deaths due to fatal neck compression. We studied 75 neck structure specimens over the period of three years which included 49 cases of hanging, 16 cases of ligature strangulation, 07 cases of throttling and 03 cases due to other causes of neck compression. Specimens subjected to radiography prior to dissection and findings were appropriately tabulated. Nature of fracture is determined by histopathological examination at the fracture site.

Key Words

Hanging, Strangulation, Fracture, Hyoid bone, Throttling

Introduction

Major proportion of unnatural deaths resulting from asphyxia is due to fatal neck compression. Most often neck compression results from hanging, strangulation [ligature and manual], assault and less commonly from industrial trauma, traffic accident and fall from height.

Neck structures of forensic importance in cases of fatal neck compression mainly includes Hyoid bone and laryngeal cartilages [Thyroid and Cricoid cartilage]. Fracture hyoid bone / laryngeal cartilages forms one of the most valuable autopsy finding in deaths due to fatal neck compression and serves as a great diagnostic criterion when the gross autopsy findings and radiological findings are correlated to mechanical injury of neck.

This study is focused on finding out incidence of fracture neck structures and its interpretation in deaths due to fatal neck compression.

Material and Methods

Excised neck structure specimens sent by medical officers of Gulbarga and Bidar districts to the Department of Forensic Medicine and Toxicology MRMC, Gulbarga, Karnataka, for expert opinion regarding suspected hyoid bone and laryngeal cartilages fracture in cases of death due to fatal neck compression, through the concerned police officials from January 2007- December 2009.

Excised neck structure specimens were subjected to radiography prior to dissection for determining ossification status of hyoid bone and any evidence of fracture. Ante mortem/postmortem nature of fracture was determined by histopathological examination of the fracture site.

Study excludes neck structure specimen in which both hyoid

Table 1.

Year	Hyoid Bone Fractures			Thyroid Cartilage Fractures		
	Present	Absent	Total	Present	Absent	Total
2007	05	20	25	02	23	25
2008	07	22	29	01	28	29
2009	04	17	21	00	21	21
Total	16	59	75	03	72	75

Table 2. Sex Incidence:

Sex	Hyoid Bone Fractures			Thyroid Cartilage Fractures		
	Present	Absent	Total	Present	Absent	Total
Male	12	25	37	02	35	37
Female	04	34	38	01	37	38
Total	16	59	75	03	72	75

Table 3. Age Incidence

Age in Years	Hyoid Bone Fractures			Thyroid Cartilage Fractures		
	Present	Absent	Total	Present	Absent	Total
<20	03	04	07	00	07	07
20-40	04	50	54	01	53	54
>40	09	05	14	02	12	14
Total	16	59	75	03	72	75

Table 4. Distribution of cases

Type of Neck Compression	Hyoid Bone Fractures			Thyroid cartilage Fractures		
	Present	Absent	Total	Present	Absent	Total
Hanging	07	42	49	00	49	49
Lig. Strangulation	03	13	16	03	13	16
Throttling	05	02	07	00	07	07
Others	01	02	03	00	03	03
Total	16	59	75	03	72	75

Table 5. Hyoid Bone fractures

Age in Years	Ante mortem		Post mortem		Total
	Number	%	Number	%	
<20	00	0.0%	02	100%	02
20-40	01	25%	04	80%	05
>40	03	33.3%	06	66.6%	09
Total	04	25%	12	75%	16

Table No 6 : Hyoid Bone fractures

Sex	Ante mortem		Post mortem		Total
	Number	%	Number	%	
Males	04	33.3%	08	66.6%	12
Females	00	0.00	04	100%	04
Total	04	25.0%	12	75%	16

Table No 7 : Thyroid cartilage fractures

Age in Years	Ante mortem		Post mortem		Total
	Number	%	Number	%	
<20	00	0.0%	00	0.0%	00
20-40	00	0.0%	01	100%	01
>40	00	0.0%	02	100%	02
Total	00	0.0%	03	100%	03

Table No 8: Thyroid cartilage fractures

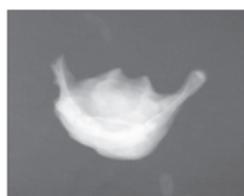
Sex	Ante Mortem		Post Mortem		Total
	Number	%	Number	%	
Males	00	0.0%	02	100%	02
Females	00	0.00	01	100%	01
Total	00	0.0%	03	100%	03



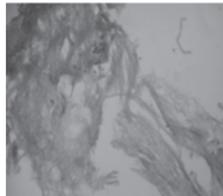
Hyoid bone showing inward compression of outer one – third of right greater horn



Section Showing RBC Extravasations at the Fracture site



Section Showing Fracture Site is Devoid of RBC Extravasations.



Hyoid bone showing clear cut incision of outer one – third of right greater horn.

bone and laryngeal cartilages were missing and those neck structure specimens not accompanied by postmortem report / inquest report.

Findings

Discussion

In our study there was no sex predominance in the victims of fatal neck compression and is consistent with study of Balabantaray et al¹. While Sarangi M.P et al² and Sengupta BK³ et al in their study noted predominance in male victims (75%) when compared to females (25%).

In the present study majority 54 (72%) of victims were aged between 20-40 yrs with youngest 16 yrs and eldest 74 yrs and this is supported by studies of Dixit P.G. et al⁴, Sengupta BK³ et al and Luke et al⁵ who also uphold the same. Ibrahim Uzun MD⁶ in their retrospective analysis of 761 autopsy cases noted that most cases were in the age group of 20–29 years (226 cases, 25.69%) with youngest case of 10 years and the oldest on 83 years which is consistent with our study results.

In our study of 75 cases of fatal neck compression 16 fractures of hyoid bone were noted in which hanging alone accounted for 07(43.75%) of cases followed by Throttling 05(31.25%), Ligature strangulation 03(18.75%) and other causes 01(6.25%). Present study records' hanging as the most common

cause of Hyoid bone fractures in cases of fatal neck compression and is in accordance with studies conducted by Dixit et al, B.R.Sharma et al⁷.

Given study records out of 75 cases of fatal neck compression 16(21.33%) fractures of hyoid bone were noted, in contrast Betz & Eisenmenger⁸, Davison⁹ observed (73%) and 46.8% Hyoid bone fractures in their study respectively. This is explained by the fact that majority (68%) of victims in our study were aged less than 40yrs and hyoid bone being cartilaginous is less likely to get fractured in this age group and many medical officers often misinterpret the natural mobility of greater cornua of Hyoid bone as fracture before forwarding specimen for medicolegal examination.

As per this study, manual strangulation records 05(31.25%) of Hyoid bone fractures. In conjunction with our study Luke¹⁰ (1967) noted 38% of Hyoid bone fracture in his study of 7 cases of manual strangulation.

In the present study 16 fractures of hyoid bone were recorded, 12(75%) in males and 04 (25%) in females. Among males 04 (25%) are antemortem in nature and 08 (75%) postmortem in nature but in females all 04 fractures noted are post mortem in nature.

In the present study 16 fractures of hyoid bone were recorded, 09(56.25%) in victims aged above 40 years followed by victims of 20-40 age group 04 (25%) and below 20 years 03(18.75%). Among victims over 40 years 03 (33.3%) are antemortem in nature and 06 (66.6%) postmortem in nature. only 01(25%) antemortem fracture is noted in victims between 20-40 years and rest were post mortem fractures. In contrast to the present study Ibrahim Uzun MD⁶ in their retrospective analysis of 761 autopsy cases noted that most cases hyoid bone fracture were in the age group of 20–29 years (25.69%).

In the present study 03 fractures of thyroid cartilage were recorded, 02(66.6%) in males and 01 (33.3%) in females. 01 (33.3%) antemortem fracture was noted in males and rest 03 (66.6%) fractures are post mortem in nature. Majority of fractures 02(66.6%) were noted in victims aged more than 40 years and one was noted in victim aged between 20-40 years. All the three fractures were noted in cases of throttling.

Conclusions

- Hyoid bone is not generally ossified below 40yrs of age, its greater horns are pliable and mobile, and this mobility should not be confused for fracture.
- Skillful techniques should be adopted for dissecting the neck structures thus avoiding postmortem artifacts.
- Best results come from best a sample, which includes proper dissection, preservation and forwarding.

Acknowledgements

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Interest of Conflict

- To reduce the incidence of post mortem fractures, training of medical officers in skillful dissection, removal, preservation and transportation of neck structure is essential.
- Fracture Hyoid bone and laryngeal cartilage is corroborative evidence in cases of fatal neck compression, examination can serve its purpose only when radiological, histopathological findings can be correlated to gross autopsy findings.

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Body Donation - A Noble Deed for a Noble Cause

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Abstract

Body donation is the donation of the whole body after death for medical education and research. Donation is made by a person in charge of the dead body to medical college. Such donated bodies remain a principal teaching tool for anatomists and medical educators teaching gross anatomy. The Anatomy Act provides for the supply of unclaimed bodies to teaching institutions for the purpose of anatomical dissection and other similar purposes. In this article, historical aspects of body donation, importance of body donation, conditions in which body donation is not accepted, places where one can donate the body, types of body donation, donor's attitudes and steps to promote the body donation etc are discussed. This article also discusses newer things beyond anatomy dissection for which such donated bodies can be utilized.

Key Words

Body donation, medical education, medical research

Introduction

Medical education begins with study of human anatomy by cadaveric dissection. A sound knowledge of anatomy is an essential part of the education of health care professionals. Learning anatomy without hands-on training of dissection on human cadaver is never considered perfect. Research in medical field and the study of the human body by medical students is mainly based on cadaver dissection. With increase in the number of medical colleges in the country, there is ever increasing demand of cadavers for anatomy dissection¹. The terms Body Donation or Body bequeathal are commonly used and synonymous. Body donation is defined as the act of giving one's body after death for medical research and education. It fits well with our philosophy of transmigration of soul. Any donation fulfills our sense of charity. It gives a feeling of accomplishing a noble deed for a noble cause and a sense of satisfaction that one is rendering service even after death.

Historical Aspects of Body Donation

The first instance of body donation was that of Rishi Dadhichi. He had complete control over his emotions. He never got angry, was free from *ahankaar*, never cursed anyone. He donated his living body (during his life time) to Devraj Indra, for preparation of auspicious weapons out of his bones. These pious weapons defeated the enemy Daitya Vritasur, by conquering him with love, compassion and kindness. These weapons made from his bones changed the temperament and nature of Daitya Vritasur. The latter was completely transformed from a most cruel and rustic demon into a thorough saint. He gave up fighting, and returned the kingdom of Devraj Indra. The noble example of rishi Dadhichi is a powerful source of inspiration for the prospective donors. One of the social organizations in Mumbai is named 'Dadhichi Dehdaan Mandal'. Dadhichi's name is permanently associated with body donation². In India, body donation was started in 70's and then gradually became popular. The pioneering work was done by 'Shishu Vihar', a social

organization in Bhavnagar, Gujarat in 1979³.

In Mumbai, three voluntary organizations namely "Manav-Jyot", "Snehda", and "Dadhichi Dehdaan Mandal", actively carry out body donation activities.

Procedure of Body Donation⁴

Anyone 18 years of age or older may wish to donate his or her body.

If it were known that the deceased had wanted to make a bequeathal of his or her body, but never got around to filing the paperwork during their lifetime, the gift (donation) could be made by their relatives after the death i.e. for unregistered body.

All govt. medical colleges can accept applications for body donation. Registration for body donation is very simple procedure done by filling up a declaration form in triplicate (where one copy is given to the person pledging, one copy is maintained in hospital record and one copy is send to Department of Anatomy).

The Particulars Include

1. Preliminary data - name & address of the donor, date of pledging, age at that time, mobile no.
2. Donor's signature.
3. Consent from relatives / next kin (at least two) with their name & addresses, tel. nos., exact relationship with the donor & signature.
4. Three Recent photographs

After the Department of Anatomy receives the declaration form, appropriate entries are made in the body donation register. They issue a registration number, body donation card, instructions related to body donation and a letter of appreciation. Some hospitals also provide other important information regarding other services like eye banks, skin donation etc.

After the death of such registered donor, the dead body of such donor has to be brought by the next kin or relatives in who is in the possession of the body, along with medical certificate of cause of death with 2 photocopies, body donation card / copy of declaration which was filled in triplicate if registered or if unregistered, a letter from the next of kin wishing to donate the body. The anatomy department forwards medical certificate of cause of death to the health department from where death certificate is issued to the next of kin.

Utility of Donated Bodies

The donated unautopsied bodies are useful for various purposes viz.

- To teach gross anatomy to medical students, doctors, nurses and other health professionals.
- For conducting various workshops like embalming techniques.
- Workshops with hands-on training of doctors through cadaveric dissection for various operative procedures, e.g. skull base surgeries, orthopedic and plastic surgical procedures.

- To practice a procedure / operation before performing a complicated surgery or procedure
- To obtain bone sets for teaching purpose
- To prepare wet mounted specimens / cross sections / vertical sections / LS etc.
- The eyes can be donated within 6 hours before the body is taken for dissection.

Donation is also a gift of discovery and knowledge to many researchers in studying new ways to develop innovative surgical techniques. Conditions where body donation is not accepted

There are various factors that may render the body unacceptable for an anatomical use. Some of the reasons for non acceptance are:

- Autopsied body,
- Extensively burnt body,
- Trauma or surgical incisions on the body that have not healed,
- Extremely obese or emaciated bodies,
- If decomposition has set in,
- If deceased is suspected of having a contagious and communicable disease e.g. AIDS, hepatitis, active tuberculosis.
- If the body is grossly mutilated.

Acceptance or rejection of a donated body is a decision of the committee of the medical college. As per the law, the institution has the right to reject a body donation for any of the above mentioned reason.

Although autopsied bodies are not accepted for anatomical purpose they can still be used for some specific purposes. However proper medicolegal protocol should be followed and necessary certificates must be obtained before the body can be utilized.

The un-autopsied / un-dissected parts can be utilized

- In workshops for learning skin grafting & other grafts, dissection of joints, base of skull surgeries.
- For bone sets, bone banks for the medical students
- For preparing specimens for teaching purpose
- To teach antemortem, perimortem and postmortem wounds.

Methods of body preservation: Donated body is usually preserved by

- a) Embalming
- b) Cold storage
- c) In formalin tanks
- d) Plastination

Types of Body Donation

It is Classified on the Basis of

1. Length of time for which the body is donated

- a. Permanent – remains are disposed as waste. routine practice
- b. Temporary (A newer concept in India) – Presently possible only in cases where the body is unclaimed and hence in the custody of the state government. After the medical purpose the body is handed back to the government for disposal. Temporary donation is useful for short term purposes like workshops, collection of specimens for museum, demonstration of minor procedures like liver biopsy etc.

2. Identification of the Deceased

- a. Known / claimed bodies
- b. Unknown / unclaimed bodies

Karnataka anatomy (Amendment) Act 1998 defines unclaimed body as “the body of a person who dies in a hospital, prison or public place or a place to which members of the public have access, and which has not been claimed by any person interested within such time as may be prescribed⁵.” Such bodies are usually obtained from municipal, govt. hospitals, prison or beggar homes.

Discussion

After the death of an individual the body of the deceased is the property of the next of the kin so it is not mandatory to donate the body even if one has pledged to donate his / her body during the lifetime. If the next of the kin does not wish to donate it no one can force him / her for doing so. The remains are disposed as per biomedical waste rules and regulations with utmost respect. The remains are disposed enmasse.

Negative Attitudes Towards Body Donation

The attitudes of donors play an important and crucial role in body donation. There is a common belief that body donation would deprive the deceased of the proper after life. They prefer to carry out last rights, where the family and friends will bid their final goodbye. The last rights can be performed symbolically and then the body can be donated. However this concept has not yet been fully accepted⁶.

Suggested Steps to Promote Body Donation

- Awareness amongst the masses can be created through media, hoardings and posters and campaigns about organ donation. Health professionals can directly relate with general population creating awareness.
- A letter of appreciation to next of kin after the donation can help create a feeling of charitable act among the relatives and friends. The medical colleges and hospitals can provide the relatives concessions in the medical aid.
- Public recognition of motivators.
- Obtaining death certificate may be difficult as the related papers do not travel through usual route of place of disposal (crematorium / burial ground etc). Special protocol should be made to hasten the procedures of obtaining the death certificate.
- The body should be treated with utmost respect by careful handling.
- The relatives should be treated with courtesy and should not be unnecessarily delayed while completing the formalities.
- The relatives should be thanked for their gesture.
- If there is no space for storage the donor should not be turned away, instead the body should be accepted for temporary storage. It may be transferred to any other college later.

Conclusion

Body donation is a generous and unselfish act for those who wish to be useful to the society even after death. The decision of an individual to donate his / her body is a vital contribution towards the understanding and advancement of medical science. Body donation plays a critical role in helping medical students to master the complex anatomy of the human body and will provide researchers with the essential tools to help our patients of tomorrow. It is better than the other methods of disposal which may consume lot of money, land and natural resources. In India although the prominent personalities have donated their bodies

and many others have pledged body donation. We as medical community may follow their example.

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Metrical Study on Skulls in Karnataka State

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Abstract

Study was conducted on the adult human dry skull in dept of Anatomy and Forensic Medicine at SSIMS & RC, Davangere. Karnataka, measurement of skull were taken using spreading caliper. Study was conducted on 49 dry human skulls (35 males and 14 females) Cranial breadth, Cranial length and Cranial index was calculated and pyriform aperture height was measured and correlated with cranial breadth, cranial length and cranial index. mean cranial breadth is 12.67cms, mean cranial length 16.87cms and cranial index 75.25, mean pyriform aperture height is 3.05cms, height of pyriform aperture in males is 3cms and mean pyriform aperture in females=3.18cms. Pyriform aperture does not showed any significance with respect to cranial length (p=0.46), cranial breadth (p=0.15) and cranial index (p=0.13).on comparison between males and females, maximum cranial breadth found highly significant (t=5.20, p=0.001), maximum cranial length significant (t=2.20,p=0.001), cranial index does not showed significance (t=1.30,p=0.18) and height of pyriform aperture showed significance (t=2.20, p=0.03)

Key words: Skull, cranial length, cranial breadth, cranial index, pyriform aperture

Introduction

In general the main objective is to study the form and shape of human as well as primate skull by means of exact measurements. This helps us to determine the differences between larger and small groups. Absolute and relative development of the various parts the skull is dependent on different factors namely genetic, morphological and functional¹.

The term cranium is some time reserved for the skull without mandible. Its upper part is a box enclosing the brain called neurocranium and remainder is called facial skeleton. Anterior nasal aperture or pyriform aperture, wider below and bounded by nasal bones and maxillae². Form and width of the osseous nasal pyramid exert significant impact on the effectiveness of nasal respiration. In planning a corrective rhinoplasty with osteotomies precise anatomic knowledge of piriform aperture can be of great benefit³.

Material and Methods

Study was conducted on 49 dry adult human skulls (35 males and 14 females) from the collections in dept of Anatomy and Forensic Medicine, SSIMS & RC, Davangere. Karnataka,

PARAMETERS	Male (n=35)		Female (n=14)		Mean Difference	t* Value	P Value, sig
	Mean	SD	Mean	SD			
Max cranial breadth in cms	12.86	0.38	12.18	0.50	0.69	5.20	<0.001 HS
Max.cranial lentgh in cms	17.01	0.75	16.51	0.55	0.50	2.20	0.03 S
Cranial index	75.81	4.81	73.84	3.98	1.98	1.30	0.18 NS
Height of pyriform aperture in cms	3.00	0.33	3.18	0.20	-0.18	2.20	0.03 S

Table no: 03: comparison between males and females

*students unpaired t test

Following measurements were taken on the skull using spreading caliper in cms

Cranial length¹: Its distance between the glabella and opisthocranium (*glabella*-it is the point which lies on the root of the nose between the supraorbital ridges of the forehead, *opisthocranium*- it is the most posteriorly projecting point in the mid sagittal plane, point lies mostly on external occipital protuberance)

Cranial breadth¹: Maximum breadth taken at right angle to mid-sagittal plane (in the present study distance between parietal tubers has been taken)

Height of pyriform aperture¹: straight distance between rhinion to nasospinale(*nasospinale* - it is the deepest point on the lower margin of the pyriform aperture projected in the mid sagittal plane, *rhinion*- it is the lowest point on the internal suture in midsagittal plane)

Cranial Index was Calculated Using Following Formula¹

Maximum cranial breadth X 100 / Maximum cranial length. All the statistical operations were done through SPSS for Windows (version 17.0-Evaluation version), SPSS Inc. New York.

Results

Table 1.

Parameters	Range	Mean	SD
Max cranial breadth in cms	11.5-13.6	12.67	0.52
Max.cranial lentgh in cms	15.6-18.6	16.87	0.73
Cranial index	65.59-83.75	75.25	4.63
Height of pyriform aperture in cms	2.5-3.9	3.05	0.31

Correlation analysis (* Karl Pearson's coefficient of correlation)

Table 2. Correlation with height of pyriform aperture

Parameters	Coefficient of correlation*	P Value, sig
Max cranial breadth in cms	-0.2	0.15 NS
Max.cranial lentgh in cms	0.1	0.46 NS
Cranial index	-0.21	0.13 NS

Fig1: Mean values of cranial breadth

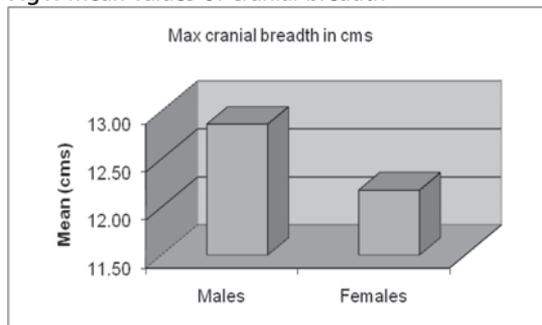


Fig 2 : Mean values of cranial length

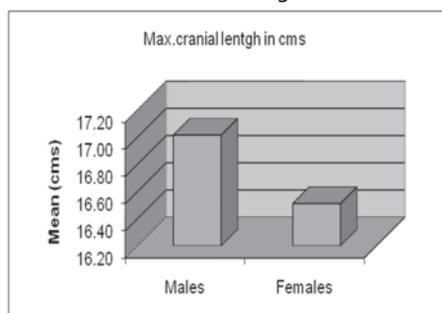


Fig 3: Mean values of cranial index

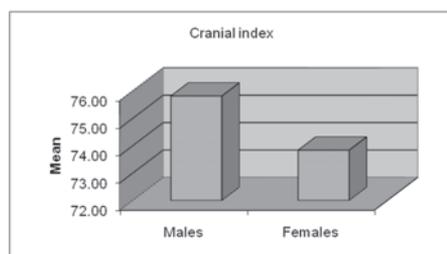
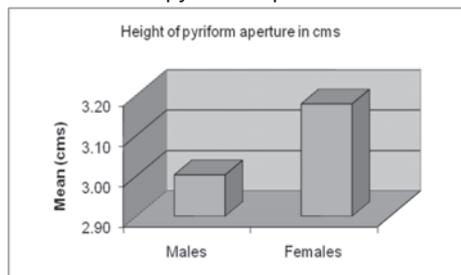


Fig 4: Mean values for pyriform aperture



Discussion

Study was conducted on the adult human dry skull in dept of Anatomy and Forensic Medicine at SSIMS & RC, Davangere. Karnataka, measurement of skull were taken using spreading caliper.

Harrower.G⁴ studied 35 Tamil skulls and reported their mean cranial length, mean cranial breadth and cranial index to be 17.96 cms, 13.15cms and 73.45cms respectively. Chaturvedi and Harneja⁵ carried out a Craniometric study of 150 adults human skulls and observed the average cranial index to be 70.75, cranial length to be 17.89 and cranial breadth to be 12.75 cms. Jayasingh et.al⁶ studied 300 adult human skull from U.P state for various skull measurements and calculated the maximum cranial length to be 17.45cms, maximum cranial breadth to be 12.69cms and

mean cranial index to be 74.35±4.15cms which falls in dolichocephalic group. In the present study mean cranial breadth 12.67cms, mean cranial length 16.87cms and cranial index 75.25.

Tae-Sun Hwang et.al⁷ In order to understand the morphological characteristics of Korean noses, the nasal bones and piriform apertures were measured and classified in the dried skulls of Korean adults found out The height of the piriform aperture was 30.1±2.6 mm in males, 28.0±2.8 mm in females. Ofodile FA⁸ studied the nasal bones and pyriform apertures of 20 skulls and were measured for length and width. There were 6 skulls from the Ashanti tribe in West Africa, 5 black American skulls, 5 skulls from Austria in northern Europe, and 4 American Indian skulls, The Indian nasal bones had a mean height of 3.0 cm and were the widest with mean widths of 0.61 and 1.28 cm. In present study mean height of pyriform aperture is 3.05cm (mean in- Males=3.00 and in Females=3.18).

Summary

Study was conducted on 49 dry human skulls (35 males and 14 females) cranial breadth, cranial length and cranial index was calculated and pyriform aperture height was measured and correlated with cranial breadth, cranial length and cranial index. mean cranial breadth is 12.67cms, mean cranial length 16.87cms and cranial index 75.25, mean pyriform aperture height is 3.05cms, height of pyriform aperture in males is 3cms and mean pyriform aperture in females=3.18cms. Pyriform aperture does not showed any significance with respect to cranial length (p=0.46), cranial breadth (p=0.15) and cranial index (p=0.13). on comparison between males and females, maximum cranial breadth found highly significant (t=5.20, p=0.001), maximum cranial length significant (t=2.20, p=0.001), cranial index does not showed significance (t=1.30, p=0.18) and height of pyriform aperture showed significance (t=2.20, p=0.03)

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A Study of Fatal Industrial Accidents Brought to Victoria Hospital Mortuary, Bangalore

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Abstract

An autopsy study of deaths due to fatal industrial accidents was conducted at Victoria hospital mortuary over a period of 18 months from January 2008 to may 2009. 128 cases of deaths due to fatal industrial accidents were studied. Male and young workers constituted the bulk. Most of the deaths were due to mechanical injury. Majority of the victims belonged to construction sector followed by electrical and mining sector. In majority of the cases no safety equipment was utilized.

Key Words

Industrial accidental deaths, electrocution, safety equipments, traumatic asphyxia.

Introduction

Industry due to its ubiquitous nature is an important cause of mortality in its own way in the form of accident. Each and every form of industries irrespective of manufacturing, processing, construction and chemical sectors, are equally contributing to the accidents. Today's intense urbanization which has affected all the major cities in the recent past has its own role to play in causing fatal industrial accidents. Approximately 4% of world's gross domestic product is lost with the cost of injury, death and disease, absence from work, sickness treatment, disability and survivor benefit¹. There are 100 million occupational injuries causing 0.1 million deaths in the world according to WHO. It is also estimated that in India 17 million occupational non-fatal injuries (17% of the world) and 45,000 fatal injuries (45% of total deaths due to occupational injuries in the world) occur each year². There is alarming increase in fatal industrial accidental deaths in Bangalore City which is the hub of all developmental activities due to changing patterns of social, cultural, economic development. In this altered scenario there is very much need for studying various patterns of death through skillful analysis and incorporate preventive strategies to avert further tragedies. A prompt attempt has been made to study the same.

Materials and Methods

The present study of 128 cases has been carried out in the department of Forensic Medicine, Victoria Hospital attached to Bangalore Medical College and Research Institute, Bangalore during the period, from January 2008 to May 2009. All the cases brought to the department for medico legal autopsy with alleged history of deaths due to fatal industrial accidents were selected on continues basis. Demographic information regarding the deceased including age, gender, occupation, literacy, per capita income, time of the incident, day and date of the incident, place of the incident and the circumstance of the death was collected from police and relative and by visit to the site of occurrence.

Results

A total number of 5448 autopsies were carried out at our center over a period of 18 months from January 2008 to June 2009. There were 128 cases of deaths due to fatal industrial accidents constituting 2.35% of all unnatural death at the center.

Table 1. Shows the educational status of the victims

Education	Frequency	Percent
Literate	60	46.9
Illiterate	68	53.1
Total	128	100.0

Table 2. Shows sector-wise distribution of accidents

Industrial Sectors	Frequency	Percent
Construction	62	48.4
Mining and Quarry	9	7.0
Chemical	5	3.9
Agriculture	2	1.6
Textile & related	3	2.3
Electrical	7	5.5
Transportation	3	2.3
Metals and non metals	2	1.6
Others	35	27.3
Total	128	100.0

The fatality rate was highest in the age group of 18-27 years (53.1%) followed by 28-37 years (27.3%) and 38-47 years (15.6%). The male victims constituted about 97.7% where as females amounted to only 2.3%. Majority of accidents took place

Table 3. Habits of the victims

Habits	Frequency	Percent
Nil	97	75.8
Smoking	8	6.3
Alcohol	5	3.9
Smoking and alcohol	13	10.2
Others	4	3.1
Smoking + Other	1	.8
Total	128	100.0

Table 4 : Cause of death of the victims

Cause of Death	Frequency	Percent
Injuries	67	52.3
Burns	21	16.4
Traumatic asphyxia	7	5.5
Electrocution	29	22.7
Drowning	4	3.1
Total	128	100.0

in afternoon hours (43.8%) and in late morning hours (27.3%) followed by evening hours (17.2%).

In 88.3% of the accidents safety equipments were not available, in 10.2% of the cases there was equipment failure, and in 1.6% of cases equipments were not utilized by workers.

Discussion

In the present study few salient interesting observation were recorded and these have been analyzed, discussed and compared with findings of similar studies. The age group of the victims in

our study ranged from 18 years to >58 years. The distribution of fatalities among different age group was in accordance with the study by international labour organization, Bureau of statistics³. In our study there was clear predominance of male victims i.e. 97.7% in contrast to females 2.3%. These values are similar to the findings of publication reports of karnataka on occupational injuries⁴. In our study the maximum number of industrial accidents occurred during the day with time period between 12.00 pm to 4.00 pm (43.8%) followed by 8.00 am to 12.00 pm (27.3%). These findings are similar to the findings observed by Williams⁵, Ann M, Feyer, and Anne-Marie. ⁵. According to the study by Folkard S and Tucker P ⁶, the risk was found to increase in an approximately linear fashion across three shifts showing an increased risk of 18.3% on the afternoon shifts and 30.4% on the night shifts but, in our study the risk increased in the morning hours and decreased in the night. This discrepancy was probably attributed to a fact that our study involved more number of construction sector victims (48.4%), who mainly worked in the morning shifts. The causative factor for crowding of accident at mid afternoon hours was probably attributed to fatigability and decreased alertness with increase in hours of work. In our study, a highest number of cases were from construction sector. The higher number of deaths in construction and mining sector is probably attributed to the fact that the majority of the workers are recruited on ad-hoc basis with term-contract of three to four months on daily wages without proper pre recruitment training over safety and type of work, Illiteracy, lack of supervision and inexperience. In 88.3% of the cases safety equipments were not available and only 10.2% of cases safety equipments were utilized however they could not prevent the accidents which can be attributed to equipment failure. Study revealed almost equal distribution of fatalities among literates and illiterates. Probable reason could be the fact that most of the literates have completed only basic education with medium of learning being regional language and English could still be a difficult language to understand, while most of the heavy machineries and construction site procedures used English as a language for written work procedures, hence no significant difference in distribution of fatalities among literates and illiterates. The habit of alcoholism among workers in our study was similar to the findings of the study done by Alleyne BC, Stuart P, and Copes

R⁷. In our study 52.35% of the cases were due to mechanical injuries, followed by electrocution, followed by burns, traumatic asphyxia and least with drowning. Shock and hemorrhage was cause of death in maximum number of cases (52.3%).

Conclusion

Accidents are unpredictable. However to learn from the past mistakes and to plan strategies to prevent them is imperative. In our study it was observed that the human factors, be it on employees or employers part i.e. lack of safety equipment, illiteracy among workers, unwillingness to utilize the available safety provisions, lack of interest to provide first aid, lack of regular medical facilities at work place, lack of pre recruitment training were all responsible. So the following recommendations if followed may help to reduce the fatalities. Providing prime importance to educating the workers about workplace hazards by the way of giving pre recruitment training, importance of first aid facilities, pre recruitments screening of new recruits for any medical disabilities such as hearing and vision ailments and providing written work procedures in understandable regional (local) languages.

- Motivating workers in regard of using available safety procedures and updating new technologies in safety aspects.
- To have a medical expert to retrospectively analyze the cause of accident as well to monitor the well being of the workers.

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A Two Year Study of Suicidal Deaths in Nagpur, Central India.

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Abstract

A two year retrospective study of suicide cases has been carried out in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur during the period of January 2001 to December 2002. Out of total 2888 medicolegal autopsies, suicide cases were accounting for 618 (21.40%). The suicide cases were predominantly observed in the males. Male to female ratio was 2.17:1. Maximum suicide cases were in the age group of 20-39 (n=365, 59.06 %) with a clear male dominance in all age groups. The commonest method adopted for suicide was poisoning (n=214, 34.63%), followed by hanging (n=153, 24.76%) and burns (n=141, 22.81%). Suicide by throwing in front of train were the least (n= 15, 2.43%). The grounds for suicide noted as marital disharmony, economic problems, unemployment and diseases.

Key Words

Suicide, poisoning, burns, marital disharmony, Nagpur, India.

Introduction

The history of suicide is almost as old as human society itself. It is legally defined as the intentional act of self destruction committed by someone knowing what he is doing and knowing the probable consequences of his action. The act of suicide is illegal in India under section 309 and 306 IPC.

Suicide is a worldwide phenomenon. It is one of the ten leading causes of death in the world accounting for more than a million deaths annually. The incidence and pattern of suicide vary from country to country. Cultural, religious and social values play some role in this regard. As per WHO [1], there is one suicidal death in 40 seconds throughout the world and there is an increase of suicidal rate by 60% worldwide in the last 50 years. Also in India, as per the report of NCRB [2], there is one suicide in every 5 minutes, and an increase of 175% of suicidal rate in the last three and half decades in spite of the fact that attempt to commit suicide is still considered a crime under section 309, Indian Penal Code.

Suicidal death is emerging as major health problem worldwide and is attracting increasing attention from the medical profession and the public health agencies as well. Suicide is a leading cause of premature death especially

among the young adults. Suicide being a criminal act as well as an indirect indicator of Mental Health of a community, this study was taken up to establish the incidence of gender, age, which subgroups of the population were most vulnerable to such deaths and commonly adopted means of suicide in Nagpur. Nagpur is an important city as well as an industrial town and the second capital of State of Maharashtra. It is situated in the central part of India, hence reflecting scenario of suicide of central India. Therefore, to properly understand the epidemiology of suicide deaths and to know the risk factors for suicide in different population subgroups, this retrospective analytical study has been undertaken that can be used in programmes aimed at prevention of suicide.

Material and Methods

The present retrospective study of 618 suicidal cases has been carried out in the Department of Forensic Medicine and Toxicology, Indira Gandhi Medical College, Nagpur for a period of two years from January 2001 to December 2002. The data was obtained from police papers (Requisition and inquest panchnama) regarding information on age, sex, causative factor and method of suicide, pertinent history and autopsy report. It was verified from the friends and relatives of deceased. All the data thus collected were analyzed, tabulated and findings are presented in this paper.

Table 1. Showing distribution of suicidal cases as per method adopted

Method	Male	Female	Total	%
Poisoning	169	45	214	34.63
Hanging	118	35	153	24.76
Burns	52	89	141	22.81
Drowning	75	20	95	15.37
Death on Railways	9	6	15	2.43
Total	423	195		

Observation

Out of 2888 medicolegal autopsies conducted during the period of two years from January 2001 to December 2002, 618 cases (29.88 %) were due to suicide.

Table -1 shows that poisoning (34.63 %) was the most common method for suicide followed by hanging (24.76 %) and burns (22.81%). Male to female ratio in the fatal suicide cases was 2.17:1; showing the predominance of males over females.

Table 2. Age and sex wise distribution of suicidal cases as per method adopted

Age in years	Poisoning		Hanging		Railway Fatality		Drowning		Burn		Total		(%)
	M	F	M	F	M	F	M	F	M	F	M	F	
0-9	0	0	0	0	0	0	0	0	0	0	0	0	0 (0)
10-19	11	14	4	10	0	0	1	3	10	12	26	39	65 (10.52)
20-29	52	17	27	16	3	2	14	3	21	34	117	72	189 (30.58)
30-39	53	11	45	7	4	2	24	5	9	16	135	41	176 (28.48)
40-49	31	1	20	1	1	1	10	1	4	11	66	15	81 (13.11)
50-59	16	1	12	0	1	0	10	3	4	7	43	11	54 (8.74)
60-69	3	1	7	1	0	1	7	3	4	6	21	12	33 (5.33)
>70	3	0	3	0	0	0	9	2	0	3	15	05	20 (3.24)

Suicide by poisoning was observed as the most preferred method by the males followed by the hanging in 39.95 % and 27.90 % respectively while females preferred to commit suicide by burning and poisoning in 45.64 % and 23.08 % respectively.

• M= Male F= Female

Table-2 shows that suicidal deaths was mostly seen in the age group of 20-39 years (n= 365, 59.06%). Most of the males were in the age group of 30-39 years (n=135), sharply followed by 20-29 years age group (n=117). Commonest age

Table 3 : Showing number of suicidal Deaths and Causative factor

Causative factor	Total	%
Alcohol influence / Addiction	24	3.88
Defamation	12	1.94
Economic problem	89	14.40
Family quarrel / Marital disharmony	227	36.73
Ill health	53	8.58
Frequent. Abortion, infertility	18	2.91
Failure in love	34	5.50
failure in examination	05	0.81
Psychiatric problem	52	8.41
Quarrel with neighbor	06	0.97
Unemployment	67	10.84
Not Known	31	5.03
Total	618	100

group for female suicide victims were 20-29 years (n=72) followed by 30-39 years (n=41) and 10-19 years (n=39). Suicide pattern illustrate that the suicide rate decreases at the extremes of age in all adopted methods

Most common cause for the suicide was the internal family quarrel and marital disharmony (36.73%), followed by economic problem (14.40%) & unemployment (10.84%). Ill health (8.58%) and mental diseases (8.41%) claimed significant cause behind suicide.

Least causative motive observed as failure in examination & love, quarrel with neighbor, defamation etc.

Discussion

Out of 2888 medicolegal autopsies conducted during the two year period in the mortuary of Department of Forensic Medicine and Toxicology, Indira Gandhi Medical college, Nagpur, 618 cases (21.40%) were of suicide. Similar higher rate of suicide cases amongst the medicolegal autopsies were observed by various researchers [3-6]. Reason for this may be the degree of urbanization and industrial development leading to increasing detachment of the individual from his social surroundings resulting in a weakening of the individual's identification, also the financial problems due to less number of job opportunity as well the less income due to crop failure leading to negative impact on the individual of this studied area.

In the study, poisoning (34.63%) was noted as the commonest method adopted for suicide followed by hanging (24.76 %) and burns (22.81 %). Similar findings were observed by the others [3-9]. Some observed poisoning as the second preferred method for suicide [10-11]. The acceptance of such type of method for suicide may be related to easy availability of the materials needed for the act, simplicity of the act, guaranteed fatality and the belief of a prompt and rapid death.

In the study, male chose poisoning and hanging as their preferred method while female preferred burning then poisoning which is fairly consistent with the findings of Sahu Geeta, Mohanty S, Tripathy SK, Patnaik M [8]. Poisons being easily available and cost effective with reasonable surety of painless death attracted the male population while inflammable materials like kerosene being readily available in homes lead the females to its easy access.

Males were the predominant sexual category to commit suicide as compared to female. Male to female ratio was 2.17:1. Males outnumbering females in suicide victims have also been

observed by other [3-7, 11-14]. The reason for male preponderance is due to more energetic life style of males and inability to fulfill the family responsibilities and frustration due to the crop failure, failure in love and examinations etc lead to end the life.

Most of the suicide cases observed in the age group of 20-29 years (30.58 %), stridently followed by 30-39 years age group (28.48 %) which is consistent with the findings of others

[3-5, 7, 9-13]. It was mainly because this particular age group is the most active and explosive group suffering all types of stress like domicile and economic stress, unemployment and educational problems etc and instead of facing defeat, they might have preferred to end their life. Study showed decreased incidence with advancing age and early childhood. The reason for this could be the family system in which elders and children are taken care of and usually relax and enjoy their life.

Internal family quarrel and marital disharmony (36.73%) was the commonest reason observed in the study followed by financial problem (14.40), unemployment (10.84%) and ill health (8.58%). Similar findings were observed by others [7, 8]. Mohanty S, Sahu G, Mohanty MK, Patnaik M [10] observed financial burden as the prime cause followed by marital disharmony. Some observed [15, 16] mental diseases as the main causative reason of suicide which is in contrast with this study.

Conclusion

Suicide is a major health problem. The incidence of suicide is increasing day by day. WHO [1] estimates by the year 2020 one death on average every 20 seconds and one attempt every 1-2 seconds of suicide. Worldwide scenario suggests second highest number of suicidal cases in India following China, which is quite alarming and needs to be dealt seriously.

This increasing incidence of suicidal menace is creating great challenge for psychiatrists, social workers, public health personnel, sociologist and psychologist to identify the underlying factors in the social system which promote suicidal tendencies and improve the mental health of the community which in turn surely prevents such incidences further. It is highest among the age group of 21-30 and 31-40 years, which symbolize the most active and productive section of the community. If it is left unrestricted the loss will be insurmountable both economically and socially.

Diverse strategies are required to prevent suicide and the medical profession has to take a role in the management of this health problem. Concept of "suicide as a preventable disease" should be well understood and stresses thorough and detailed study regarding the matter.

The present study exposes a wide range of causative factors of suicide among the different age group and gender which may due to series of socioeconomic, psychosocial and cultural practices and raise awareness and stir up interest with regards to the serious public health and community burden represented by suicide.

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Study of Incidence of Sutural Bones at Different Sutures in Western India

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Abstract

Sutural bones are the bony ossicles found at the different sutures of the crania.

The aim of the present study is to find out the incidence and percentage frequency of sutural bones, at the different cranial sutures of the male and female crania.

This study includes 310 crania (155 male and 155 female) and in each skull the presence of sutural bones were noted.

The study revealed that total 494 sutural bones were observed in male and 470 bones in female. The maximum number of sutural bones was noted at the lambdoid suture. These bones are important because they can mislead in the diagnosis of the fracture of skull bones.

Introduction

The wormian bones or sutural bones are small bones found at the sutures of the skull. They are unnamed because they vary from person to person in number and shape. They found commonly in relation to the frontal and occipital bones.

Isabare M defined the sutural bones as "They persisting within the suture and not incorporated into the adjacent bone during mineralization and maturation. They are called wormian bones after the Danish anatomist Olaus Worm. The largest of these is the interparietal, which is triangular in shape and represents the interparietal portion of the occipital bone. A foetal wormian bone, usually disappearing by birth and fusing with the supraoccipital bone at the posterior margin of the foramen magnum called Kerkring's bone." ¹

Material and Methods

Total 310 adult human crania of known sex as male or female were studied for the present study. The crania collected for the present study were from different ethnic groups and casts. Only fully ossified adult crania were included in the present study. Sutural bones in the crania were observed and classified into large (>1 cm) and small (< 1cm) bones. The presence of sutural bones at different sutures was also noted.

Observations

Numbers of Sutural Bones

Sutural bones	Male	Percentages	Female	Percentages
Total Number	494		470	
Small	169	34.21%	150	31.91%
Large	325	65.79%	320	68.09%

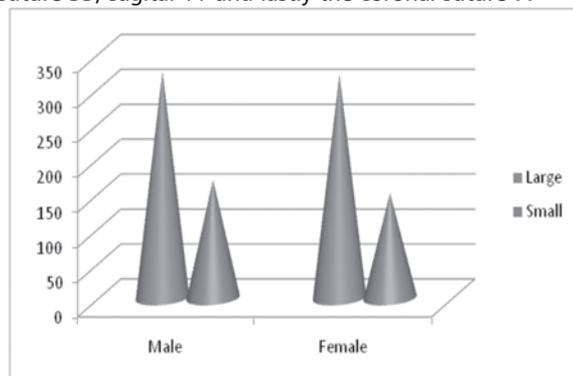
Total numbers of sutural bones found in male crania are 494. Out of that small bones are 169 and large bones are 325 i.e. (34.21%) and (65.79%) resp.

Whereas total numbers of sutural bones in female crania are 470, of which large bones numbered 320 and small 150 i.e. (68.09%) and (31.91%) resp.

In male crania the large sutural bones were numerous at the lambdoid suture i.e. 276 followed by parietomastoid suture 25 and then the coronal and sagittal sutures 12 each.

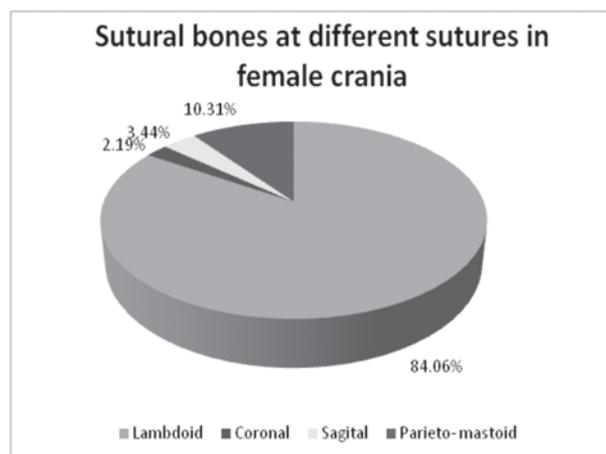
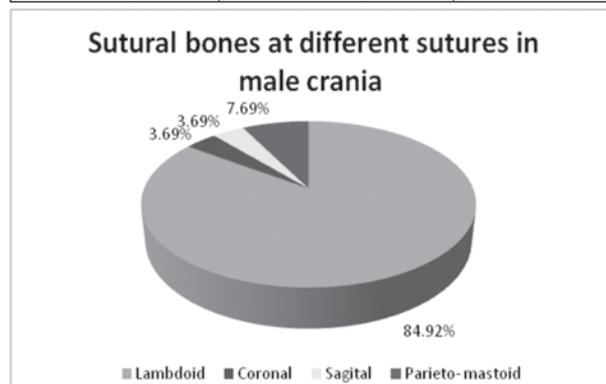
While in female crania also the largest number found

at the lambdoid suture i.e 269 followed by parietomastoid suture 33, sagittal 11 and lastly the coronal suture 7.



Sutural bones at different sutures

Name of suture	Male		Female	
	No. of sutural bones	Percentages	No. of sutural bones	Percentages
Lambdoid	276	84.92%	269	84.06%
Coronal	12	3.69%	7	2.19%
Sagittal	12	3.69%	11	3.44%
Parieto-mastoid	25	7.69%	33	10.31%
Total	325	100	320	100



Discussion

Wide variation is observed in the incidence of sutural bones in the population of different areas. Gopinathan K et al observed the incidence of sutural bones was highest at the lambdoid suture and least at the coronal suture. He noted that no statistical side difference was found in the bilateral sutures.²

Berry AC studied the incidence and sexual difference of 30 non-metrical variants. He noted that the frequency of the sutural bones at the asterion was highly statistically significant for N. W. coast American Indians and London. This was not apparent in other groups.³

Gomusburun E studied the sutural bones in Anatolian-ottoman skulls. He concluded that the incidence of sutural bones was well suited for comparative studies as an anthropological marker or an indicator of population distance.⁴

At the Bregma a large wormian bone was observed which occupied the space between the two halves of the frontal bone and two parietal bones.⁵ Nayak SB found ten wormian bones in the lambdoid suture in an adult Indian skull.⁶

Conclusion

The knowledge of sutural bones is clinically important.

The presence of series of sutural bones may lead to problems in posterior approach to the cranial cavity. These bones might lead to confusions in reading the radiographs in case of head injuries they may be mistaken for the multiple fractures.²

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Soft Drinks and Oral Health

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Abstract

Soft drink consumption has increased dramatically across all demographic groups, especially among children and teenagers. Soft drinks have many potential health problems, including dental caries and enamel erosion. Soft drinks containing inherent acids and sugars have both acidogenic and cariogenic potential. Many studies showed a positive relationship between caries and dental erosion and the consumption of soft drinks. Compared with caries, dental erosion seems to have much stronger relationship with soft drinks. It is necessary to educate patients about the harmful effects of excessive soft drink consumption and to advise them with the following tips to prevent dental erosion and caries: limiting soft drinks intake, choosing the low erosive soft drinks, improving the drinking habit, avoiding brushing tooth within 1 h after consuming acidic food, and using fluoride or remineralizing toothpaste.

Key Words

Soft drinks, dental caries, erosion

Introduction

Urbanization and economic development result in rapid changes in diet and lifestyles. Market globalization has a significant and worldwide impact on dietary excess leading to chronic diseases.¹ In socioeconomically developing countries, the change from a traditional lifestyle to a Western lifestyle has, among other things, led to an increase in sugar consumption from food and beverages.² Soft drink consumption has increased dramatically across all demographic groups, especially among children and teenagers. The popularity of soft drinks has been increasing year after year, due in part to their sweet taste, and in part to the aggressive and pervasive advertising campaigns run by soda companies.³

Soft Drink

Soft drink (also referred to as soda, pop, soda pop or fizzy drink) is a non-alcoholic beverage typically containing water and a flavoring agent. Many are carbonated and sweetened, and may contain additional ingredients such as fruit juice.

Composition

The first carbonated soft drinks, which were named as such in order to clearly differentiate them from hard, alcoholic beverages, and the technology to make them were imported from the Europeans, who had discovered how to force carbon dioxide gas into water back in the sixteenth century. The original bubbly drinks were carbonated mineral waters mimicking those found in therapeutic natural springs and the first of these were patented in the United States in 1810.⁴ Generally composition of soft drink are:

Sugar: Most of the soft drinks contain the monosaccharides glucose and fructose and the disaccharide sucrose.⁵

Artificial Sweetener: like aspartame, acesulfame-K, saccharin or sucralose. These sweeteners have a number of possible side effects: migraines, memory loss, heart complications,

depression and increased cancer risk.

Caffeine: Caffeine is used to increase the flavor in soft drinks, but it is also very addictive. Caffeine stimulates the nervous system and increases the heart rate. It also increases slightly the excretion of calcium.⁶

Carbon Dioxide: Carbon dioxide makes soft drinks fizz but it is also a waste product.

Phosphoric or Citric Acid: Acids are added to soft drinks to give them a nice tingling feeling when they are swallowed. These acids also act as a preservative to keep the soft drink fresh and crisp-tasting.

Preservatives: Preservatives are put into soft drinks so that they last longer. However, Juicing-for-health.com explains that preservatives like sodium benzoate or sulfur dioxide can cause asthma, rashes, hyperactivity, fainting, shock, or a coma.

Coloring: Soft drinks may contain artificial coloring. These coloring ingredients make the drink look more appealing to drink. For example, caramel coloring agent gives the drinks a rich brown color. Artificial colorings, especially Yellow No. 5, promote attention-deficit hyperactivity disorder in some children. Yellow No. 5 also causes hives, asthma, and other allergic reactions in a small number of individual.⁶

Impact on Health

Excessive consumption of soft drinks adversely effects health. While there are questions regarding artificially sweetened diet soft drinks and their effect on health, the evidence that consuming soft drinks sweetened with sugar or high fructose corn syrup can result in harmful effects has been thoroughly researched and documented.⁷

In 1998, the Center for Science in the Public Interest published a report which examined statistics relating to the soaring consumption of soft drinks, particularly by children, and the consequent health ramifications, including tooth decay, nutritional depletion, obesity, osteoporosis, type-2 diabetes, and heart disease.⁶

A Danger to Oral Health

Soft drinks contain high amounts of sugar and acids, which are added to give sodas their characteristic good taste. Unfortunately, both these components pose significant risks to oral health. Soft drinks have many potential health problems, including dental caries and enamel erosion.

Dental Caries: Dental caries may result from a long-term high intake of soft drinks. When sucrose intake exceed 15-20 kilograms per person per year is directly associated with caries prevalence, when sucrose is consumed between meals. 375 ml Can of soft drink contain in excess of 40 gm of sucrose, thus one Can of sugared soft drink per day for 1 year will in itself account for 15 kilograms of sucrose per year.⁸

A frequent exposure to dietary acids will have ecological effects on the oral biofilm and can shift the supra gingival oral flora toward aciduric micro-organism. As the intra-oral

pH falls, the number and proportion of aciduric organism such as mutans streptococci and lactobacilli increases, and the proportions of acid – sensitive species fall. The reduction in pH caused by the drink not only enhances the competitiveness of cariogenic organism, but also inhibits the growth and metabolism of non –caries associated species.⁸

A recent large study of young children in Iowa found “intake of regular soda pop was the strongest predictor of the extent of caries”.⁶ There is also a strong association between the frequency of between-meal consumption of soda pop and caries.^{9, 10}

Strong associations between high DMFS (decayed missing filled surfaces on teeth) scores and soft drink consumption in persons aged 25 and above have been seen. Serious problems will occur particularly in people who have dry mouths (caffeine, medications, exercise and certain ailments cause dry mouth).¹¹

It has also been observed that the children with a high carbonated soft drink consumption pattern showed significantly higher caries experience, even compared with those children with a high juice consumption pattern.¹² The reason being sugar substrates in 100% juice are primarily fructose and glucose, whereas the substrate in regular soda pop and regular beverages from powder is sucrose and/or high-fructose corn syrup (i.e., fructose and glucose). Glucosyltransferase from *Streptococcus mutans* uses sucrose but not fructose or glucose to form extracellular glycans that facilitate dental plaque adherence to the enamel surface. Linkages between glycans are rigid and increase the porosity of the plaque, which could facilitate diffusion of sugars and acid within the plaque and increase caries risk. In the laboratory, sucrose seems to promote *Streptococcus mutans* selection.¹⁰

Dental Erosion

Dental erosion (erosive tooth wear) is the situation of a chronic loss of dental hard tissue that is chemically etched away from the tooth surface by acid and/or chelation without bacterial involvement. Soft drinks containing inherent acids and sugars have both acidogenic and cariogenic potential.¹³ Many studies showed a positive relationship between caries and dental erosion and the consumption of soft drinks.^{14,15} Compared with caries, dental erosion seems to have much stronger relationship with soft drinks.¹³

It is found that over time, exposing dental enamel to carbonated beverages weakens and permanently destroys enamel.^{16,17}

Regular black soft drink contains orthophosphoric acid. It is well known that orthophosphoric acid will dissolve the protective pellicle layer deposited by saliva onto teeth, and will etch both enamel and dentine. Citric acid in soft drink sequesters calcium ions from saliva, preventing remineralization, etches dentine and causes dental erosion.

More importantly, these various acids are effective buffers, giving the drink high titratable acidity and making their pH reducing effects in the mouth greater than the protective buffering action of saliva. This explains why enamel and dentine hardness decreases after exposure to soft drinks and erosion areas develop.⁸

In an study carried out by researchers at the University of Melbourne, showed damage to tooth enamel by acid erosion was reported by 25-45% of those surveyed.¹⁸ Sugared versions of soft drinks proved to be more erosive than their diet counterparts.¹⁹

The erosive potential of drinks is mainly represented by their pH and the buffering capacity. Carbonated drink could reduce surface hardness of enamel, dentine, microfilled composite, and resin-modified glass ionomer. Carbonated drinks have lower pH than fruit juices. The buffering capacities

are in the following order: fruit juices > fruit-based carbonated drinks > non-fruit-based carbonated drinks.¹³

Studies have shown that dental erosion is also associated with the drinking methods. Holding the drink longer in the mouth leads to a more pronounced pH drop.¹⁴ Drinking with an increasing flow rate and with decreasing outlet diameter could increase the erosion depth. The effect is also strengthened when acid temperature grows higher.¹³

Prevention

Individual approach: Obviously, lowering or eliminating soft drink consumption entirely is not a very likely solution.

1. **Substitute different drinks** with beverages containing less sugar and acid such as water, milk and 100 percent fruit juice.²⁰
2. **Rinse with water:** After consuming a soft drink, flush your mouth with water to remove vestiges of the drink that can prolong exposure of tooth enamel to acids.¹⁶
3. Avoid any erosion-inducing habits such as sipping, swishing or holding drinks in the mouth. Do not brush teeth for at least one hour after an erosive challenge (such as consumption of a highly acidic beverage).²¹
4. **Fluoride toothpaste and mouth rinse:** Fluoride reduces cavities and strengthens tooth enamel, so brush with a fluoride-containing toothpaste s. Rinsing with a fluoride mouthwash also can help.
5. **Professionally applied fluoride treatment.**²²

For school children: American Dental Association opposes contractual arrangements in schools that promote increased access to soft drinks for children, thereby influencing consumption patterns.⁴

The American Academy of Pediatrics has stated that the “providing soft drinks in schools can lead to childhood obesity” and should focus on providing more nutritious, lower calorie beverages such as water, milk, 100% fruit juice and vegetable juice. Communities and schools are uniting across America to pass legislation banning the sale of soft drinks in schools especially during meal times. However, much more effort needs to focus on competitive foods, foods sold at school stores and at fundraisers.¹

Public Health Approach: The Center for Science in the Public Interest offers the following suggestions for reducing the consumption of soft drinks.⁶

- Individuals and families should consider how much soda pop they are drinking and reduce consumption accordingly. Parents should stock their homes with healthful foods and beverages that family members enjoy and, for the most part, not keep soft drinks—especially non-diet drinks—in the refrigerator.
- Physicians, nurses, dentists, and nutritionists should routinely ask their patients how much soda pop (and other low-nutrition foods) they are consuming and advise them, when appropriate, to consume less.
- Labels on non-diet soft drinks should state that frequent consumption of those drinks promotes obesity, diabetes, and tooth decay, osteoporosis and other health problems.
- Local, state, and federal governments should be as aggressive in providing water fountains in schools, government buildings, parks, and other public spaces as the industry is in placing vending machines.
- School systems and other organizations catering to children should stop selling or advertising soft drinks.
- Organizations concerned about children’s health, dental and bone health, heart disease, and cancer should collaborate on campaigns to reduce soft drink consumption.
- State and local governments should consider levying small taxes on soft drinks.
- Federal agencies should sponsor more scientific research to further explore the effects of soft drink (and refined-sugars)

consumption on nutrient intake, obesity, dental caries and erosion, osteoporosis, kidney stones, and heart disease.

Persepective from Soft Drink Industry Trade Association

Soft drink consumption has become a highly visible and controversial public health and public policy issue. The industry trade association in the United States (the American Beverage Association, formerly the National Soft Drink Association) counters nutrition concerns with several key points: (1) the science linking soft drink consumption to negative health outcomes is flawed or insufficient, (2) soft drinks are a good source of hydration, (3) soft drink sales in schools help education by providing needed funding, (4) physical activity is more important than food intake, and (5) it is unfair to "pick on" soft drinks because there are many causes of obesity and there are no "good" or "bad" foods. Similar positions have been taken by other trade associations such as the British Soft Drinks Association and the Australian Beverages Council.²³

Conclusion

The contemporary changes in beverage patterns have the potential to affect oral health. Though there is limited epidemiological evidence assessing the association between oral health and soft drink consumption, it consistently indicates that soft drinks adversely affect dental caries and enamel erosion. Although the diseases are different in their histological appearance, the two conditions occurring concurrently could be deleterious to dental hard tissues. Moreover, numerous in vitro and animal studies have consistently shown enamel erosion with the use of soft drinks. Given this evidence it would seem appropriate to encourage children and adolescents to limit their intake of soda.

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Assessment and Evaluation of Depression and Loneliness among People Living with HIV in Selected Places of Coastal Andhra Pradesh

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Abstract

BACK GROUND: The AIDS pandemic continues to be an escalating health problem throughout the world. Mental health of PLHIVs is one of the neglected aspects in the Continuum care and most often it is under diagnosed as well as under treated. This study was proposed to assess the prevalence of depression and loneliness among PLHIV so that adequate measures could be taken to address their needs, and if required treatment of mental illness could be prioritized, which would rather be a more holistic approach.

OBJECTIVES: To review key mental health issues such as loneliness and depression in the continuum of care for people living with HIV (PLHIV) & to provide a framework for integrating mental health services into HIV/AIDS interventions. **METHODS:** 380 PLHIV from the districts of East Godavari & Vishakhapatnam were interviewed using the SRQ-10 depression scale and R-UCLA loneliness scale for assessing the depression and loneliness respectively the responses were graded according to the standard guidelines and the mean scores for each scale were obtained. Statistical analysis was done using the student t-test and Chi square for categorical variables number and percentages were calculated. **RESULTS:** An overall 71.84% of subjects were depressed and 66.57% were found to be lonely. Loneliness & depression was significantly higher in female population. Depression as well as loneliness was found to be significantly associated with their educational status, financial status and the presence of opportunistic infections. **CONCLUSION:** The mental health indicators depression and loneliness need more stress in the continuum of care of PLHIV.

Key Words

People living with HIV, Depression, Loneliness, ASSESSMENT AND EVALUATION OF DEPRESSION AND LONELINESS AMONG PEOPLE LIVING WITH HIV IN SELECTED PLACES OF COASTAL ANDHRA PRADESH

Introduction

Mental disorders make a substantial independent contribution to the burden of disease worldwide, interacting with many other health conditions. Although evidence from low income countries is limited, fairly consistent associations have been reported between HIV and poor mental health⁽¹⁾.

Studies have shown the prevalence of mental distress in various populations like Geriatric and Adolescent populations and other health conditions like many chronic diseases⁽²⁾. Psychological research with PLHIV has reflected a conceptual shift towards perceiving HIV and AIDS as a chronic disease⁽³⁾.

With the advent of recent HIV epidemic, PLHIV have become a significant sector in the society.. Out of 23 districts, 17 districts are reporting generalized HIV epidemic. Eight of

the nine coastal districts are reported to have generalized HIV epidemic⁽⁴⁾.

Between mental health and HIV, there exists a bidirectional relationship.. 70% patients with HIV suffer from an acute psychiatric complication during the course of the illness⁽⁵⁾ and 90% of people who have recently been diagnosed with HIV infection suffer from acute stress disorder⁽⁶⁾. North American and European studies also suggest that people with HIV often suffer from depression and anxiety disorders as they adjust to the diagnosis ,adapt their life to such a life threatening illness, and witness the death of their friends and family.⁽⁷⁾⁽⁸⁾⁽⁹⁾

On the other hand, with the myths associated with HIV transmission, a person affected may be isolated by friends and family, may feel lonely, alienated and develop negative attitude towards life. Alternately, one may prefer to take revenge on the society by practicing unsafe sex, or even infecting others silently. Thus, mental distress in HIV increases the risk of transmission of the disease adding to the gravity of the public health problem.

Therefore, keeping the above situation in mind, this study was proposed to assess the prevalence of depression and loneliness among PLHIV so that adequate measures could be taken to address their needs, and if required treatment of mental illness could be prioritized, which would rather be a more holistic approach.

Material and Methods

Study Type: Community based cross sectional study

Study Settings: PLHIVs registered in the ART centers of East Godavari which is a high prevalence district as well ART center of Vishakhapatnam district which is a low prevalence district of AP were selected for study.

Study Period: 2 months (1st July to 31th August 2010)

Study Sample: Out of total study population comprising about 35,000 PLHIVs in both the districts, sample population was taken after taking a marginal error of 5% at confidence level of 95% and a response distribution of 50% by presuming the prevalence of depression & loneliness to be higher than that of general population which is 31.2%⁽¹⁰⁾

Therefore, 380 study subjects were interviewed based upon the above calculation in both the districts divided equally.

Study Subjects: People Living with HIV (PLHIVs), registered at the Anti Retroviral Therapy (ART) centers of East Godavari (total 12,982) & Visakhapatnam districts (total 22,000) either on pre ART or ART were selected after taking their consent and obtaining the necessary permission from the concerned authority.

Inclusion Criteria: All study subjects above 18 yrs & below 70 yrs of age, willing to take part in the study.

Exclusion Criteria

- Those study subjects having history of previous mental abnormality (i.e. before sero-positivity).
- Subjects below 18 yrs and above 70 years
- Those who do not wish to participate or cooperate during the interview.

Study Tool: Socio demographic profile was obtained through a pre designed and pre tested questionnaire. HIV - loneliness and depression was explored by using Revised UCLA (University of California, Los Angeles) scale three item loneliness scale ⁽¹¹⁾ and SRQ – 10 (Self Reporting Questionnaire-10) ⁽¹²⁾ respectively. SRQ is a scale developed as part of a collaborative study on strategies for extending mental health care coordinated by the WHO. In this scale, weights are assigned to the responses based on DSM (Diagnostic & Statistical Manual of Mental Disorders) IV criteria ⁽¹³⁾ for depression and a cutoff point were set at 7/20 for probable cases of depression. Similarly, Revised UCLA scale and three item loneliness scale were used to measure loneliness among PLHIVs and for both scales; the sum of all items were calculated.

The study tools were translated in to the local language and were explained in detail to the outreach workers engaged for data collection.

Data Collection: Contacts established with PLHIV in pre selected ART centers. The contacted persons were interviewed after establishing rapport and trust.

Study Variables: Age, sex, education, income, marital status, duration of infection, HIV prevalence

Statistical Analysis: Statistical analysis was done using the SPSS software, version 16.0. The mean and standard deviation (SD) was used. Student t-test was used to compare between 2 means, and analysis of variance was used to compare more than 2 means. For categorical variables, the number and percentage distribution was calculated. The level of significance was set at $p < 0.05$.

Observation & Results

Table 1 shows that about 283 out of 380 study subjects (73.68%) belong to 20-40 age group. Out of 380 study subjects, 216 (56.84%) were females. Most of them were educated upto primary school i.e. 47.89% (182 out of 380) & about 28% (105 out of 380) were found to be illiterate.

Out of 380, 226 (59.47%) of respondents were married whereas about 37% of them were found to be either widow/widower, separated or divorced.

In terms of wealth index, majority i.e. 331 out of 380 (87.1%) were found to be categorized under "Below Poverty line" (BPL) by Govt. of Andhra Pradesh. About 296 out of 380 (78%) respondents reported that their sero-positivity is > 6 months while 22% were found to be recently infected i.e. less than 6 months.

Table 2 shows Comparison of loneliness & depression between Male and Female. Females are found to be lonelier & depressed in comparison to males. There is significant difference in loneliness between male and female ($p=0.003$) but no

Statistically significant difference in depression among both the sexes. Table 3 shows comparison of loneliness between Visakhapatnam and EG districts where it is seen that there is a significant difference in loneliness between Visakhapatnam district and East Godavari district ($p<0.05$) but there is no significant difference in depression between both districts ($p>0.05$)

Among those PLHIVs who are on ART, the loneliness is slightly more and depression was found to be less in comparison to those who are on pre ART. This was found to be insignificant ($p=0.599$, $p=0.563$)>0.05. (Figure 1)

Association of loneliness and Depression regarding some selected Demographic variables:

Age: There is an insignificant association in loneliness ($p=0.083$ >0.05), depression ($p=0.257$ >0.05) regarding age among PLHIVs.

Sex: Also there is an insignificant association in loneliness but significant association between depression and sex ($p=0.042$ <0.05)

Area of Prevalence: There is a highly significant association

of loneliness ($p=0.000$ <0.005), depression ($p=0.000$ <0.005) with the area of prevalence.

Education: There is a highly significant association of loneliness ($p=0.000$ <0.05), depression ($p=0.000$ <0.05) with educational status.

Marital status: There is highly significant association between loneliness and marital status. ($p=0.002$ <0.05).but no significant association with depression. ($p=0.075$ >0.05)

Duration of infection: There is no significant association between loneliness or depression ($p=0.064$ >0.05) and duration of infection.

Opportunistic Infection: There is a highly significant association of loneliness as well as depression with Opportunistic Infection, which is highly significant($p=0.000$ <0.05)

Wealth Index: There is no significant association between loneliness and wealth index. ($p=0.068$ >0.05) but there is a significant association with depression($p=0.035$ <0.05)

Table 1: (Frequency & percentage distribution of demographic variables of PLHIVs)

Sl. No	Demographic Variable	Frequency	%
1	Age		
	20-40	283	73.684
	40-60	94	24.73
	>60	3	0.7894
2	Sex		
	Males	164	43.157
	Females	216	56.842
3	Education		
	Primary	182	47.89
	Secondary	72	18.94
	High	16	4.210
	Professional	5	1.315
	Illiterate	105	27.631
4	Marital status		
	Married	226	59.473
	Unmarried	17	4.473
	Widow	110	28.947
	Widower	7	1.842
	Divorced	12	3.157
	Separated	8	2.105
5	Wealth index		
	BPL (below poverty line)	331	87.10
	APL (above poverty line)	49	12.89
6	Duration of infection		
	<=6 months	84	22.10
	>6 months	296	77.89

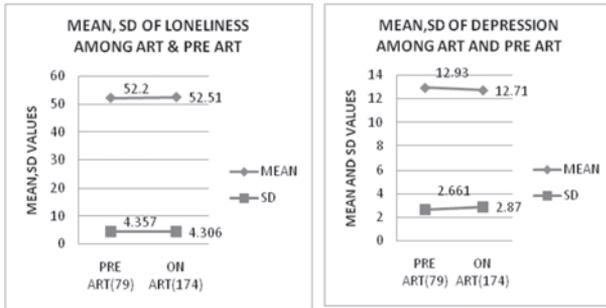
Table 2 : Comparison of loneliness & depression between Male and Female

Sex	Loneliness	Mean	SD	Depression	Mean	SD
Male	104	51.45	3.98	109	12.72	2.673
Female	149	53.09	4.425	164	12.81	2.898
$p=0.003 (<0.005)$				$p=0.804 (>0.05)$		

Table 3: Comparison of loneliness between Visakhapatnam and EG districts

Districts	Loneliness	Mean	SD	Depression	Mean	SD
Visakhapatnam (low prevalence)	110	53.05	4.477	114	12.68	3.113
East Godavari (high prevalence)	143	51.934	1.83	159	12.84	2.572
$p=0.041 < 0.05$				$p=0.656 > 0.05$		

Figure 1. Comparison of loneliness between ART and pre ART



Discussion

Among the total study sample, 73.68% of people belonged to the age group of 20-40. This distribution of age supports the national data⁽⁴⁾ of a higher prevalence among 15-49 yrs of age (89%).

Out of the 380 subjects, there were 216 (57%) female and 164 (43%) male. This observed gender distribution is as per the national data of People Living with HIV sex ratio of 60:40. About 37% of them were found to be either widow/widower, separated or divorced. Out of 216 female respondents, 50.9% of the females were widows and widowers were only 4.16%. A greater percentage of widows reflect the social and economic damage caused by the disease and the vulnerability of the female population to the scourge of mental illness like depression and loneliness. The mean values of the scores on both depression and loneliness scales in table 2 also showed a greater occurrence of depression and loneliness in the female population.

About 76% of subjects are either illiterate or have attained primary education in the study population. However, I.A. Kabbash, M. El-Gueneidy et al.⁽¹⁴⁾ In their study at Egypt found that 48% of respondents to be illiterate & primary educated. An educated person can easily gain information about the prevention and treatment of the illness. Education indirectly reveals the occupation and thus economic status of the person.

In our study also educational status showed a highly significant association with both loneliness and depression.

As the study was conducted in the ART centers and CCCs in NGO setups, majority of the participants were below poverty line classified under Govt. of Andhra Pradesh. Loneliness was independent to their financial index whereas PLHIVs are depressed irrespective of their financial index.

As per the study, in a low prevalent district; even though people feel lonely they are not depressed. The role of other contributing factors such as strong networking among PLHIVs, quality counseling, NGO support etc. can at times act as strong buffer.

Loneliness & depression also influence adversely on Prevention, Treatment and Care Outcomes. In preventive aspect, the focus is to control high risk behavior, higher rates of infections and higher rates of transmission. On treatment and care there will be limited access, low uptake and adherence to ART, high failure rate to routine checks. Clinical outcome can be HIV dementia, rapid AIDS progression and higher mortality. Stone V, et al⁽¹⁵⁾. in their study on depression & ART adherence found 69.2% non adherence to ART. Several other studies on the relationship between psychological factors and adherence to ART suggested significant association and low adherence^{(16) (17)(18)(19)}

Comparison of loneliness between pre ART and on ART showed that, among those PLHIVs who are on pre-ART, the loneliness is less and depression was found to be more. This may be due to the fact that once they are registered for ART they attend the "Community care centers" where they interact more with other PLHIVs who are on ART, NGOs and counselors. On the other hand, free access to ART & a hope

for quality life gives them some relief

Similarly in our study we also found that, Loneliness & depression are independent of the duration (> 6 months) of seropositivity which implies that those who feel lonely or depressed, the situation does not change over the time.

The present study also showed that those who suffer from one or more opportunistic infections, the loneliness & depression among them are present.

Conclusions and Recommendations

On the basis of results, the most vulnerable section among the PLHIVs i.e. the women can be given special attention and the gender issues, social issues, insecurities which contributes to loneliness & depression can be prioritized and addressed during the counseling sessions.

In the continuum care component, the counseling and networking can be focused more and the mental health issues can be addressed by making the services more approachable and user friendly & Policy makers can incorporate the mental health components in it. The WHO recommends that attention to the psychosocial needs of people with AIDS should be an integral part of HIV care⁽²⁰⁾.

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Ethical and Legal Issues in Research involving Human Subjects; What more can be done?

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Abstract

Biomedical research is conducted for the purpose of systematically collecting and analyzing data from which generalisable conclusions may be drawn that may aid in improving the care of currently unknown beneficiaries in the future. The conduct of human experimentation raises a large number of ethical and legal issues. In the past there were no guidelines or ethical concerns regarding the use of humans in bio medical research which resulted in large scale exploitation of the human subjects such as Nuremberg trial on prisoners, Tusegee Syphilis study (1932-1972) etc. After the world war II, many ethical principles were laid down starting from "The Nuremberg Code – (1947)" and the efforts are going on to make the practice of Biomedical research involving human subjects safe. This article traces the progress made in laying down the ethical principles and guidelines over the years and what more needs to be done. The literature on the subject is also reviewed.

Key Words

Human experimentation, Biomedical research, Ethical issues in human research, Legal issues in human experimentation.

Introduction

The conduct of biomedical research involving human participants raises a host of ethical and legal issues that have concerned philosophers, lawyers, policy makers, Scientists and clinicians for many years.

Biomedical research is conducted for the purpose of systematically collecting and analyzing data from which generalisable conclusions may be drawn that may aid in improving the care of currently unknown beneficiaries in the future.(1)

Historical Perspective of Ethics in Human Experimentations

- Edward Jenner (1749-1823) tested small pox vaccines on his son and neighborhood children.
- Johann Jorg (1799-1856) Swallowed 17 drugs in various doses to record their properties.
- World war II – Nuremberg trials on prisoners.
- Tuskegee Syphilis Study (1932-1972)

Tuskegee Syphilis study

American medical research project conducted by the U.S. Public health services from (1932 to 1972) examined the natural course of untreated syphilis in black American men. They were not told that they had syphilis, nor were they offered effective treatment.

Role of human participants: is to serve as a source of much needed data. This is different from clinical medicine in which diagnostic and therapeutic interventions are carried out solely to benefit the same patients.

Ethical Concerns: Use of human beings as experimental

subjects raises the following concerns(2)-

- Accurate assessment of benefits risk and harm
- Autonomy and respect for persons used as subjects
- Justice in the distribution of burdens, use of benefits and other research activities.

Evolution of Ethical Principles & Code

- The Nuremberg Code:** (1947)-after the trials on prisoners (World War II) the Nuremberg code was adopted with the following points.
 - Voluntary consent for participation
 - Benefits of the research outweigh the risks.
 - Ability of the subject to terminate participation at any time.
- Declaration of Helsinki:** (1964). This was adopted by the 18th world Medical Assembly, Helsinki, Finland, 1964. It contained Recommendations guiding Medical Doctors in biomedical research involving human subjects 'concern for the interests of the subjects must always prevail over the interests of science and society'
- The Belmont Report:** - (1979) The National Commission for the protection of human subjects of biomedical and behavioral research presented its report on April 18, 1979, which was termed the Belmont report, which contained Ethical Principles and guidelines for the protection of human subjects of research

In India also many Regulations were Framed, Namely

- Code of Medical ethics, MCI – 1956
- Policy statement on ethical considerations involved in research on human subjects – 1980
- Revised ICMR Guidelines – 2000
- Indian GCP guideline – 2001
- Amendment to drugs and cosmetics
- Ethical Guidelines for biomedical research on human subjects -Prepared by central Ethics Committee on Human Research (CECHR) – 2002 (3)
- Revised ICMR Guidelines – 2007.

Salient Ethical Values in Research: All the above guideline attempt to uphold the ethical values in research involving human subjects which are as follows:

- Beneficence (Doing Good)
- Non – Maleficence (Preventing or mitigating harm)
- Fidelity and trust within the fiduciary (Investigator/Participant relationship)
- Personal dignity
- Autonomy to informed, voluntary and competent decision making
- Privacy of Personal Information.

Informed Consent: will be obtained after giving the full information to the participants regarding.

- Purpose of research, its expected duration and the nature of any interventions/experiments.
- Anticipated risks and benefits of the participation.

- c. Confidentiality provisions relating to the research records.
- d. Any compensation and /or treatment available for research related injuries
- e. The right to not participate and to discontinue participation at any time without penalty
- f. Informed consent will be documented appropriately

Regulatory oversight in USA : American regulations governing the conduct of biomedical research involving human participants were published in 1981 by the federal department of health and human services (DHHS) (1)

- Research involving the testing of investigational drugs or medical devices in regulated concurrently by the federal food and Drug administration (FDA)
- Research to which the FDA regulations apply must be reviewed and approved initially by the institutional review board (IRB).

Approval of a Protocol for Human Research in USA

The institutional Review board (IRB) must determine that each of the following requirements

- a. Physical and Psychological risk to the subjects are minimized.
- b. Physical and Psychological risk to the subjects are reasonable in relation to the anticipated benefits.
- c. Selection of the subjects is equitable.

Similar guidelines are in place in India by the central ethics committee on Human Research (CECHR) Guidelines 2002, but there is no mechanism by which its implementation can be strictly monitored.

Law Suit: Private civil Law suits may be brought by a particular participant against research and protocol sponsors for breach of common law tort standards of care (that is medical malpractice) in the conduct of research involving and harming that participant.

Conclusion

Experimentation of human subjects is essential to scientific progress and the promotion of medical being. Research risks are unavoidable and the dangers in medicine and healthcare can be immense, International and National guidelines are in place, which offer safeguards to the human participants. However mere presence of ethical principles and guidelines does not ensure complete safety to the Participants. The persons or institutions involved in human experimentation must avoid any harm (Physical, mental, or Psychological) to the human participants. If any harm occurs, the participants should be treated and or compensated. National and International Regulatory bodies must be given more powers so that the Research involving human subjects in closely monitored and violation of ethical principle should be reported immediately and remedial action taken. These bodies should be given extra powers to stop the research project midway if the guidelines are being regularly violated. The legal provisions should be simplified so that if any harm is brought to the participants, the persons responsible may be prosecuted. These actions will ensure the safety of the human participants in the future.

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Biochemical and Histological Changes in Carbon Tetrachloride Toxicity

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Abstract

Carbon tetrachloride induced hepatotoxicity has been studied in Albino rats both histologically and biochemically. Ccl4 induced hepatotoxicity results in significant elevation of the transaminases biochemically and fatty change and hemorrhagic necrosis of liver histologically.

Key Words

Ccl4, transaminases, Fatty change, Hemorrhagic necrosis.

Introduction

Carbon tetrachloride was once used in the dry cleaning industry. Experimental poisoning with carbon tetrachloride (Ccl4) has an ancient and varied history and its hepatotoxic action has been reviewed by several workers (1, 2, 3). Yet the views on the mechanism of genesis of hepatotoxicity are still controversial.

The use of serum enzyme activities for human clinical diagnosis has increased greatly during the past several years (4, 5).

In the past it has also been reported that serum transaminases and alkaline phosphatase activity has been found to be altered in certain pathological conditions which were associated with necrosis or other type of cellular damage of cardiac, hepatic or skeletal muscle tissues (6, 7, 8). The activity of glutamic pyruvic transaminases (SGPT) was found to be relatively greater in liver than in other tissues as compared to the activity of glutamic oxaloacetic transaminase (SGOT) and alkaline phosphatase (9, 10).

This might perhaps suggest that the SGPT might possibly be a more specific index of liver cell damage than the SGOT, because of its relative concentration in the hepatic tissue. The assessment of liver function by estimation of serum enzyme changes in toxicity and histologically detectable organ damage due to carbon tetrachloride has been reviewed.

Material and Methods

Experiments were performed in 10 male Albino rats weighing between 100 to 130 Gms.

They were divided into two groups – Group 1 and Group 2. Group 1 formed the control which received 2ml of distilled water orally while Group 2 formed the test group which received Ccl4 (0.2 ml/kg) orally. After a period of 24 hours the Serum of both the control and drug treated groups was collected and the liver transaminases (SGPT and SGOT) and alkaline phosphatase were estimated according to the method of Reitman's and Franket (1957)⁽¹¹⁾.

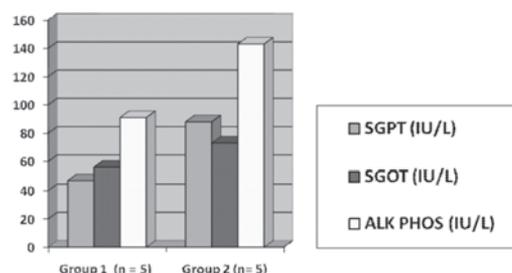
The animals were later sacrificed; a piece of liver was collected and put in 10% formalin. The tissue was processed by routine processing and stained by haematoxylin and eosin stain and examined under light microscope to ascertain the degree of liver damage.

Results

The activities of SGOT, SGPT and Alkaline phosphatase were higher in the Ccl4 treated group than in the control group (table 1). Histological examination showed fatty change and hemorrhagic necrosis in Ccl4 treated rats (figure 1) and normal histology in distilled water received rats (figure 2).

Table 1

	Group 1 (n = 5)	Group 2 (n= 5)
SGPT (IU/L)	47	88
SGOT (IU/L)	56	73
ALK PHOS (IU/L)	91	143



SGPT – Serum Glutamic pyruvic transaminase; SGOT - Serum Glutamate oxaloacetic transaminase; ALK PHOS – Alkaline phosphatase.

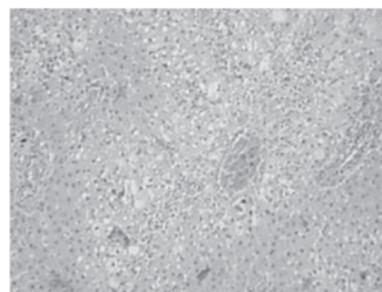


Figure 1: Fatty change and hemorrhagic necrosis (H&E, x 100)

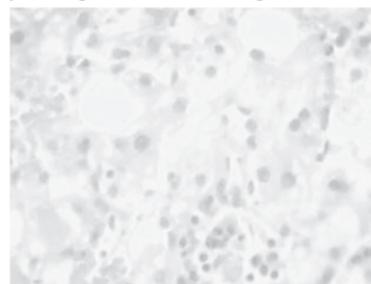


Figure 2: Fatty change and hemorrhagic necrosis (H&E, x400).

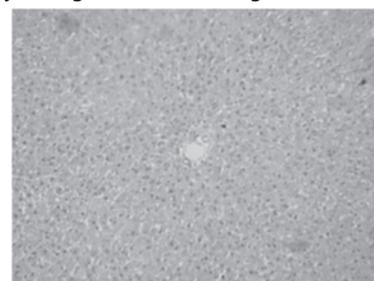


Figure 3: normal appearing hepatocytes (H&E, x 100)

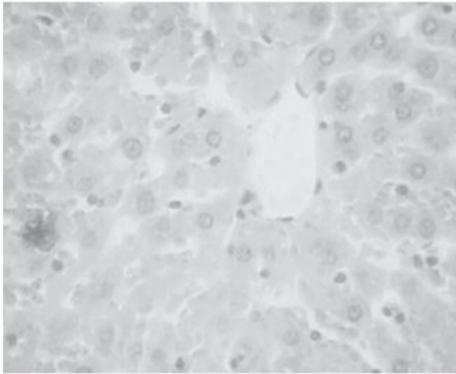


Figure 4: Normal appearing hepatocytes (H&E, ×400).

Discussion

The study showed that there was an increase in the serum transaminase and Alkaline phosphates levels in the animals treated with CCl₄. This elevation could be explained on the basis that CCl₄ caused necrosis of the liver cells. It is known that as a result of necrosis of the hepatic cells, these enzymes are released into circulation with consequent rise in the serum levels^(12, 13). The toxic effect of CCl₄ is due to its conversion by p-450 to the highly reactive toxic free radicals CCl₃ (CCl₄ + e = CCl₃ + e⁻). The free radicals produced locally cause auto oxidation of the polyenoic fatty acids present within the membrane phospholipids. There, oxidative decomposition of the lipid is initiated, and organic peroxides are formed after reacting with oxygen. This reaction is autocatalytic in that new radicals are formed from peroxide radicals themselves. Thus, rapid breakdown of the structure and function of the endoplasmic reticulum is due to decomposition of lipid. It is no surprise; therefore, that CCl₄ induced liver injury is both severe and extremely rapid in onset. Lipid export from the hepatocytes is reduced owing to their inability to synthesize apoprotein to complex with triglycerides and thereby facilitate lipoprotein secretion. The result is the fatty liver of CCl₄ poisoning. Mitochondrial injury then occurs, and this is followed by progressive swelling of the cells due to increased permeability of the plasma membrane. Plasma membrane damage is thought to be caused by relatively stable fatty aldehydes, which are produced by lipid peroxidation in the smooth endoplasmic reticulum but are able to act at distant sites.

This is followed by massive influx of calcium and cell death⁽¹⁴⁾.

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Wound Photography: A Step Towards Reality

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Abstract

Different branches of Medical specialties are adopting latest technologies in their clinical practice in Wound documentation. We need to change our approach in our basic documentation. In wound documentation we still use word format to explain the nature of injury. Photographs can convey a very simple manner what hundreds of properly coined words may not be able to convey. Present article is a step forward to substantiate the importance of use of Photography in routine Medical practice.

Key Words

Wound, Photograph, Documentation.

Introduction

Medical profession requires accurate data for evaluation. With the advancement of technology with modern techniques, we still adopt old age technique for describing the wounds in medical profession in the form of words and sketches. This approach needs to be updated in line with the advancement of technology. One such latest approach in wound documentation is the use of photographs.

For a doctor, who works in Causality department, definitely it strikes to the doctor's mind: Is there is any other way of recording the wounds other than in Word format?. This is because we come across more complicated injuries and also different types of wounds incurred in different situations like blast injuries, calamities etc.

Recording such injuries becomes difficult, time consuming and hinders in facilitating urgent treatment. Recording such injuries by photographs is an alternative additive approach for describing the wounds. This is an easy technique to adopt with latest equipments for accurate imaging, diagnosis, evaluation and presentation of wounds in Medical profession. ¹

Advantages of Wound Photograph ²

- Record: Taking photograph is very quick especially in cases of mass casualties. It gives ample time to see more cases. Recorded wounds can be seen later and presented in words as when required.
- Not an expensive method.
- Planning the treatment course.
- Recollecting the wound.
- Understanding type of injuries suffered by the patient earlier.
- To illustrate and supplement the written medicolegal and/or medical record.
- To teach undergraduate and postgraduate medical students.

Discussion

Following points needs to be addressed for thorough documentation of wounds ³:

- They should be in color preferably, in focus, adequately

illuminated and taken by a good quality camera, preferably by a professional.

- Each photograph should contain a ruled reference scale, an identifying case name or number.
- Serial photographs reflecting the course of the essential examination prior to and following undressing, washing etc must be included.
- Close up photographs should be supplemented with distant and/or immediate range photographs to permit orientation and identification of close-up photographs.
- All photographs should be comprehensive in scope and must confirm the presence of all demonstrable signs of injury or disease commented at the time of injury.

Questions and challenges one must be ready regarding admissibility of the photographs include ⁴:

- Exactly where and when the photograph was taken.
- Exactly what the photographs depicts.
- The exact anatomical location of the wounds.
- The type of camera, film used, filter used on lens.
- Whether the photographs of wounds were obtained by informed consent or implied consent.
- Where the film was developed and if it represents the hospital's standard protocol.

Recent Advances ⁵

Photogrammetry of wounds is being used increasingly in some countries to photograph the scene of occurrence of wounds.

Digital camera does offer some advantage over traditional slide- and print films. Digital images are easily stored, e-mailed, and exported into multimedia presentations. A digital image can be easily converted to a slide or print. The digital image can be easily manipulated either for enhancement or alteration.

Reflective Ultraviolet photography (RUV) is useful to capture the details associated with the surface of the skin and highlights the surface aberrations associated with the injured skin. Since ultraviolet (UV) penetrates only a few microns into the surface of the skin, capturing photographic images utilizing RUV requires the use of a light source that emits a strong band of UV light, a band-pass filter on the front of lens that allows only UV light to reach the film, a film that has sensitivity to the UV spectrum and a lens that does not have a filter to block the transmission of UV light.

Infrared Photography (IR) can help capture the photographs of injuries below the skin for example subcutaneous extravagated blood as the IR light is capable of penetrating upto 3mm below the surface of the skin and is strongly absorbed in the blood. The IR photographs, when viewed in comparison to UV or Visible light photographs, will appear slightly fuzzy looking because the image being photographed is not on the surface.

Sketches: Sketches are handy in depicting a scene of occurrence of wounds. In combination with the photographs, the sketches provide an ideal presentation of the scene.

1. They indicate inter-distances between relevant objects.
2. They indicate relevant evidence only.

Conclusions

Wound photographs can convey in a very simple manner what hundreds of properly coined words may not be able to convey. According to Andreas Feininger, "a good photograph is one which conveys to the observer something which he has not seen, known, or thought before—". Surgical photography of wounds can be used to document the surgical procedures associated with plastic and reconstructive surgeries. Photographic documentation also assists surgeons in their teaching and publishing needs during their routine practice. Photographs when taken must ensure the privacy and confidentiality of the patients. The photographs can be further stored digitally and be reproduced for further reference with the click of a button. Therefore, photography of wounds will definitely provide

useful information to the doctor and is superior when compared to word documentation alone.

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Profile of Poisoning Cases autopsied at District Government Hospital, Davangere

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Abstract

Deaths due to poisoning are on the rise today. Early and effective treatment will hold the key for survival. Males (70.19%) were more commonly involved as compared to females (29.81%). Maximum number of victims (37.74%) were in the age group of 21-30 years, from rural area (56.23%) and 66.03% were married. Organo-phosphorous poisoning (63.77) was most commonly consumed by the victims and 69.43% were suicidal poisoning. Detection of type of poison and commonly used poisons by the victims will help to effectively treat and reduce the mortality due to poison.

Key Words

Poisoning, organo-phosphorous, manner of death, Suicide

Introduction

Paracelsus (1493-1541) the father of toxicology wrote, "All things are poisons and there is nothing that is harmless, the dose alone decides that something is no poison".¹ Agrochemicals (insecticides, pesticides and rodenticides) are a group of chemicals used predominantly in agriculture against insects, vectors, rodents, etc. it is evident that agrochemicals are used for variety of benefits it provides to mankind.² Hundreds of active ingredients and tens of thousands of formulations are used to control agricultural pests and disease-carrying vectors. It is estimated that more than 50,000 people die every year from toxic exposure in India.³ Poisoning from occupational, accidental and intentional exposure is a major public health problem in India. Many factors affect the outcome including the degree to which the poison's toxicity is understood, the speed in which patient comes to clinical attention and the availability of effective medical treatment. Present study was taken up to identify the more common causative agents which can provide a practical guide for the general practitioners and hospital staffs towards the management of poisoning cases..

Materials and Method

This study is a prospective study conducted at mortuary of District Government hospital, Davangere, between January 2008 to December 2008, which included 265 deaths due to poisoning. A detailed autopsy was conducted on these victims and all the data was entered in a proforma. The details regarding the manner of death were decided upon the inquest report and direct interrogation with the relatives and police. The stomach wash and viscera was sent to the Regional Forensic Science Laboratory (RFSL), Doddabathi which is nearer to Davangere city and the poison was confirmed by the chemical analysis report. The data thus obtained was analyzed and the study was done with respect to age, sex wise distribution of cases, marital status, manner of death and the most common poison involved.

Results

The data with respect to the age and sex wise distribution of poisoning cases showed that, out of 265 cases, 186(70.19%) were males and 79(29.81%) were females. The maximum number of victims, 37.74% was in the age group of 21-30 years, followed by 17.36% in the age group of 11-20 years and 15.47% in 31-40 years. Among the 186 males, the maximum numbers of victims were in the age group of 21-30 years which included 37.63% followed by 31-40 years which included 16.13%. Among the 79 female victims, the maximum of victims, 37.97% were in the age group of 21-30 years, followed by 24.05% cases in the age group of 11-20 years, and 13.92% in 31-40 years. (Table-1)

Table 1. Age and sex wise distribution of poisoning cases

Age(In Years)	Male		Female		Total	Percentage
	Number	Percentage	Number	Percentage		
0-10	3	1.61	2	2.53	5	1.89
11-20	27	14.52	19	24.05	46	17.36
21-30	70	37.63	30	37.97	100	37.74
31-40	30	16.13	11	13.92	41	15.47
41-50	29	15.59	8	10.13	37	13.96
51-60	18	9.68	5	6.33	23	8.68
>60	9	4.84	4	5.06	13	4.91
Total	186	70.19	79	29.81	265	100

On comparing rural/urban subdivide of cases showed that 56.23% were from rural as compared to 43.77% from urban area. (Table-2)

Table 2. Area wise distribution of cases of poisoning

Area	Number of Case	Percentage
Urban	116	43.77
Rural	149	56.23
Total	265	100

On comparison of marital status and the poisoning deaths, overall in 66.03% cases the persons were married and in 33.96% cases they were unmarried. In among the males, 63.98% males were married and 36.02% were unmarried. Likewise, in among the females, 70.89% of females were married and 29.11% were unmarried females. (Table-3)

Table 3 : Comparison of poisoning cases with respect to marital status

Status	Male		Female		Total	Percentage
	Number	Percentage	Number	Percentage		
Married	119	63.98	56	70.89	175	66.03
Un-married	67	36.02	23	29.11	90	33.97

The data with regard to the mode of poisoning and marital status showed that suicidal poisoning was seen in 69.43%, accidental poisoning in 30.19% and homicidal poisoning in 0.38% of cases. (Table-4)

Table 4: Manner of death due to poisoning

Manner	Number	Percentage
Suicidal	184	69.43
Accidental	80	30.19
Homicidal	01	0.38
Total	265	100

The cases confirmed by chemical analysis report from RFSL

showed that out of 265 poisoning cases sent for analysis, poison was detected in 249(93.96%) cases. The commonly encountered poison was Organo-phosphorous 169 (63.77%) followed by Organo-chlorine 33(12.45%), Alluminium phosphide 21(7.92%), Alcohol 16(6.03%), Carbamates 6(2.26%), Zinc Phosphide

Table 5 : Distribution of poisoning cases according to the type of poison detected at chemical analysis

Sl No	Type of poison	Number of cases	Percentage of cases
1	Organo-Phosphorous	169	63.77
2	Organo-chlorine	33	12.45
3	Aluminum Phosphide	21	7.92
4	Carbamates	6	2.26
5	Zinc Phosphide	2	0.75
6	Alcohol	16	6.04
7	Benzo diazapines	1	0.37
8	Barbiturate	1	0.37
9	Undetected poisons	16	6.04
	Total	265	100

2(0.75%), Benzodiazapine 1(0.37%), Barbiturate 1(0.37%) and in 16(6.03%) cases the poison was not detected by chemical analysis. (Table-5)

Discussion

The incidence of deaths due to poisoning is ever increasing despite the advances in the treatment facilities. Mortality is on the rise in the developing countries like India where agrochemicals are deliberately used. In our study males (70.19%) are commonly involved as compared to (29.81%) females. Similar results were obtained in the study conducted at Department of Forensic Medicine, Shri. M. P. Shah Medical College, Jamnagar where Males were more prone to death by poisoning (62.1%) compare to females (37.9%).⁴ Similarity was observed in the study at Gandhi Medical College, Bhopal, where 71% of the cases were males and 29% were females.⁵ Males being the daily bread winners of the family, are subjected to more stress and strain of life and will take up the extreme step.

Maximum number of deaths was in the age group of 21-30 years (37.74%) among both the sexes. Similar results were observed at M.K.C.G. Medical College Hospital, Berhampur where 40.5% of cases were seen in 21-30 years, followed by 21.6% in 31-40 years and 20.9% in the age group of 11-20 years.⁶ This age of 21-30 years being most active will work without any protective measures at fields and being subjected to physical, mental and social stress will make up their mind to end their life.

In our study, among the males, the maximum numbers of victims were in the age group of 21-30 years which included 37.63% followed by 31-40 years which included 16.13%. Among the female victims, the maximum of victims, 37.97% were in the age group of 21-30 years, followed by 24.05% cases in the age group of 11-20 years and 13.92% in the age group of 31-40 years. Similar results were observed in the study at District and Al Ameen Medical college hospitals of Bijapur where males were involved in 44% between 21-30 years, 28% between 31-40 years and 11% between 11-20 years. Among the females 40% were in the age 21-30 years, 12% in the age 31-40 years and 37.33% in the age 11-20 years.⁷ Similar results were seen in the study at Government Wenlock Hospital, Mangalore where Majority (53%) of victims with suspected use of poison were in between 21-40 years followed by the age group between 1-20 years (25%).⁸ The incidence among the teens are quite on the substantial rise because they being more sensitive, struggling to adapt to the stress at schools and colleges will commit suicide.

In our study, rural/urban subdivide of cases showed that 56.23% were from rural as compared to 43.77% from urban area. Similar results were observed in the study at central mortuary of F. M. & T. Department of M.K.C.G. Medical College, Berhampur, where 58.2% were from rural and 41.8% were from

urban area.^{6,4} Similar results were found in the study at Malwa region, Punjab where 64% were from rural and 36% were from urban area.⁹ The ease of availability of poisons in every house of rural India, is the reason for more number of rural victims.

In our study, overall in 66.03% cases the persons were married and in 33.96% cases they were unmarried on comparison of marital status and the poisoning deaths. Our study showed that, 63.98% males were married and 36.02% were unmarried and 70.89% of females were married and 29.11% were unmarried females. Similar results was also found by the study conducted in the Department of Forensic Medicine, Shri M. P. Shah Medical College, Jamnagar where 57.2% were married and 42.45 were unmarried. Among the males, 52.4% were married and 47.6% were unmarried. Among the females, 66% were married and 34% were unmarried.⁴ Married men and especially women are subjected to more stress in life due to poverty, dowry menace will commit suicide.

In our study, results of the manner of poisoning deaths showed that suicidal poisoning was seen in 69.43%, accidental poisoning in 30.19% and homicidal poisoning in 0.38% of cases. Similar observations was made by the study conducted in the Department of Forensic Medicine, Shri M. P. Shah Medical College, Jamnagar where suicidal deaths was seen in 68.2%, accidental poisoning in 31.1% and unknown in 0.7%.^{4,7} Again the factors like stress, dowry, and ease of availability is to be blamed for increase in suicidal poisoning.

In our study poison was detected in 249(93.96%) cases out of all the 265 cases sent for chemical examination. The commonly encountered poison was Organo-phosphorous 169 (63.77%) followed by Organo-chlorine 33(12.45%), Aluminum phosphide 21(7.92%), Alcohol 16(6.03%), Carbamates 6(2.26%), Zinc Phosphide 2(0.75%), Benzodiazapine 1(0.37%), Barbiturate 1(0.37%) and in 16(6.03%) cases the poison was not detected by chemical analysis which included animal bites and undetected drugs and poisons. Similar observations was made in the Department of Forensic Medicine, Shri M. P. Shah Medical College, Jamnagar, where organo-phosphorous poisoning was confirmed in 62.24% cases, organo-chlorine in 6.13%, Aluminum Phosphide in 14.28%, Carbamates in 4.08%. No poison was detected by the chemical examiner in 7.37% of cases and in 85.2% cases the poison was detected and the rest of the cases the report was yet to be received.⁴ The Organo-phosphorous clearly is largely used by our agricultural laborers' and so its incidence is quite high even in our study.

Conclusion

Agrochemical poisons, particularly organo-phosphorous are responsible for deaths in the majority of cases; but organo-phosphorus compounds are important to sustain crop production in a country like India where pests and rodents at large will destroy the crops. Some preventive measures by the Government agencies should be taken with respect its storage, handling and marketing. The ease of availability in every house in the rural area will result in more number of suicidal deaths, besides careless handling of these insecticides during spraying without protective measures will result in accidental poisoning. The need for quicker detection of the poison with the help of Poison Information center (PIS) will help in accurate diagnosis and treatment.

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Potter Sequence-Role of Perinatal Autopsy in Diagnosis

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Abstract

Congenital malformations of kidney and urinary tract in the fetus are one of the commonest causes for development of oligohydramnios in antenatal life. Oligohydramnios, present over a prolonged period of time can result in compression deformities of the fetus that have been collectively termed as potter sequence. A retrospective study of 24 perinatal autopsies presenting with a history of oligohydramnios was done to evaluate the relative frequencies of congenital malformations and their association with potter sequence. We observed that 8 out of 12 cases of potter sequence were having an underlying congenital anomaly of kidney and urinary tract, whereas in the rest 4 cases of potter sequence the pathogenesis of oligohydramnios can be attributed to non renal causes. We also observed 4 cases of congenital malformations of kidneys that were not severe enough to produce potter sequence. We recommend that a meticulously done perinatal autopsy, in the light of thorough clinical and ultrasonological findings can yield a wealth of information regarding precise diagnosis of congenital malformations.

Key Words

Oligohydramnios, Potter sequence, Perinatal autopsy, Congenital anomalies.

Introduction

Congenital malformations remain a common cause of perinatal deaths and account for 25–30% in developed countries and 10–15% in developing countries like India. In all, 3% of neonates have a major congenital malformation and 0.7% have multiple congenital malformations.¹The proportion of perinatal deaths due to congenital malformations is increasing as a result of reduction of mortality due to other causes owing to the improvement in perinatal and neonatal care.²Currently, the autopsy rates are declining due to various factors. However, it has been shown that autopsy can change the clinical diagnosis or add significant information to it in a high proportion of cases³.

Since long oligohydramnios has been correlated with adverse perinatal outcome, such as increased risk of intrauterine growth restriction, congenital abnormalities, postdated pregnancy, meconium passage, abnormal fetal heart rate patterns, and lower Apgar scores.⁴

The oldest and simplest explanation for the origin of amniotic fluid is attributed to Hippocrates who is reported to have held that such fluid is the product of the fetal kidneys. There is evidence that fetal urine significantly contributes to the volume of amniotic fluid.⁵In late pregnancy the finding of oligohydramnios often indicates that the fetus in utero is suffering from a gross renal abnormality or from an obstructive lesion in the lower urinary tract.⁶

Potter sequence or oligohydramnios sequence comprises the consequences arising when kidney development in the fetus is absent or defective. It includes pulmonary hypoplasia, characteristic facial traits and other growth anomalies.⁷In the present study we review the congenital anomalies of kidneys and urinary tract detected at perinatal autopsy and their role in causation of oligohydramnios sequence.

Material and Methods

A retrospective study was done at the Department of Pathology, J J M Medical College, Davangere, Karnataka for a period of four years from Jan 2007 to Dec 2010. A total of 81 perinatal autopsies were conducted during this period of which 24 cases had a history of oligohydramnios diagnosed antenatally. The diagnosis of oligohydramnios was based on ultra sonological estimation of amniotic fluid index (AFI). AFI was obtained sonographically by dividing the maternal abdomen into four quadrants; the linea nigra was used to divide abdomen into right and left halves and umbilicus was used to separate upper and lower halves. The largest amniotic fluid pocket was identified in each quadrant and its vertical diameter taken. All four vertical diameters were summed up to obtain AFI in cm. Single deepest pocket (SDP) of less than 2 cm and amniotic fluid index (AFI) of less than 5 cm or less than the fifth percentile were taken as the criteria for diagnosis of oligohydramnios. Detailed obstetric history, autopsy findings and final autopsy report were obtained from the autopsy records of the department. The results were tabulated and analyzed.

Observations

In the present study the total number of cases diagnosed to be having oligohydramnios were 24, out of these 17 cases (70.83%) were diagnosed in the second trimester of pregnancy and the rest 7 cases (29.16%) were diagnosed in the third trimester. On ultrasonological examination 12 cases (50%) had anomalies of kidney and urinary tract which was confirmed on perinatal autopsy. 8 cases among these 12 cases had manifestations of potter sequence characterized by typical potter facies (Fig 1) and limb deformities. There were 4 cases of potter sequence in the present study which did not have any underlying anomaly of kidney and urinary tract, the cause for oligohydramnios in such cases being non renal in origin. Bilateral pulmonary hypoplasia was detected on ultrasound and confirmed on autopsy in 5 cases



Fig 1: Potter Fig 2: Low set ears Fig 3: ADPKD (20.8%). Limb malformations in the present series were seen in 7 cases (29.16%).

Discussion

Amniotic fluid is necessary for fetal development. Fetuses with insufficient fluid volume often develop oligohydramnios sequence, characterized by features of facial compression like loose skin folds, especially beneath the eyes, flattened and beaked nose, large, flat, low set ears (Fig 2), pulmonary hypoplasia and positional deformities such as asymmetric

Table 1: Table showing USG and autopsy findings in cases with renal anomalies that presented without potter sequence

Sl.No	USG findings	Gross findings of kidneys	Histopathology of kidneys	Renal anomalies
1	Multicystic kidneys, oligohydramnios	Both kidneys enlarged with superficial cystic spaces, hypoplastic ureter and bladder	Enlarged kidneys with dysplastic features	B/L cystic Renal dysplasia
2	Oligohydramnios, renal cysts	Multiple cysts seen over the surface of kidneys and also throughout the parenchyma	Cysts lined by variable lining epithelia with papillary projections in occasional cysts	ADPKD (Fig 3)
3	Oligohydramnios, Left kidney not visualized Right kidney enlarged	Multicystic kidney (right) Renal agenesis (left)	Unilateral right kidney with dysplastic features	U/L Cystic renal dysplasia
4	Oligohydramnios	Both kidneys are hypoplastic, ureter and bladder-U/R	Kidneys appear U/R	B/L Hypoplastic Kidney

Table 2: Table showing USG and autopsy findings in cases with renal anomalies that presented with potter sequence

Sl.No	USG findings	Gross findings of kidneys	Histopathology of kidneys	Renal anomalies
1	Oligohydramnios, potter facies, clubfoot, camptodactyly		U/R	U/R Nil
2	Oligohydramnios, potter facies, clubfoot, spade like hands		U/R	U/R Nil
3	Oligohydramnios Nonvisualization of kidney, clubfoot, camptodactyly	Bilateral renal agenesis	No kidney tissue identified	B/L Renal agenesis
4	Severe oligohydramnios Large echogenic kidneys Nonvisualization of bladder	Grossly enlarged kidney, maintained reniform shape, tiny cysts visible on external surface	Kidney—elongated cysts radiating from cortex to medulla lined by cuboidal to flattened lining epithelium	ARPKD
5	Severe oligohydramnios Non visualization of kidney, clubfoot, camptodactyly	Potter facies, absent kidney on both sides, absent ureter and bladder	No kidney tissue identified	B/L Renal agenesis
6	Severe oligohydramnios, nonvisualization of kidneys, clubfoot, spade like hands	Bilateral renal agenesis, absent ureter, severe hypoplastic bladder	No kidney tissue identified	B/L Renal agenesis
7	Severe oligohydramnios Dilated bladder Dilated pelvicalyceal system, clubfoot, spade like hands	Dilated thin UB Hydroureter	Tiny Cortical renal cysts communicating in places, small immature tubules lined by cuboidal epithelium and surrounded by a collar of mesenchyme. No heterologous tissue identified	Posterior urethral valves
8	Oligohydramnios, potter facies, clubfoot, camptodactyly		U/R	U/R Nil
9	Bilateral enlarged kidney with cystic spaces, severe oligohydramnios,	Bilateral enlarged kidneys with elongated cysts perpendicular to the surface and bladder normal	Kidney—elongated cysts radiating from cortex to medulla lined by cuboidal to flattened lining epithelium	ARPKD
10	Oligohydramnios, potter facies		U/R	U/R Nil
11	Oligohydramnios, potter facies, single kidney visualized	Single kidney seen, Left side-U/R	Single kidney-U/R	U/L Renal agenesis
12	Oligohydramnios, potter facies, renal cysts	Multiple fusiform cysts seen arranged radially at corticomedullary junction	Cysts are lined by low cuboidal epithelium	ARPKD

U/L-unilateral, B/L-bilateral, U/R- unremarkable, ARPKD-autosomal recessive polycystic kidney disease, ADPKD-autosomal dominant polycystic kidney disease.

Table 3: Table showing the frequency of congenital anomalies of kidney and urinary tract in the present study.

Sl. no.	Anomalies	Number
1	B/L renal agenesis	3
2	U/L renal agenesis	1
3	U/L renal dysplasia	1
4	B/L renal dysplasia	1
5	ADPKD	1
6	ARPKD	3
7	B/L hypoplastic kidneys	1
8	Posterior urethral valves	1
9	Total	12

club feet, major joint contractures, and broad, flat hands with redundant skin. Although oligohydramnios (or Potter) sequence was initially described in neonates with renal anomalies [Potter, 1946], other causes of oligohydramnios such as premature rupture of membranes (PROM) or uteroplacental circulatory disorder lead to the same final result.⁸

Potter syndrome is considered to be the paradigm for a birth defect "sequence" in which a primary malformation results in a series of secondary birth defects. In the case of bilateral renal agenesis/hypoplasia/dysplasia, the primary malformation is an intrinsic error of renal development with the other features of Potter syndrome resulting from intrauterine deformation due to oligohydramnios. It should be noted, however, that Potter syndrome may also be the result of obstruction of urinary excretion caused by a primary abnormality of the lower urinary tract.⁹

An accurate and reproducible method of determining abnormality in amniotic fluid volume (AFV) is sonographic assessment of amniotic fluid index (AFI). An AFI less than or equal to 5 cm, consistent with most sonographic criteria has been used as an indication for delivery of infants at or near term.¹⁰

In the present study anomalies of kidney and urinary tract and limb anomalies were the commonest malformations, similar results were observed by Stoll et al.¹¹In the present series of fetal autopsies anomalies of urinary system were noted in 12 out of 24 cases of oligohydramnios which is comparable to the results obtained by Lee et al who observed fetal renal anomalies in 11 out of 18 cases of oligohydramnios.¹²The nonrenal features of Potter syndrome are all secondary manifestation of prolonged fetal compression due to oligohydramnios. The oligohydramnios is usually due to renal agenesis or some other defect in the urinary system such that urine production or flow into the amniotic space is grossly deficient.¹³

Anomalies of urinary tract were observed in 8 out of 12 cases of potter sequence encountered in the present study, in the remaining 4 cases the pathogenesis of potter's sequence can be attributed to non-renal causes of chronic oligohydramnios, which were not elicited due to lack of data. However, Scott et al observed anomalies of urinary tract in lesser proportion of cases (28/60) in their study of potter sequence.¹⁴ In our study the commonest congenital anomalies of kidney and urinary tract were B/L renal agenesis and ARPKD (table 3), whereas in the data presented by a series from mayo clinic multicystic renal dysplasia and ARPKD were the commonest anomalies.¹⁵

Pulmonary hypoplasia was seen in 5 out of 12 cases of potter's sequence in the present study. In oligohydramnios, neonatal survival is highly conditioned by pulmonary hypoplasia which, in cases with severe reduction in the amniotic fluid volume, can reach the frequency of 21%. The etio-pathogenesis of this severe neonatal respiratory disease seems related to the compression of the ribcage, absence of respiratory movements, loss of pulmonary amniotic fluid and reduced perfusion of the fetal lungs.¹⁶ Wigglesworth and Desai showed that the hypoplastic lungs associated with oligohydramnios had narrow airways and there was a failure of elastic tissue development round the airways and terminal sacs.¹⁷

Conclusion

Our study demonstrates that a thoroughly performed perinatal autopsy with relevant clinical and ultrasonological findings can facilitate in the diagnosis of congenital malformations in the fetus. We recommend that perinatal autopsies of fetuses with antenatal history of oligohydramnios be performed with special emphasis on anomalies of renal and musculoskeletal system, as they constitute the commonest associations with oligohydramnios.

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Biocrime: Neurochemicals in Criminal and Anti-Social Behavior

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Abstract

How do some people decide to commit a crime? Do they think about the benefits and the risks? Why do some people commit crimes regardless of the consequences? Why do others never commit a crime, no matter how desperate their circumstances? Throughout history people have tried to explain what causes abnormal social behavior including crime. Some recent bio-forensic studies have found that certain neurotransmitter, neurochemicals imbalances in the brain such as low serotonin, and certain hormone imbalances such as extra testosterone, are associated with some greater likelihood of committing crime.

Criminal behavior has always been a focus for psychologists due to the age old debate between nature and nurture. Is it the responsibility of an individual's genetic makeup that makes them a criminal or is it the environment in which they are raised that determines their outcome? Research has been conducted regarding this debate which has resulted in a conclusion that both genes and environment do play a role in the criminality of an individual. This evidence has been generated from a number of twin, family, and adoption studies as well as laboratory experiments. Furthermore, the research has stated that it is more often an interaction between genes and the environment that predicts criminal behavior. Having a genetic predisposition for criminal behavior does not determine the actions of an individual, but if they are exposed to the right environment, then their chances are greater for engaging in criminal or anti-social behavior. Therefore, this paper will examine the different functions that genetics and the environment play in the criminal behavior of individuals.

Key Words

Biocrimes, Neurochemicals, Gene, Anti-Social behavior, Environment

Introduction

In the early part of the present century it was a very popular notion that criminality is hereditary. According to this notion those who commit have particular criminal traits in connection with this contention. We can mention the Hobrosian doctrines which maintain a close relationship between physical structure and criminal behavior. Lambroso and his followers have used comparison of criminals and savages and they come to the conclusion that criminal are born. Dugdale and Estrabrook have extensively used family trees in the effort to prove that criminality is inherited. Study of Dugdale and Estrabrook thus pointed out that criminal traits appear in successive generations. Karl Rath in his study of family history has attempted to demonstrate that criminality in successive generations appears in accordance with Mendelian ratio. Lambroso and his followers have insisted that criminal have certain physical traits. According to them criminals are characterized by certain stigma. So then the criminal constitute an inferior biological type. Similarly according to Hootan there are differences between prisoners and non prisoners. He comes to the conclusion that the primary cause of crime is biological inferiority. New Lambroso theory mentions that mental defectiveness is the main causes of crime. In other

words the roots of crime are based on mental pathologies namely, feeble mindedness, insanity, neuropathy conditions and psychopathic personality.

In some cases, however, one of the other of these environments may be primarily responsible for the behavior, as when an individual with no observable psychological or biological peculiarities succumbs to the influence of antisocial companions. Our concern here is with cases at the other end of the biosocial, spectrum, namely, those instances in which pathological internal environments appear to dominate- in which the major causative role may be assigned to biological conditions. Research show that heredity may account for as much as 50% of the variance in scores achieved on various measures of personality (Dworkin et al., 1976) for instance, found heritability intimates of 56 to 72% on questionnaires measuring aggression, altruism, assertiveness, empathy, and nurturance, over 25 studies have been published since Rosenthal review (1975) of research in this area. Genetics, which is a study of biology involving heredity and different traits, is questioningly being incorporated into criminality research. This new area of study revolves around the controversial possibility that anti-social characteristics are inherited. The relevancy of biology to the study of crime seems to be justified and researchers are presently developing the ground work. Researchers have divided the study of genetics and crime into four different categories: family studies, twin studies, adoption studies and crime environment interaction studies. Considerations such as social, political or treatment implications as well as the financial and emotional impact that criminals have on society must be taken into account when studding the relationship between genetics and crime. Lambroso (1918) was one of the first investigators to assess the possible connections between heredity and crime through the study of phrenology. He said that criminals were a throwback of an earlier development stage of mankind acknowledged by the slanting foreheads and protruding jaws. Sheldon (1942) is credited with developing the first genetic theory of criminality which eventually led to the XYY sex chromosome theory in the early 1960s. A handful researchers have introduced this topic so far and because of their pioneer ship, many more will have an easier path to follow in the study of genetics and crime. The history of criminology does not reflect early beginning as found in medicine and biology. In the 1920 the term criminology was used to apply to sociology. Criminology started with the school of Lambroso and others in an attempt to apply science to the study of human behavior. The main figures in this movement were Charles Darwin, Ceaser Lambroso, Gregor Mendel, and Sigmund Freud, However before Lambroso's time there were a number of prominent figures who were developing the study of the brain in relationship to human behavior. Darwin published the Origin of Species in 1859, and Paul Broach's work on the brain was emerging at the same time. Mendel's original work on genetics appeared in 1866. Herbert Spencer's First Principles appeared in 1862 using a bio-evolutionary model for the study of society, and his Principles of Psychology, published in 1896. A study recently carried out by Gabrielli and Mednick (1984) determined that both antisocial, biological parentage and urban home environment correlated with adoptee

criminality, although these relationships were found to be largely independent and non-interactive. Other gene-environment interaction studies have found similar results.

Individuals are not inherently criminal, nor do they become homicidal maniacs (except under certain circumstances). Evidence is now accumulating that the developing brain of a fetus is relatively fragile and sensitive to insult. Insults can be directly biological, for example, when a mother abuses alcohol and/ or drugs, or indirectly biological, when the mother experiences a severe psychological trauma and the physiological consequences are experienced by both her and her baby.

Neurochemicals

Recent studies have found that certain neurotransmitter imbalances in the brain such as low serotonin, and certain hormone imbalances such as extra testosterone, are associated with some greater likelihood of committing crime. Other studies have found that criminals tend to have slower reactions in their autonomic nervous systems. While some criminologists infer that these biological conditions increase the tendency to commit crime, other criminologists point out that all of these biological factors can be influenced by the environmental conditions. There has been considerable research, for example, on the influence of diet on crime, with some people arguing that excessive sugar intake results in increased aggression in juveniles. Consuming alcohol has a strong relationship with increased aggression in the short run, as does the consumption of certain illegal drugs. Ingesting various toxic substances such as lead tends to result in long-term increases in the commit crime. In addition, complications during pregnancy or birth and certain types of head injuries increase the risk of crime in the long run. There is, however, a similar problem with inferring that these environmentally based biological conditions cause crime.

The perception that crime, especially violent crime, has become one of the most serious problems facing society has led to determined efforts by many researchers to find the causes of criminal behavior. Researchers have focused on biological causes, believing that a biological basis of criminality exists and that an understanding of the biology will be useful in predicting which people are predisposed to become criminals. In the 1960s it was proposed that males with an extra Y chromosome were predisposed to violent criminal behavior; later work found no support for this hypothesis. Recently, two approaches, one genetic, the other biochemical, have received widespread publicity. I would argue that currently approach provides convincing evidence that criminal behavior can be understood in terms of genetics or biochemistry.

Neurochemicals are responsible for the activation of behavior patterns and tendencies in specific areas of the brain. As seen in the Brunner et al. study, there have been attempts to determine the role of neurochemicals in influencing criminal or antisocial behavior. Included in the list of neurochemicals already cited by researchers are monoamine oxidase (MAO), epinephrine, nor epinephrine, serotonin, and dopamine.

Monoamine oxidase (MAO) is an enzyme that has been shown to be related to antisocial behavior. Specifically, low MAO activity results in disinhibition which can lead to impulsivity and aggression. The Brunner et al. study is the only one to report finding of a relationship between a point mutation in the structural gene for MAOA and aggression, which makes the findings rare. However, there has been other evidence that points to the conclusion that deficiencies in MAOA activity may be more common and as a result may predispose individuals to antisocial or aggressive behavior. MAO is associated with many of the neurochemicals that

already have a link to antisocial or criminal behavior. Nor epinephrine, serotonin, and dopamine are metabolized by both MAOA and MAOB. While, according to Eysenck (1996), MAO is not related to nor epinephrine, epinephrine, and dopamine, which are all related to the personality factor of psychosis.

Serotonin is a neurochemical that plays an important role in the personality traits of depression, anxiety, and bipolar disorder (Larsen & Buss, 2005). It is also involved with brain development and a disorder in this system could lead to an increase in aggressiveness and impulsivity (Morley & Hall, 2003). As Lowenstein (2003) states, "studies point to serotonin as one of the most important central neuro-transmitters underlying the modulation of impulsive behavior and emotional aggression. In addition, children who suffer from conduct disorder, have also been shown to have low blood serotonin. Needless to say, there is a great deal of evidence that shows serotonin is related to aggression, which can be further associated with antisocial or criminal behavior.

Dopamine is a neuro-transmitter in the brain that is associated with pleasure and is also one of the neurotransmitters that is chiefly associated with aggression. Activation of both affective (emotionally driven) and predatory aggression is accomplished by dopamine. Genes in the dopaminergic pathway have also been found to be involved with Attention Deficit Hyperactivity Disorder (ADHD). In one study cited by Morley and Hall (2003), a relationship was found between the genes in the dopaminergic pathway, impulsivity, ADHD, and violent offenders. Obviously, from this list of neurochemicals it seems plausible that there is a genetic component to antisocial or criminals behavior.

Conclusion

This has clearly proven that genetic factors can and do influence certain types of criminal behavior, and recidivistic criminal behavior in particular. First, biological factors must be added to the list of causes of crime; it is through heritable biological structures and processes that the genes exert their influence. Second, we must try to identify the specific biological mechanisms through which heritable predispositions toward criminal behavior are expressed. By identifying these mechanisms, we can learn how to successfully treat and prevent criminal behavior. Research on the genetic components of human behavior suffers in general from numerous methodological and interpretive flaws. It is difficult to isolate genetic factors from developmental events, cultural influences, early experiences, and housing conditions. It is also severely criticized because criminal behavior is a legalistic label, not descriptive of actual behavior. Genetic studies that focus on criminal behavior may be inherently flawed; as criminal behavior is heterogeneous, genetic effects may be more directly associated with particular traits that place individuals at risk for criminal labeling. As a rule, what is inherited is not a behavior; rather, it is the way in which an individual responds to the environment. Also, genetic influences on human behavior are polygenic- no single gene effect can be identified for most behaviors. In sum, social behavior is learned through the principles of conditioning, which are founded on biological and genetic dictates in accord with stimulus-response relationships. Social behavior satisfies biological needs and drives by providing adaptive mechanisms for reproduction, mating, rearing, defense, and numerous other biological functions. The weaknesses in design, sampling techniques, and statistical procedures prevent drawing distinct conclusions, and results are frequently contested and unreliable. I believe, deriving from the information researched on the relationship between genetics and criminality, that heredity definitely influences deviant behavior in society. The environment, rearing practices, outside influences, etc. also play a role in the development of criminal behavior. A mixture of both factors clearly shows that genetics is, at the least, a justifiable issue in criminology.

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Reliability of Base of Orbit in Sex Determination: A Study in 60 Adult Human Skulls

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Abstract

The cranium ranks amongst the foremost as the classical, most studied and informative subject of examination in physical anthropology. Sex determination is one of the essential prerequisites for identification of an individual. The skull is probably the second best area of the skeleton for determining sex following pelvis. Diverse techniques for sexing crania are based either on visually determinable descriptive features of the cranium or on exact measurements of various parts of cranium and their ratios. Metric analysis allows less error even in the hands of less experienced with skeletal morphology. In the present study, skulls of 60 individuals of known sex (30 of either) were studied. A series of five metric variants were studied (orbit height, orbit breadth, orbital index, interorbital breadth, biorbital breadth). Population specific craniometric standards were established for sex assessment from the skulls of Indian population. Upon statistical analysis, orbital index and biorbital breadth were found to be the best sex discriminants and these were able to classify 61.7% of the skulls correctly.

Key Words

Cranium, sex, orbit, metric, measurements.

Introduction

The three most vital determinations that must be made when dealing with skeletal remains are age, sex and racial affinity. It would be nearly impossible to identify, much less reconstruct, the face of an individual without the information on the age, sex and racial affinity. There is no question that all of these factors have a significance bearing on appearance and also serve to narrow the range of possible matches¹. The race and sex of the human skull can be determined by craniometry. Since the skull is amongst the best preserved parts of the skeleton after death, many of these schemes have concentrated on cranial and mandibular measurements².

Forensic Anthropologists have at their command a variety of indicators of sex to aid them in their identification efforts, albeit with rare exceptions they are applicable to the post – adolescent period only³.

Diverse techniques for sexing of crania are based either on visually determinable descriptive features of the cranium or on exact measurements of various parts of cranium and their ratios. In the hands of the expert, the observation technique is astonishingly accurate, but it requires training and experience and is inaccurate when used by the layman. Methods based on measurements and statistical techniques are more serviceable for use in sex determination⁴. One of the advantages of metric analysis may be that it can appear more “scientific” when presented to juries in a courtroom situation. It may also be true that metric analysis allows for less error in the hands of those less experienced with skeletal morphology⁵. Most of older studies of sex differences on the skeleton (skull and pelvis mainly) centered on morphological traits in a descriptive manner. The newer studies focus on morphometry in a largely quantitative and statistical sense.

The orbits are higher, more rounded and relatively larger compared to upper facial skeleton, in the female. The orbital margins are sharper, less rounded, than in male. In females, orbits are squared, lower, and relatively smaller with rounded margins⁶. The orbital index is a higher in females; in other words the vertical height is greater relative to the breadth of the orbital opening (Sorsby⁷; Catalina-Herrera⁸, 1988; Whitnall⁹).

The present study was initiated with the following aims and objectives:

1. To know the reliability of the base of orbit in determination of sex in the Indian adult crania.
2. To do the morphometric analysis of the base of orbit.
3. To know the usefulness of craniometric methods in forensic identification and reconstruction of face.
4. To supplement the existing data on the base of orbit.

Material and Methods

60 dry adult Indian crania (30 of either sex) were used as a material for the present study. The material was procured from the Departments of Anatomy and Forensic Medicine, Govt. Medical College, Patiala.

Inclusion Criteria

- The skulls of known sex were considered for the study.
- The study was done on skulls with all required bony landmarks (craniometric points) intact allowing full set of measurements without any approximation.
- The study was done on skulls in which spheno-occipital junction was synostosed.

Exclusion Criteria

- The skulls with physical damage or loss of part (s), apparent deformity, defect or disease were excluded.
- The juvenile skulls, in which spheno-occipital junction was not synostosed and senile skulls, in which skull was edentulous with wasted alveolar processes were also excluded.

Bony Landmarks (Photograph 1)

1. Dacryon (dk)¹⁰: The apex of lacrimal fossa (lacrimal groove), as it impinges on the frontal bone.

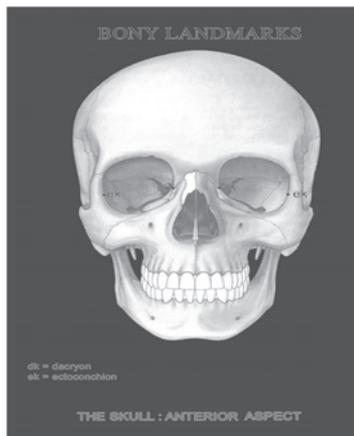
In an ideal well-preserved specimen this point is the meeting point of fronto-lacrimal, fronto-maxillary and lacrimo-maxillary suture.

2. Ectoconchion (ek)¹⁰: The intersection of the most anterior surface of the lateral border of the orbit and a line bisecting the orbit along its long axis.

A series of 5 metric measurements were studied on 60 adult skulls, 30 each of male and female. The bony landmarks were marked with a lead pencil and the metric measurements were taken by the sliding caliper after excluding the error in the instrument. The methodology was adopted from Prof. William W. Howell¹⁰. All the unilateral readings were taken on left side

for matter of convenience. Each skull was given its own separate identification number. All the readings were taken three times at different time intervals by the same observer to alleviate the error. The mean of three readings was taken as the final reading. These metric readings were then tabulated and subjected to statistical computations (stepwise discriminant function analysis).

Photograph 1.

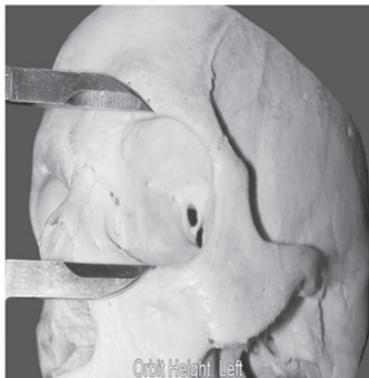


Metric Measurements (in mm)

1. **Orbit Height, Left (OBH)**¹⁰ (Photograph 2): The height between the upper and lower borders of the left orbit, perpendicular to the long axis of the orbit and bisecting it.
2. **Orbit Breadth, Left (OBB)**¹⁰ (Photograph 3): Breadth from ectoconchion(ek) to dacryon(dk), as defined, approximating, the longitudinal axis which bisects the orbit into equal upper and lower parts
3. **Interorbital Breadth (DKB)**¹⁰ (Photograph 3): The chord across the nasal space from dacryon (dk) to dacryon (dk).
4. **Biorbital Breadth (EKB)**¹⁰ (Photograph 4): The breadth across the orbits from ectoconchion (ek) to ectoconchion(ek).
5. **Orbital Index**¹¹

$$\text{Orbital Index: } \frac{\text{Maximum orbital height} \times 100}{\text{Maximum orbital breadth}}$$

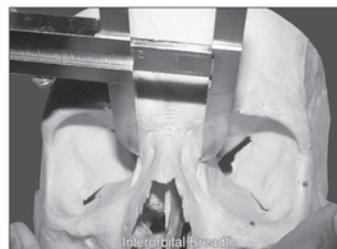
Photograph 2.



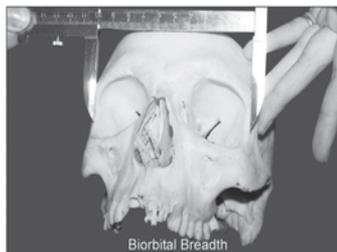
Photograph 3.



Photograph 4.



Photograph 5.



Observations

Table 1:

MEASUREMENT	SEX	MEAN	S.D.	RANGE	
				MIN	MAX
ORBIT HEIGHT, LEFT	Male	33.3	3.60	29.74	8.6
	Female	34.23	3.62	28.35	44.5
ORBIT BREADTH, LEFT	Male	39.14	2.26	32.8	43.4
	Female	37.97	2.19	30.5	41.8
INTER-ORBITAL BREADTH	Male	19.81	2.50	15	24.5
	Female	18.85	5.16	16	22
BIORBITAL BREADTH	Male	94.18	3.74	88	101.5
	Female	91.34	5.16	73.5	100
ORBITAL INDEX	Male	85.48	13.30	70.76	148.17
	Female	91.56	10.84	71.3	127.66

Statistical Significance of Metric Measurements between Males and Females

T - test was applied to all the metric measurements and

Table 2:

Measurements (in mm)	Mean		P value
	Male	Female	
Orbital Height, Left	33.30	34.23	> .05*
Orbital Breadth, Left	39.14	37.97	£ .05**
Interorbital Breadth	19.82	18.85	£ .05**
Biorbital Breadth	94.18	91.34	£ .005***
Orbital Index	85.48	91.56	£ .05**

*p > 0.05 Insignificant, **p £ 0.05 Significant

***p £ 0.005 Highly significant

following results were found out (Fig. 2) :

Statistical Analysis of Metric Measurements of the Base of Orbit by Stepwise Discriminant Function Analysis

SPSS PC+ program was used and following results were found out after using stepwise discriminant function analysis

Table 3:
Classification Function Coefficients

Measurements (in mm)	Sex	
	0 (Male)	1 (Female)
Orbital index	0.469	0.515
Biorbital breadth	4.601	4.450
Constant	-237.469	-227.516

Fisher's linear discriminant functions

Table 4:
Classification Results

		SEX	Predicted Group Membership		Total
			0	1	
Original	Count	0	21	9	30
		1	14	16	30
	%	0	70	30	100
		1	46.7	53.3	100

61.70% of original grouped cases correctly classified.

to the metric measurements on base of orbit

After applying stepwise discriminant function analysis to the metric observations of base of orbit, 61.7% of the skulls were correctly classified.

Following equation for sex determination of unknown skull was obtained using the sex discriminant functions of the above two measurements:

For Males

$$\text{Score} = X1 \times 0.469 + X2 \times 4.601 - 237.469$$

For Females

$$\text{Score} = X1 \times 0.515 + X2 \times 4.450 - 227.516$$

X1 = Orbital index

X2 = Biorbital breadth (mm)

Discussion

One important constant feature described in literature is sharpness of orbital margin in females (Whitnall⁹, Montagu¹², Breathnach¹³, Warwick¹⁴, Bass¹⁵, Briggs¹⁶, Rao¹⁷) and the shape of the orbits have been described as rounded in females and square to rectangular in males (Whitnall⁹, Warwick¹⁴, Briggs¹⁶, Rao¹⁷).

In the present study morphometric analysis of base of orbit was done and mean values for all the metric observations are higher in skulls of male individuals except for orbital height and orbital index which were found to be higher in skulls of female individuals. This is true in previous studies also.

Skulls having a Mongoloid trait do not show any sex difference in interorbital breadth (Song et al¹⁸) whereas in present study, this measurement has been found to be significant as a sex determinator. It is inferred that there can be certain measurements which have regional variations for determining sex.

Carpenter¹⁹ in his study based on American Whites and Blacks showed that orbital breadth is significant for sexual dimorphism in this part of region whereas orbital height has been found to be insignificant in sex determination. The present was in concordance with his study.

As regards the orbital index, it is an important indicator for determining sex as it is higher in females in studies conducted by Catalina-Herrera⁸, Whitnall⁹ and also in the present study. This index perhaps has no regional / racial inference in both the sexes.

It is further mentioned that other variables used in the present study have been found to be highly significant as an indicator for sex determination.

Discriminant Function Analysis Results

Selected variables were subjected to both stepwise

discriminant function analysis to calculate specific discriminant formulae. In case of base of orbit, two measurements (Orbital index and Biorbital breadth) were found to be the best sex discriminators and 61.7% of the skulls were correctly classified.

Till now most of the equations for sexual dimorphism have been calculated on whole of the skull by discriminant function analysis. But in determination of sex from fragmentary cranial remains where whole of skull is not available, it is important to find out the value of sex determination from various regions individually. In the present study, base of orbit has been studied.

Johnson et al² found out in his study that best discriminators for sex are not necessarily the best for race. The sex within each race is best described by a unique discriminant function. Thus discriminant function equation obtained in the present study for sex determination is unique to skulls of Indian population only and this will provide a comprehensive basis for future sexing of complete or fragmentary cranial material.

Summary and Conclusion

There have been many studies on sexing of skeletal material, particularly skulls, from different populations. Regional variations may be because of race differences and functional anatomy of a particular group.

The present study was initiated with the aim of evaluating the usefulness of base of orbit in determination of sex. Very sophisticated methods of statistical analysis (stepwise discriminant function analysis) were used in the present study to increase the accuracy of sex determination.

Mean values for all the metric observations are higher in skulls of male individuals except for orbital height and orbital index which were found to be higher in skulls of female individuals.

Measurements whose means have been found to be statistically highly significant in sex determination of skulls by applying the t-test are biorbital breadth. The measurements whose means have been found to be statistically significant are orbital breadth, orbital index and interorbital breadth. The measurements whose means have been found to be statistically insignificant is orbital height.

Similarly, two most reliable measurements on the base of the orbit: orbital index and biorbital breadth were able to classify correctly 61.7% of the skulls.

Thus, sex determination equations obtained for the unknown skull using the sex discriminant functions of the studied skulls will provide a objective means of sexing fragmentary cranial material with a calculable reliability. But, the discriminant function equations obtained in the present study for sex determination is unique to skulls of Indian population only. Thus, the study has also resulted in development of population specific craniometric standards designed for sex assessment from the skulls of Indian population. The present study also established the following facts:

- Predictive value of sex determination does not depend upon the number of variables that are being used but depends upon discriminatory power of the variables.
- Accuracy of sex determination depends at least partly upon the statistical method employed. Therefore stringent statistical techniques need to be employed to obtain reliable effects. Discriminant function analysis is entirely an objective method for sex determination.
- Determination of sex from craniometric methods/indices is one of the essential pre requisite for identification and in reconstruction for forensic purposes. A dead skull is, in a sense, the matrix of the living head; it is the bony core of the fleshy head and face in life. Thus, reliable standards can be established from the present study on the basis of statistically valid data and can be used for reconstruction methods for craniofacial identification.

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Exostosis of the Upper End of Femur Bone

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Abstract

Exostosis also called as osteochondroma is a cartilage covered bony outgrowth that arises from the surface of the bone. It is usually metaphysical in location, more commonly seen in male than in females. Usually its growth stops with the fusion of epiphyseal plate. It can affect any bone preformed in cartilage. Most common site is lower end of femur bone.

The exostosis when present can cause limitations of joint movements and deformities.

Key Words

Exostosis, osteochondroma, femur bone, benign bone tumour.

Introduction

Femur bone is the bone present in the thigh; it is the longest and strongest bone in the body. It has a body or shaft, with tow ends, upper and lower ends. Upper end has a head neck, greater trochanter and a lesser trochanter. Lower end is expanded and consists of 2 condyles.¹

Femur is the second bone after clavicle to show the signs of ossification. It ossifies by five centres – one primary and four secondary centre. The primary center for body appears at 7th week of IUL. The secondary center for head appear during first half of the year, for the greater trochanter at 4th year, and for the lesser trochanter between 12-14 years.¹ The secondary centre for lower end appears during the 9th month of IUL (just before birth) and is a deviation from laws of ossification. All secondary centers unite with the shaft independently after puberty.¹

Exostosis or Osteochondroma

This is a cartilage covered bony out growth that arises from the surface of the bone. It is the most common benign skeletal tumour, which accounts for 40% of all the benign bone tumours. It may arise spontaneously or as a result of previous osseous tumour. It can be either sessile or pedunculated. There can be solitary or multiple exostosis usually occurs between the age group of 10-35 years with male: female ratio of 2:1. Most common site of occurrence is long bone ends around the knee joint (lower end of femur and upper end of tibia) and shoulder joint. Exostosis can affect any bone preformed in cartilage².

Materials and Methods

During routine counting of bones in department of Anatomy, J.J.M Medical College, Davangere, we found the left femur bone, which had bony outgrowths at its upper end. The bony outgrowths were arising from the greater and lesser trochanter. The bony outgrowths were measured using the slide calipers. The X-ray of the femur bone was taken and observation were recorded.

Observation

The femur bone was of the left side. In the upper end of the femur 3 bony outgrowths were present. Photographs of the diseased femur bone were taken in the anterior and posterior



Fig. 1 : Anterior view and posterior view of the left femur bone

Table showing the measurements in the normal and the diseased left femur bone

Measurements	Normal left femur bone	Diseased left femur bone
Greater trochanter Length	4.5 cm	(Sessile) 8 cm
Greater trochanter Breadth	6 cm	11 cm
Lesser trochanter Length	2.5 cm	(Pedunculated) 8 cm
Lesser trochanter Breadth	2.5 cm	4.5 cm
Growth on intertrochanteric line Length	-	(Sessile) 5.5 cm
Growth on intertrochanteric line Breadth	-	5 cm

The growth on the greater trochanter and the intertrochanteric line were sessile whereas the bony outgrowth from the lesser trochanter was pedunculated



Fig. 2 : X-ray of normal femur and the diseased left femur bone

Findings of Radiological Examination (Fig. 2):

1. The cortical surfaces and marrow cavity of the lesions were contiguous with the underlying bone.
2. The borders of the growths were clearly demonstrated.
3. No lytic lesion was seen; no sclerosis seen; and no stippled calcification noted in the lesion which indicate its not an malignant lesion of bone but an benign one.

Discussion

Having noted the above findings; we will now exclude the other possibilities of the bony outgrowths one by one. Depending on the findings we can conclude that the present case is an exostosis of upper end of femur. Other of conditions being giant cell tumour or osteoclastoma, osteosarcoma, chondrosarcoma which are excluded based up on the findings noted in our case.

Although the frequency of exostosis may be difficult to characterize. The osteochondromas can be found as palpable mass that may cause pain due to over inflammation, fracture through a pedunculated stalk, or impingement on an overlying anatomical structures (nerves and vessels). Effects of solitary exostoses of the proximal femur have been well described as trochanteric bursitis, external snapping of the hip, and sciatic nerve compression or surgical excision.³

Solitary osteochondromas of the greater trochanter of the proximal femur may be as development of femoral acetabular impingement for many reasons. Additionally, isolated osteochondromas may be related to removal acetabular impinging traumatic injury. Indications for excision of solitary osteochondromas include unacceptable cosmetic correction. As solitary osteochondromas lead to recurrent injury or discomfort, development of painful overlying bursa and compression of vital structures (nerves, arteries, joints), or radiographic signs of malignant degeneration³.

Conclusion

Osteochondromata of the proximal femur have been reported to occur in 30% to 90% of patients with hereditary multiple exostoses. More recent studies have shown abnormal development of both the proximal femur and the acetabulum.⁴ Shapiro et al noted that coxa valga occurred in 25% of patients, and acetabular dysplasia less often.⁵

By checking the individual characteristics of the clinical

conditions of bony outgrowths we came to a conclusion that the bony outgrowth was to be exostosis of upper end of femur. This was supported by the gross observations made and the X-ray findings of the deceased bone.

Clinical Importance

The present case depicts the unusual or rare sites of the occurrence of the exostosis i.e, in the upper end of femur. This finding is opposite to the most common site of exostosis which is seen in lower end of femur. The knowledge of such type of variation is essential for orthopedicians as this is a rare site for exostosis to occur. These bony outgrowths could bring about limitation of joint movements and fixed extended deformity. This can also bring about mechanical compression of the neurovascular bundle of the lower limb.

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Sudden Unexpected Natural Death-A Case Report

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Abstract

A 23 year old male, complained of chest pain and breathlessness on getting up from bed in the early morning at 4.00 AM. On arrival at the casualty of Sri Siddhartha Medical College Hospital, Tumkur, he was declared brought dead to the hospital by the casualty medical officer at 6.15 AM on 8/7/09. Autopsy was conducted in the Department of Forensic Medicine, revealed no demonstrable changes in the myocardium except obstruction to the left coronary main trunk.

Key Words

Atherosclerosis Brought dead, Chest pain, Thrombus.

Introduction

Sudden cardiac death must be defined carefully; sudden is defined for most clinical and epidemiologic purposes as 1 hour / less between the onset of terminal clinical event or death.¹ WHO, definition is of death within 24 hours from the onset of symptoms, but this is much too long for many clinicians and pathologists; some will accept death within 1 hour from the onset of illness.² In many cases of sudden death following coronary occlusion or stenosis, no evidence of myocardial infarction will be revealed even by the most sensitive methods. If the interval was too short.³ Death occurred perhaps from ventricular fibrillation or damage to conduction system.⁴ Death is said to be sudden / unexpected when a person is not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness (WHO).⁵

Case Report

The deceased was brought dead to the hospital. There was nothing forth coming from the hospital records. The post mortem examination was conducted on 08/07/09.

Post-Mortem Examination Findings

A. External Findings

The body of a young male aged about 23 years moderately built and nourished. Rigor mortis present all over the body. Post mortem staining present over back and it was fixed. No injuries were found on the body.

B. Internal Findings

Scalp, skull, meninges, brain, ribs was intact

Lungs was intact and congested

Stomach contains 50 ml of cream colored mucus like fluid, no unusual smell, and mucosa was normal Heart was weighed 380gms, fatty change seen on surface of the heart, atheromatous plaques present in ascending aorta with narrowing of both coronary ostia. Left coronary ostia was narrowed more when compared to right coronary ostia. Left coronary artery

showed completely occluded, 0.5cm from its origin. Circumflex and right coronary artery showed 20-30% block.

Cause of Death

Death is due to cardiac failure as a result of complete occlusion of left coronary artery by atheromatous plaque and thrombus.

Discussion and Conclusion

Coronary artery disease is more common cause of arrhythmic sudden death. One third of all people developing myocardial infarction die before reaching to the hospital, many within an hour of the onset of acute symptoms, and the cardiac rhythm in the majority of these cases is ventricular fibrillation / pulseless ventricular tachycardia.⁶ The normal weight of the heart depends upon body weight and height; it averages approximately 300 to 350g in males.⁷ In this case the heart was weighed 380g. More than 90% of cases, the cause of myocardial infarction are reduction of coronary blood flow due to atherosclerotic coronary arterial obstruction. Myocardial infarction may occur at virtually any age, but the frequency rises progressively with increasing age.⁷ Among diseases of CVS occlusive coronary artery disease is the single most important cause of sudden death. Thrombosis secondary to atherosclerosis accounts for partial/complete obstruction in 75% of cases.⁸ Occlusion of left main trunk was least varies between 0-10%.⁹ Coronary artery disease including progressive occlusion of coronary artery by recent coronary thrombosis, associated with coronary atherosclerosis.¹⁰ Nandy A has experience to record death due to myocardial infarction with advanced vascular atheroma in an young man of 29 years of age.¹¹ Death may occur at the time of occlusion from ventricular fibrillation without demonstrable changes in the

Fig 1: Left coronary ostia – showing atheromatous plaque

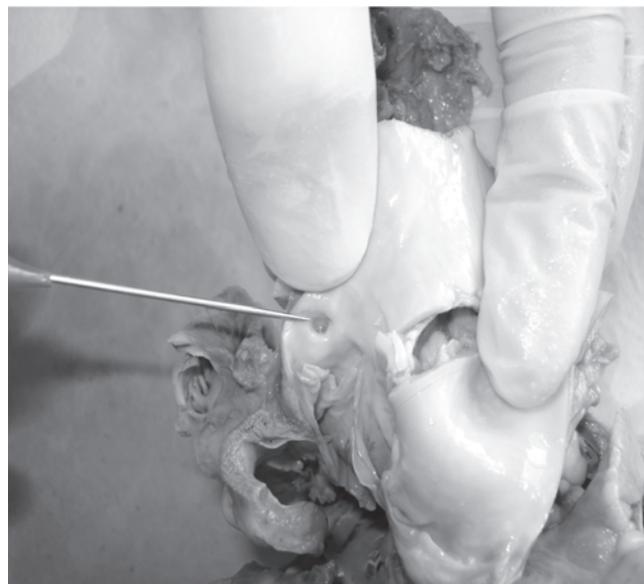


Fig 2: Coronary main trunk (Lt) – showing occlusion



Fig 3: Dissection further main trunk – showed complete block



myocardium.⁸ Basic mechanism of stenosis / occlusion of one / more branches of the coronary arteries by atheromatous lesions / one of the complications of such lesion. Whatever the precise origin of the blood, it is clear that subintimal haemorrhage is a potent factor in rapidly reducing the available lumen of a coronary artery and sometimes precipitating thrombosis by further stretching and damaging the overlying intimal cap.² Virtually all forensic pathologists deal not only with suspicious, accidental or suicidal deaths, but also with a wide range of deaths from natural causes. Many of these deaths are sudden unexpected, clinically unexplained / otherwise obscure.² This case revealed no demonstrable changes in the myocardium except obstruction to the left coronary main trunk as it was very rare.

Fig 4: Histopathology (Lt) main coronary artery- showed atheromatous plaque and thrombus

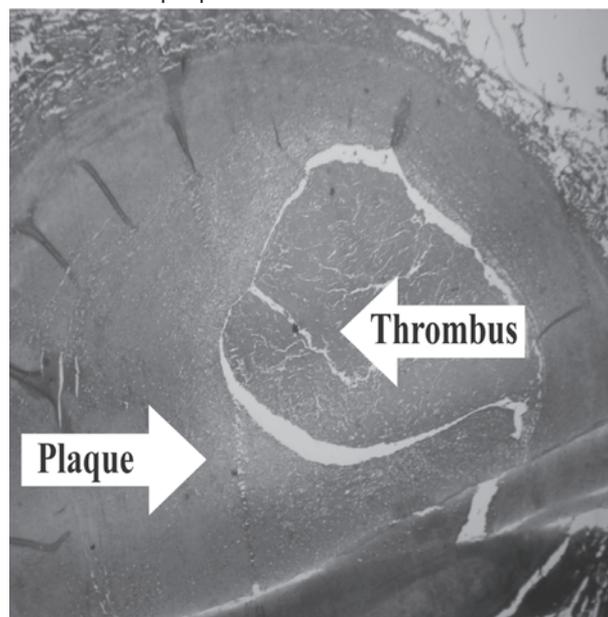
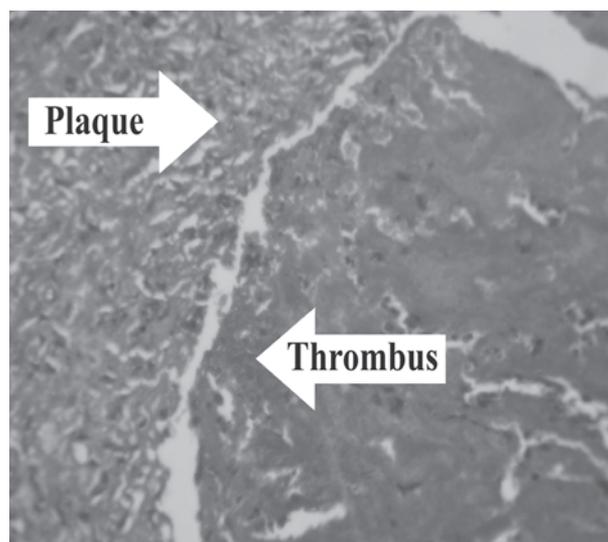


Fig 5: High power field – showing atheromatous plaque and thrombus



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Discrepant Autopsy Diagnosis of Death Due to Cerebral Malaria

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Abstract

Malaria is the most important parasitic disease of man. Plasmodium falciparum infection is an emergency because of risk of cerebral malaria that is the most severe complication. Malaria diagnosis is usually made on blood samples of feverish patients coming from endemic areas. Although most of the cases of fatal cerebral malaria are diagnosed well before the patient's death, occasionally autopsy surgeon encounter cases in which the presence of cerebral malaria was not suspected prior to death.

We present two cases of cerebral malaria which were clinically undiagnosed. Medico-legal autopsy was started with history available from hospital records and police investigation report. On the basis of macroscopic and histopathological findings the patient was considered to have died of malignant cerebral malaria with multiple organ failure. These cases demonstrate the role a forensic pathologist may play in determining the natural cause of death like cerebral malaria.

Key Words

Plasmodium falciparum, cerebral malaria, autopsy, hemazoin pigment.

Introduction

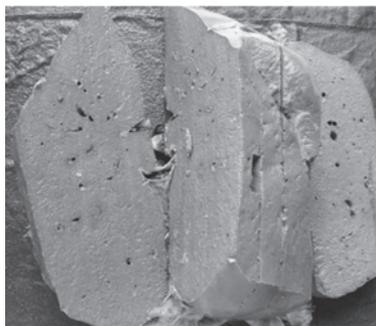
Approximately 5% of world's population is infected and there are approximately one million deaths each year¹. Falciparum malaria is a medical emergency and requires immediate diagnosis and treatment². Cerebral malaria is a rapidly progressive, potentially fatal complication of plasmodium falciparum infection². Cerebral malaria is defined strictly as unrousable coma (there is a non-purposeful response or no response to a painful stimulus) in falciparum malaria¹. Although cerebral malaria is the most prominent feature of severe falciparum malaria, some patients with lethal infections never lose consciousness until they die¹. Because this disorder may appear as sudden death, these victims may be referred to a Forensic pathologist³.

Case Reports

CASE 1: A 37 year old man presented to outpatient department (OPD) with history of consumption of poison. Patient was a known alcoholic. The clinical diagnosis of alcoholic dependency syndrome with alcoholic hepatitis was made. On seventh day patient expired and a medico legal autopsy was done. On examination - Skin showed generalised yellowish discoloration. Meninges were yellowish. Brain was congested and oedematous. Liver was enlarged, weighs 2kg, cut section revealed slate grey appearance (fig1). Kidney showed petechial haemorrhages. Cut section was unremarkable. Right sided pleural adhesions were seen. Viscera were sent for chemical examination. Specimens of heart, brain, liver and kidney were sent for histopathological examination. Chemical analysis report was negative for any poisonous substance.

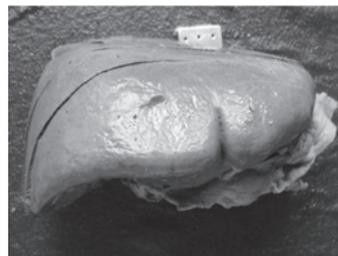
ASE 2: A 40 year old man under the custody of police, presented to OPD with complaints of high degree fever with chills and rigor, associated with vomiting since 10 days, yellowish discolouration of eyes and skin since 10 days, generalised weakness associated with loss of appetite since 10 days.

Fig 1: Liver cut section showing slate grey appearance



Giddiness, irritability and restlessness since 1 day. On examination icterus was 4+ and per abdominal examination showed distended abdomen with hepatomegaly. The clinical diagnosis of viral infective hepatitis with hepatic failure was made. Patient didn't respond to treatment and expired on 10th day of admission. Medicolegal autopsy was done. Gross examination of heart, lungs and kidneys were unremarkable. Spleen was enlarged, weighing 700gm, measuring 15x13x6cm. The external surface was black. Cut section showed homogenous black area with scattered white fibrous bands (fig2) Liver-external surface showed slate grey appearance. Cut section was greyish. Specimens of lungs, liver, heart, spleen, kidney and brain were sent for histopathological examination.

Fig2: Spleen cut section



Microscopic appearance of both cases: Sections studied from brain (fig3), heart(fig4) and lungs(fig5) showed congestion of capillaries filled with parasitized red cells and malarial pigments. Sections studied from spleen showed congestion of red pulp and macrophages with engulfed parasites and red cells. Sections studied from liver showed sinusoids filled with parasitized red cells, containing malarial pigments. Kupffer cells were heavily laden with malarial pigments, parasites, and cellular debris, some pigment was also present in hepatocytes (fig6). Sections from kidney

Fig 3: Sections studied from brain

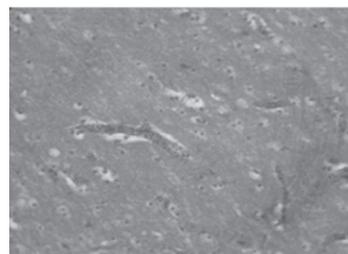


Fig 4: Sections studied from Heart

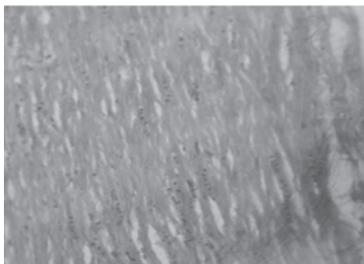


Fig 5: Sections studied from lungs

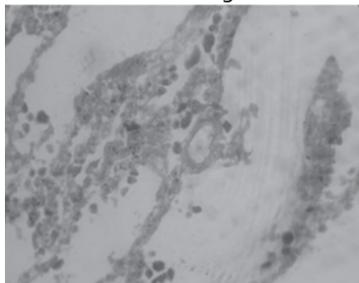


Fig 6: Sections studied from Liver

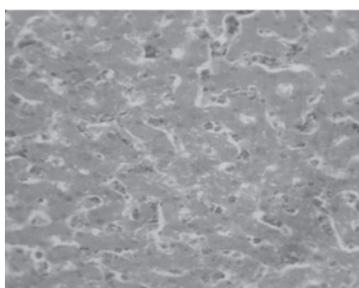
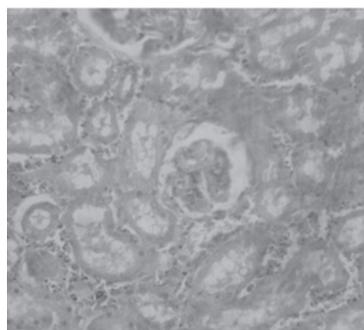


Fig 7: Sections studied from Kidney



showed glomerular capillaries filled with parasitized RBCs and malarial pigments(fig7).

Discussion

Severe malaria is a complex multisystem disorder with many similarities to sepsis syndrome⁴. Human cerebral malaria is frequent encephalopathy that occurs in the endemic tropical-sub tropical zones³. Forensic pathologists are rarely confronted with malaria lesions and if the occasion arises, the diagnosis is often already known or suspected and pathologist has to confirm it. Rarely malaria is unknown before histological examination and the diagnosis is based on identification of specific histopathological features. Autopsy study is very useful in uncovering such discrepancies in diagnosis. Analysis of such cases can shed light on specific pitfalls hindering diagnosis of cerebral malaria. Post mortem diagnosis of cerebral malaria can also be confirmed (in a non medico-legal case) from brain smear by obtaining a needle aspirate or biopsy through the superior orbital foramen or the foramen magnum¹. We conclude that the non specific symptoms of malaria can lead to a misdiagnosis and the need for a forensic expert to intervene at the scene of death, which usually occurs in the home⁵.

Conclusion

Malignant cerebral malaria is often diagnosed well before death. However, vague or short term symptoms and limited health care access can dissuade patients from medical attention and result in failure to diagnose these cases correctly. The external signs, hospital records, history and investigation report given may be discrepant from the actual cause of death. However a meticulously performed autopsy may reveal the diagnosis of cerebral malaria that was not suspected prior to death. In addition, by analyzing the incidence of these cases one can draw conclusion about evolving effectiveness of medical (autopsy) diagnosis.

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GIST : An Incidental Finding During Autopsy

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Abstract

Gastrointestinal stromal tumours (GISTs) are mesenchymal tumours expressing a protooncogene protein called CD117 detected by immunohistochemistry. GISTs are rare and constitute about 1-3% of all gastrointestinal malignancies, nevertheless they are the commonest type of GI mesenchymal tumours. GISTs are usually discovered as an incidental finding during operation, abdominal imaging or during endoscopy.

Key Words

Gastrointestinal stromal tumours (GISTs), CD117, autopsy

Introduction

Gastrointestinal stromal tumors (GISTs) are the most common mesenchymal tumours of the gastrointestinal tract.¹ GISTs account for 1-3% of all gastrointestinal malignancies. They are typically defined as tumors whose behavior is driven by mutations in the Kit gene or PDGFRA gene.² The GISTs are believed to originate from precursor cells that give rise to smooth muscle cells of gastrointestinal tract as well as to the interstitial cells of Cajal.³ On immunohistochemistry, the consistent expression of CD 117(KIT protein) is seen in nearly all cases.⁴ The symptoms of gastrointestinal stromal tumour depend on the site and size of the tumour and may include abdominal pain, gastrointestinal bleeding or signs of obstruction. Small tumours may however be asymptomatic.⁵ Here we report a case of GIST which was incidentally discovered while performing a medico legal autopsy in a poisoning case.

Case Report

A 23 yr old male was brought dead to our hospital mortuary with a history of consumption of organophosphorous compound. According to the history the deceased was suffering from depression and committed suicide by consuming insecticide. Medico legal Autopsy was conducted and following are the autopsy findings:

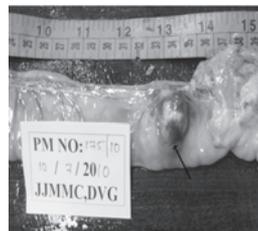
External examination: A white froth was present at the mouth and nostrils, pupils were dilated. No external injuries were seen.

Internal Examination

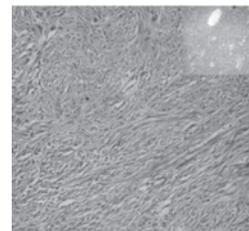
Stomach contained 150 ml of light brown coloured fluid material with kerosene like smell coming from it. Mucosa was congested and haemorrhagic. Other organs like lungs, liver, spleen and kidneys were congested.

A solitary nodular, hard, greyish white swelling of 2x2 cm was noticed on the serosal surface of the 3rd part of duodenum. Internally the swelling presented with a 1x1 cm ulcer on the mucosal surface and the edges were raised. Complete dissection of the whole of intestine did not show presence of any other swelling. The specimen of 3rd part of duodenum involving the nodular mass was sent for histopathological examination.

Histopathologically it was reported as gastrointestinal stromal tumour and this was confirmed by immunohistochemistry which showed that the tumour cells were



Gross specimen showing the nodular growth over the serosal aspect of duodenum



Photomicrograph showing GIST with spindle cell morphology. Inset shows IHC Positivity with CD 117.

CD117(c-KIT) positive.

Cause of death was finally opined as organophosphorous insecticide poisoning as confirmed by Forensic Science Laboratory report.

Discussion

GISTs are the commonest mesenchymal tumours of the gastrointestinal tract, the stomach and small intestine being the favoured sites of occurrence.⁵ The common sites of location are, in order, the stomach (60-70%), the small intestine (20-30%), the rectum and the colon (5%), the esophagus and a small percent may be located elsewhere in the abdominal cavity (<5%).⁶

On pathological evaluation of gross specimen GISTs are soft, fleshy, lobulated masses with heterogeneous internal appearance and areas of necrosis and cystic degeneration.⁴ GISTs demonstrate variable histology, including sheet like arrangement, short fascicles, whorls, storiform and organoid pattern.⁷ Globoid extracellular collagen accumulations (so called skeinoid fibers) are frequently observed, especially in benign small intestinal GISTs. Factors that correlate with malignancy are tumour size >5 cm, mitotic count > 5/50 HPF, dense cellularity and mucosal invasion.⁸ Among GISTs of the duodenum those composed of large cells having organoid pattern are predictably low risk, whereas highly cellular tumours with small cells and little or no organoid pattern are high risk.⁹ Small intestinal GISTs are positive for CD 117 (c-KIT) and usually for CD34. A subset 30-50% are positive for alpha smooth muscle actin. Most tumours are negative for desmin and almost are negative for S-100 protein.⁸

Clinically, GIST are associated with nonspecific symptoms. No physical findings specifically suggest the presence of a GIST. The main manifestation of GIST is acute or chronic upper gastrointestinal hemorrhage (61%). Many GIST are discovered incidentally during operation, abdominal imaging or endoscopy. Tumors found incidentally are usually small, with a mean diameter of 1.5 cm, and carry a better prognosis. Although extraluminal in origin, GIST may ulcerate through the overlying mucosa.¹ The study done by Sanchez BR et al, GISTs were discovered as an incidental findings in 0.8% of patients who underwent laproscopic gastric bypass surgery.¹⁰ Similar results were obtained by Beltran MA et al, who observed the incidence of incidental pathology during laparoscopic bariatric surgery to be around 2%, and that of

gastrointestinal stromal tumors (GISTs) to be 0.8%.¹¹

Conclusion

We conclude that GISTs could be one of the incidental findings that can be documented with high index of suspicion during routine autopsy.

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Profile of Fatal Poisoning In and Around Bidar, Karnataka

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Abstract

The paper presents the study of 132 cases of poisoning received in the Dept of Forensic Medicine, Bidar Institute of Medical Sciences & Teaching Hospital Bidar, Karnataka, for post-mortem examination (PME) during the span of two years. Out of 850 PME done during the study period 132 cases were that of poisoning. The cases were then analysed on various epidemiological parameters feeding the information in the proforma prepared for this purpose. We concluded that majority of victims were married, Hindu, males, from rural area and low socio economic group. Majority of victims died within 1-6 hours of consumption of poison. Suicidal cases were for more commoner than accidental one. No case of homicidal poisoning was detected in present study. Chemical analysis of viscera was done in 115(87.12%) cases (snake bite cases excluded) during the span of study we could get report of C.A. in 98 (85.21%) cases. Insecticides still topped the list as killer no one. While snake bite was second most common fatal poisoning, this study differs from most of the contemporary studies in one important aspect that is we could get C.A. report in large no of cases C. A. reports were positive in 90 per cent cases.

Key Words

Poisoning, Bidar

Introduction

Poison and poisoning are known since time immemorial. This region is no different. When we got cases of poisoning every now and then in our post-mortem room we thought are we getting the same cases as others[1,2,3,4,5,6,7,8,9,10,11] have reported or any different? So we undertook this study to know what is the profile of poisoning in this part of world? Poisons are subtle and silent weapons, which can be easily used without violence and often without arousing suspicion. At present due to vast development in all fields of life like industries, medicine, and agriculture a significant number of new compounds have appeared as new poisonous substances, which lead to more number of poisoning cases. Even though the advanced medical treatment and awareness, the deaths due poisoning cases are increasing day by day. As various chemicals are in use in modern era, they are very handy for misuse or accidental calamity as well. Most of the people prefer them for the purpose of suicide, as poisons leading peaceful death. An attempt has made to find out some epidemiological factors, pattern and significant features of poisoning.

Material and Methods

The present study was conducted in the Department of Forensic Medicine, Bidar Institute of Medical Sciences & teaching hospital Bidar, Karnataka, during the period from June 2008 to May 2010. During these period total 850 autopsies were conducted. Out of these 850 cases, poisoning was observed in 132 cases. Detailed and complete post mortem examination of the bodies was done, including chemical analysis of viscera which was done at Forensic Science Laboratory Gulbarga & Bangalore. A proforma was prepared to fill up detail of the parameters used

in the study.

Observation

Out of total 850 cases, 132 cases of poisoning were detected from the present study. Incidence of poisoning was more in second (24%) and third decade (43.1%) as compared to both extremes of life. Males were more prone to death by poisoning (62.1%) compare to females (37.9%). Incidence of poisoning was more in Hindu people (90.9%) and maximum cases were from joint family (59.8%). Maximum persons were illiterate (55.3%), married (57.6%) and from lower socio-economic class (87.1%) and from rural area (62.8%). The incidence was more in farmers (28.8%) compare to that in people of other occupation. Spot deaths were found in 40.1% of cases followed by 1-6 hours of duration of survival (33.3%). Incidence of suicidal cases was highest in the present study (68.2%), followed by accidental poisoning (31.1%). this inference is based on history. According to history, insecticide was the commonest poison (22.7%), followed by snake bite poisoning (12.9%) and aluminum phosphide poisoning (4.5%).

In Karnataka, generally we get report of chemical analysis (CA) within two to three months. Out of 132 cases snake bite cases turned out to be second most common (17 cases; 12.9 %) behind only to agricultural poisons. Though poisoning due to snake bite is second most common, we did not sent the viscera for chemical analysis in such cases because we were aware that there were no facilities available in our region to test snake bite poisoning. In remaining 115 cases the viscera were sent for CA. The reports of CA were received in 98 cases (72.4%). According to the reports, insecticide was the commonest poison (71 cases; 72.44%), followed by aluminum phosphide (14 cases; 14.28%) and acid (cases 3; 06.3%). In ten cases (10.20%) no poison could be detected in CA. After CA in the insecticides category, organophosphorus compounds were the commonest (62.24%), followed by organochloro compounds (6.13%) and carbamates (4.09%).

Discussion

Trends of the poisons seem to be a function of need and availability of specific substances. Since last three years, there is a significant increase in the misuse of agrochemicals. Despite of tremendous progress in all fields of life, snake bite continues to be the major cause of morbidity and mortality in India.

The incidence of poisoning in the present study was 15.9% which is comparable to other studies [1,2,3,4,6,9,10,11]. The incidence of poisoning was higher in third decade of life, in males, in married people and people from joint family, which is similar to most of the studies by various authors [1,2,4,5,6,7,8,9,10,11]. This might be due to modern life style, stress, tension, family and social problems. The higher incidence was also observed in people from rural area, lower socio economic class. Most of the victims were Hindu, which can be explaining by the fact that major population of India is Hindu, farmers and unemployed persons were more prone to death by poisoning in the

present study; same as other studies (3,4). This is so because larger segment of our population comes from these groups.

Spot deaths were more in present study, which might be due to lack of awareness to go for the treatment, lack of proper treatment, distance between hospital and scene of incident, a firm commitment in the mind of suicides to die which did not allow them to go far the treatment and commonly the suicides choose agricultural poisons, the fatal dose of such poisons is in milligrams and most of these are classified under die category of extremely toxic and highly toxic group (12).

Most of the studies [1,2,5,6,9,10] including this study show that most of the cases were suicidal deaths. This inference of manner of death is based on history given either by police or and relatives. We tend to believe history because when person is claiming that death is due to suicide he has nothing to hide, but when he claims that death may is due to accident; he may be having a motive to hide something. The suicides may be due to various stress factors coming from financial, social, family problems, low level of education, immaturity and many more aspects of life. Easy availability of poisons made them easy victims also.

Out of total 115 cases (87.1%) sent for chemical analysis, in 98 cases (85.2 %) the reports of chemical analysis were received. Accordingly, the analysis was then done. Out of total 98 cases, insecticides were found in 71 cases (53.79%). aluminum phosphide poisoning -14 cases (10.60 %). acid poisoning - 3 cases (2.27 %). While in 10 cases (7.37 %) no poison was detected. Among insecticides, the organo-phosphorus compounds were maximum - 61 cases (62.24%). followed by organochloro compounds - 6 cases (6.13%) and carbamates - 4 cases (4.08%). However, snake bite poisoning was there in 17 cases (12.88%).

Most of the authors have studied the incidence of type of poisoning according to the history given to them by police officers relatives of the victim and by medical case papers [1,2,5,6,9,10]. Except Nigam et al⁸ afore mentioned authors did not analyse or categorise incidence of poisoning after receiving the report of CA. While in present study we have scientifically and accurately calculated the incidence of poisoning according to the nature of poison after the chemical analysis that most common poison was one of the organophosphorus compounds in this region.

Conclusion

Pattern of poisoning in present study is more or less similar to the pattern found in most of the other studies. This similarity is there in almost all parameters used in study. Most poisoning is by agricultural poison. In that category the OPC tops the list. Most of the workers did not include the CA report in their analysis. Probably in their provinces

Table 1: Age and sex wise distribution of poisoning cases

Age group (in years)	Male		Female		Total cases	Total percentage
	Cases	%	Cases	%		
0-10	02	2.4	00	00	02	1.5
11-20	10	12.1	22	44	32	24.2
21-30	41	50.0	16	32	57	43.1
31-40	13	15.8	04	8	17	12.8
41-50	10	12.1	04	8	14	10.6
51-60	04	4.8	02	4	06	4.5
Above 60	02	2.4	02	4	04	3.0
Total	82	100	50	100	132	100

Table2: Area wise distribution of poisoning cases

Area	Total cases	Total	%
Urban		49	37.12
Rural		83	62.88
Total		132	100

Table 3: Distribution of poisoning cases according to religion and type of family

Religion	Total cases	%
Hindu	120	90.9
Muslim	11	8.3
Christian	01	0.8
Total	132	100
Family	Cases	%
Nuclear	53	40.2
Joint	79	59.8
Total	132	100

Table 4: Distribution of poisoning cases according to educational status

Educational status	cases	%
Illiterate	73	55.3
Below metric	29	21.9
Metric and above	18	13.6
Graduate	12	9.1
Total	132	100

Table 5: Distribution of poisoning cases according to marital status

Status	Male cases	%	Female cases	%	Total cases	Total %
Married	43	52.4	33	66	76	57.6
Unmarried	39	47.6	17	34	56	42.4
Total	82	100	50	100	132	100

Table 6: Distribution of poisoning cases according to socio-economic class

Class	cases	%
Upper	1	0.8
Middle	16	12.1
Lower	115	87.1
Total	132	100

Table 7: Distribution of poisoning cases according to duration of survival

Duration	cases	%
Spot death	53	40.1
1-6 hours	44	33.3
6-12 hours	10	7.6
12-24 hours	8	6.1
1-3 days	13	9.8
3-7 days	3	2.3
More than 7 days	1	0.8
Total	132	100

Table 8: Distribution of poisoning cases according to manner of death

Manner	cases	%
Suicide	90	68.2
Accidental	41	31.1
Homicidal	0	0
Not known	1	0.7
Total	132	100

Table 9: Distribution of poisoning cases according to type of poison

Poison	cases	%
Insecticides	30	22.7
ALP 06	4.5	
Acids	03	2.3
Snake bite	17	12.9
Not known	76	57.6
Total	132	100

Table 10: Distribution of poisoning cases according to Type of poison after chemical analysis

Poison	cases	%
Insecticides	71	53.79
Snake bite	17	12.88
Aluminum phosphide	14	10.60
Acids	03	2.27
No poison detected	10	7.57
No report received	17	12.88
Total	132	100

Table 11: Distribution of poisoning cases according to the poisonous compound

Compound	cases	%
Monocrotophos	20	20.41
Malathion	15	15.31
Methyl parathion	6	6.12
Chlorpyriphos	2	2.04
Phosphamidon	3	3.06
Dimethioate	5	5.10
Fanvalrat	2	2.04
Quinalphos	2	2.04
Dichlorwas	2	2.04
Phoselon	2	2.04
Fantion	1	1.02
Forate	1	1.02
Endosulphan	5	5.10
Benzene hexa chloride	1	1.02
Carbamates	4	4.08
Aluminum phosphide	14	14.28
Hydrochloride acid	3	3.06
No poison	10	10.20
Total	98	100

they must be receiving very late. Our study did it.

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Medico-Legal Study of Suspicious Death in Newly Married Females in Bidar, Karnataka

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Abstract

A rapid increase in unnatural deaths in females, especially in the first few years of their married life was observed in our society for last few decades. This drew the attention of people and forced the socio-political system to investigate and develop preventive measures [1-3].

In this study most of the victims were young (18-22 years) Hindu females of middle or lower-middle socio-economic status living in a joint family with their husband & in-laws and died in suspicious circumstances within three years of their marriage.

Majority of such deaths were suicidal or homicidal. Burning was the most common cause of death, followed by hanging and poisoning. Few of them were strangled to death and then burned to temper the evidences. Pressure for dowry was the single largest reason behind such deaths. Ill-treatment by the in-laws, rash and negligent behavior or extra-marital affairs of husbands, and mal-adjustment in females were other important reasons. Few of these deaths were also accidental catching fire while cooking or handling open lamp/fire carelessly. Loose synthetic saris of the victims were responsible for large number of mortalities in this study.

Key Word

Dowry, Newly married female. Husband and in-laws, arranged marriage, burn.

Introduction

The high incidence of unnatural deaths in newly married females within first few years of their marriage is a dark spot on the noble tradition of our society. The most obvious reason behind such deaths are unending demands of dowry (cash/kinds) by their husbands &/or in laws, for which they sometimes kill or torture the bride in such a way that she commits suicide [4].

Besides this, family quarrels due to ill-treatment by in-laws, rash & negligent behavior or extra marital affairs of husband and maladjustment & infertility in wives are other reasons behind such deaths. Burning is the most common cause of such deaths. Hanging, poisoning, strangulation or jumping from the terrace is also used by few to end the lives. The present study deals with the epidemiological, social & medico legal aspects of unnatural deaths in newly married females.

Materials and Methods

The material for the present study comprises of all the cases of newly married females died within seven years of their marriage that were brought to Mortuary Bidar Institute of Medical Sciences, Bidar for post mortem examination during the period from June 2008 to May 2010. To concentrate more on unnatural deaths due to family problems, the women died due to mass casualties, road traffic accidents, natural deaths and unidentified bodies were not included in this study. All the relevant information regarding epidemiological characteristic and their medico

legal aspects were gathered from the perusal of police papers, from interrogation of police officers, relatives, friends & others accompanying the dead bodies. Causes of death were noted from medico legal autopsy.

Observation & Results

Incidence: Total numbers of unnatural deaths in newly married females during the period from June 2008 to May 2010 were 143, which constitute of total 850 deaths autopsied during the same period.

Most of the victims (131 - 91.65%) were young adults between 18 to 26 years of age, of which 48 victims (33.57%) were between 21-22 years of age, followed by 38 (26.57%) in 18-20 years and 29 (20.28%) in 25-26 years age groups (Table1).

Table 1: Age of the victims

Age Group	No. of Cases	Percentage (%)
18-20	38	26.57
21-22	48	33.57
23-24	16	11.19
25-26	29	20.28
27-28	7	4.89
29-30	5	3.50
Total	143	100.00

The cases were few after 26 years, probably as the age advances, the girls become mature and handle the situation in much efficient manners.

Majority of the deaths (86-60.01%) happened within 3 years of marriage. The maximum number of cases - 39 (27.27%) were found between 1-2 years of marriage, followed by 26 (18.18%) within 1 year and 21 (14.69%) between 2-3 years of marriage (table 2).

Table 2: Duration since marriage of victims

Duration (Years)	No. of Cases	Percentage (%)
<1	26	18.18
1-2	39	27.27
2-3	21	14.69
3-4	10	6.99
4-5	18	12.59
5-6	8	5.59
6-7	21	14.69
Total	143	100.00

The number of unnatural deaths were decreased after 3 years but a slight increase was observed in 6 to 7 years after marriage i.e. 21 (14.69%) probably because of problems of infertility or infidelity.

Social Aspects

Almost all the victims (135-94.41%) were Hindu females where dowry system is more prevalent in the society. Muslims were only 8 (5.59%) and none of them died due to dowry.

Majority of the victims were either illiterate (37-25.87%) or poorly educated (65- 45.45%), only 6 (4.20%) of the victims were intermediate and 4 (2.80%) were graduate (table 3).

None of them was post graduate or professionally qualified. Amongst these almost all (138- 96.5%) the victims were nonworking (housewives) that were dependant on their husbands or in-laws. Four (2.80%) victims were laborers and one (0.70%) was a school teacher.

Majority (79-55.25%) belonged to lower middle (class IV), followed by 52 (36.36%) of middle (class III) socio-economic

group (table 4).

Table 3: Educational Status of victims

Educational Status	No. of cases	Percentage (%)
Illiterate	37	25.87
Primary	54	37.76
Jr. High School	11	7.69
High School	31	21.68
Intermediate	6	4.20
Graduate	4	2.80
Post-Graduate	-	-
Technical / Professional	-	-
Total	143	100.00

Table 4: Socio-economic Status of victims

SE Class	No. of cases	Percentage (%)
Lower (Class V)	8	5.59
Lower middle (Class IV)	79	55.25
Middle (Class III)	52	36.36
Upper Middle (Class II)	4	2.80
Upper	-	-
Total	143	100.00

Very few cases were seen from lower (class V) 8 -3.59% or upper middle (class II) 4 - (2.80%) strata. No one was found from upper (class I) group. The marriages were arranged in almost all (142-99.30%) the cases and three- quarters (105-73.43%) of the victims were living with their in-laws in joint families. 38(26.57%) were living with their husbands. There was only a single case of love marriage.

About half of victims husband were either unemployed (58-40.60%) or sharing family business (12- 8.39%). Husbands were employed in 42 (29.37%) cases but most of them were Jpw

Table 5: Occupation of the victims husband

Occupation	No. of cases	Percentage (%)
Unemployed	58	40.60
Service	42	29.37
Own business	19	13.28
Family business	12	8.39
Labor	06	4.20
Pheriwala	04	2.80
Others	02	1.40
Total	143	100.00

Table 7: Cause and Manner of Death

Cause of death	Manner of death							
	Suicidal		Homicidal		Accidental		Total	
	No.	%	No.	%	No.	%	No.	%
Burning	17	11.89	13	9.09	33	23.08	63	44.06
Hanging	42	29.37	-	-	-	-	42	29.37
Poisoning	13	9.09	5	3.50	-	-	18	12.59
Strang/throttling	-	-	15	10.49	-	-	15	10.49
Drowning	-	-	-	0.70	-	-	1	0.70
Others	2	1.40	-	-	-	-	2	1.40
Total	72	50.35	36	25.17	33	23.08	143	100.00

deaths were nearly equal i.e. one fourth each of the total cases (Table 7).

In suicidal cases, hanging was the commonest (42- 29.37%) cause of death, followed by burning (17- 23.61 %) and ill-

Table 8: Motives behind suicidal and homicidal deaths

Motives	Suicidal deaths (72 cases)		Homicidal deaths (36 cases)	
	No.	%	No.	%
Dowry	18	25.00	21	58.33
Ill-treatment by in-laws	19	26.39	2	5.56
Hash & neg. behav. of husband	11	15.28	2	5.56
Extra-marital affairs	6	8.33	7	19.44
Drunkness	5	6.94	3	8.33
Mal-adjustment of wife	6	8.33	-	-
Poverty	4	5.56	-	-
Infertility in female	3	4.17	-	-
Total	72	100.00	36	100.00

salariied. 19 (13.28%) of the victims husbands had their own business (table 5).

Remaining 12 (8.39%) were either laborers or doing similar job.

Family life was not happy in three quarters (107-74, 82%) of the cases. The prime cause of unhappiness was the pressure for dowry by in-laws and its inability to pay by the parents, which was ectly observed in 39(27.27%) cases. The other causes were ill-treatment/torture by in-laws in 21(14.68%)cases rash and negligent behavior of husband in Table 6: Reasons behind unhappy married life of the victims

Reason of	No. of eases	Percentage (%)
unhappy life Dowry	39	27.27
Ill-treatment by in-laws	21	14.68
Rash & negligent behavior of husband	13	9.09
Extra-marital affairs	13	9.09
Drunkness	8	5.59
Mal-adjustment of wife	6	4.20
Poverty	4	2.80
Infertility in female	3	2.10
Total	107	74.83

13(9.09%) cases & inability of victim to adjust properly in 6 (4.20%) cases (table 6).

The extra-marital affairs (13- 9.09%) and alcoholism in husband (8-5.59%) were few other reasons behind marital unhappiness. The evidence of unhappy married life was not traced in 36 (25.17%) cases.

Medico Legal Aspects

Amongst the causes of death, burning was the commonest one (63- 44.06%), followed by hanging (42- 29.37%) and poisoning (18-12.59%). As to the nature of death, about half (72-50.35%) of unnatural deaths-were suicidal. Homicidal (36-25.17%) & accidental (33-23.08%)

treatment by in-laws (19-26.39%), excessive dowry demand (18- 25.00%) and rash & negligent behavior of husband (11-15.28%) were three important reasons behind such deaths (table 8).

In homicidal cases, strangulation/ throttling was the commonest (15- 41.67 %) cause of death, followed by burning (13- 36.11 %) and failure to fulfill dowry demands (21- 58.33%) & opposing the extra-marital affairs of husband (7-19.44%) were main reasons behind murders.

All accidental deaths were due to burning, where unprotected cooking (27- 81.81%) in loose synthetic sari (25-75.75%) was the main factor behind the causality.

Discussion

The high incidence of unnatural death in young Hindu females, within 3 yrs of their marriage was probably due to widely prevalent dowry system amongst Hindus of upper & middle class of Northern India, where the newly married victims were tortured for "cash/ kinds" in such a way that no option was left except to end their unhappy married life[5]. For this, they preferred hanging, burning or poisoning whatever may be easily available at the time. For the same reason, few of them were killed by their husband or in-laws by the means of strangulation or burning. Here in some cases, bodies were also burned to tamper the evidences of murder. The authors [6] in another study of strangulation found that victims were killed & then burned to hide the crime in 38.46% cases. Thus, the perpetrators get enough opportunity to tamper with or destroy the circumstantial evidences.

Besides dowry, ill-treatment/torture by mother in-law, extra-marital affairs, rash & negligent behavior and drunkenness of husband and non-adjusting nature of wives were the other reasons behind such deaths. Illiteracy, joint family structure, unemployment & economic dependence of husband on their parents and nearly complete dependence of women on their husband &/or in-laws were other contributory factors affecting the marital unhappiness in one or the other way [7].

This can be prevented by

- Promoting literacy & professional courses and encouraging employment among girls to make them economically independent at the time of marriage.
- Encouraging inter-caste marriage through free choice or mutual understanding.
- Discouraging dowry demands and costly & ostentatious marriage rituals through education.
- Allowing newly wed couples to live separately from their families during first few year of their married life.
- All the accidental deaths in this study were due to BURN and most of the victims caught fire while cooking on open unguarded flame such as chulha, kerosene stove,

cooking gas etc. in loose, highly inflammable synthetic garments like sari. This is also because the responsibility of cooking was assigned to newly, married housewife in most of the families of Northern India [8].

Conclusion

Deaths in newly married females due to various family problems constitute 5% of total unnatural deaths.

- Most of the victims were young Hindu women between 18-26 years of age who died within three years of their marriage.
- Majority of the victims were poorly educated, non-working (housewives), belonging to middle or lower-middle socio-economic groups. Their marriage was arranged and they were living with their in-laws in joint family.
- Husbands were either unemployed or poor salaried and they were dependent on parents for most of the expenses.
- Family life of the victim was not happy in most of the cases. Pressure for more dowry, ill-treatment/ torture by in-laws, rash & negligent behavior or extra-marital affairs of husband were the important reasons behind family unhappiness.
- Half of the deaths were suicidal. Homicidal & accidental cases shared equally the remaining half. As a whole, burning was the most common cause of death but hanging was the commonest in suicidal, strangulation in homicidal and burning in accidental deaths.
- Ill-treatment by the in-laws, excessive pressure for dowry and negligent behavior of husband were the main reasons behind suicidal deaths. Failure to fulfill dowry demands & opposing extra-marital affairs of husband were main reasons in homicidal deaths & wearing loose synthetic sari while cooking on unprotected flame in cases of accidental deaths.

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FORDISC Analysis of Metric Osteogenetic Traits of North Indian Crania (Predominantly Haryanavi)

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Introduction and Review of Literature

Much attention has been paid to the variations of the shape and size of the human skull and efforts have been made to associate these variations with certain differences which characterize different races¹. It is a matter of common experience that in dealing with crania of different racial types, an impression of racial affinity and differences may often be introduced. Skeletal metric and non-metric variables are widely used for such studies².

Measurements play an important role in skeletal morphology. Cranial and postcranial measurements have typically been used to describe individuals and to correlate various ethnic and racial groups. Prior to the year 1960³, comparisons were based on single measurements. These measurements have shown the shape and size variations of different racial groups. Then came the era of multivariate analysis. The modern methods based on the computed softwares focussed on various statistical programs backed by multivariate analytical methods⁴. Alternatively, the craniometric methods have extensive use in forensic anatomy by reconstructing the most probable human faces and physiques from dry skeletal remains⁵. Besides rebuilding the actual morphology of "most probable" figures, one can also rebuild the ancestry of the individual by using the genetically transmitted traits⁶. At present these methods play very crucial roles in many branches of science including human anatomy, forensic anatomy, palaeoanthropology, bioanthropology, bioarchaeology and other human population and evolutionary studies.

Material and Methods

For the study 150 complete skulls (115 males, 35 females) were used. These bones were retrieved & available in the department of Anatomy, Pt. B.D. Sharma PGIMS Rohtak. Skulls showing obvious pathological deformities were excluded from study. The age to which these skulls belonged was also noted from records, whenever possible.

The study was conducted according system proposed by Howells. These systems involve identification of certain landmarks on skull for making measurements. Landmarks selected for cranial measure merits were as described by Howells⁷. 21 variables were used for the study and these were Glabella-occipital length (GOL), Basion-nasion length (BNL), Basion-bregma height (BBH), Maximum cranial breadth (XCB), Bizygomatic breadth (ZYB), Biauricular breadth (AUB), Basion-prosthion length (BPL), Nasal height (NLH), Orbital height (OBH), Nasal breadth (NLB), External palate breadth (MAB), Mastoid height (MDH), Biorbital breadth (EKB), Interorbital breadth (DKB), Foramen magnum length (FOL), Frontal chord-nasion-bregma chord (FRC), Parietal chord-bregma-lambda chord (PAC), Occipital chord, lambda-opisthion chord (OCC), Inferior malar length (MAL), Basion bregma height (BBH) and Minimum frontal breadth (WFB)

Observation and Discussion

Data was analyzed as follows:

FORDISC 2.0 analytic method developed by University of Tennessee USA. It has data from 28 populations of the world.

Different variables (GOL, XCB, ZYB, BBH, BNL, BPL, MAB, MAL, AUB, WFB, NLB, NLH, BBH, OBH, EKB, DKB, FRC, PAC, OCC, FOL, MDH) of each crania were entered in FORDISC. Following results of each cranium were obtained.

1. Sex
2. Race in which each cranium was classified along with population distance, typicality probability and posterior probability.
3. Percentage correction of sex and race.
4. Population to which Haryanvi skull showed maximum affinity (one out of Howells 28 population).

Sex Estimation

In our study all the crania belonged to known sex. Sex was also estimated with the help of FORDISC to find out its reliability rate. Out of 115 male crania only 54.78% were classified as males while rest were classified as females. Similarly out of 35 female crania 31 (88.57%) were classified as female, four were classified as males. Accuracy of results of female crania was better than male crania. There appears to be sound reason for this. In the data base of FORDISC, most of the crania are from Americans and Negroes and fewer crania are from China, Japan and Vietnam. Americans and Negroes are robust as compared to other populations. So small size crania of population of north India are more likely to be classified as females. Present finding are consistent with what has been reported by Kannappan et al⁸ that Indians male skulls are smaller than American female skulls i.e. why most of the male crania were classified as females.

Racial Classification

When mean of different variables were entered in FORDISC, it was observed that north Indian males showed close affinity with Hispanic males while females showed close affinity with American Whites. With individual crania measurements highest affinity was found with American White (34.66%), followed by Blacks (25.33%) and Hispanic (22.00%) (Table 1). On the racial basis this population showed Caucasoid affinity 56.66%, Negroid 31.33% and Mongoloid 11.99% (table 1). Reddy described that Indians are Caucasoid with few Negroid characters. **Present study has proved that in addition to Caucasoid and Negroid features Haryana have some resemblance with Mongoloid too.** The present findings further support the contentions of David et al⁹ who suggested that analysis of individual crania rather than means to be more suggestive of population affinity. The same FORDISC software calculations have pronounced that North Indian crania specially from Haryana crania have significant affinities with American White (34.66%), followed by Blacks (25.33%) and Hispanic 22.09% (Mediterranean group/ Spanish speaking people).

Summary

On the racial basis Haryana population showed Caucasoid affinity 56.66%, Negroid 31.33% and Mangoloid 11.66%. Till now it has been described that Indians are Caucasoid with few Negroid characters. Present study has

added a new dimension that in addition to Caucasoid and Negroid features Haryana crania have some resemblance with

Mongoloid too.

Table 1: North Indian population affinity with different races

Population of FORDISC	Race	No. of cases showing affinity for different population	Percentage frequency
American Black (AF/AM)	Negroid	9	6.00
American White (WF/WM)	Caucosoid	52	34.66
Blacks (BF/BM)	Negroid	38	25.33
Japanese (JM/JF)	Mongloid	3	2.00
Vietnams (VM/VF)	Mongloid	4	2.66
Chinese (CHM/CHF)	Mongloid	11	7.33
Hispanic (HM/HF)	Caucosoid	33	22.00

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Comparison in the Toxicities of Cuprous (Cu⁺) and Cupric ion (Cu²⁺) Salts on the Various Organs of Ratus Norvegicus and its Comparison with the Lead

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Abstract

We know that heavy metal toxicity is a serious problem which adversely affects the growth, health, reproductive performance and life span of all living organisms. In our previous work¹, we have studied the effects of Lead on the reproductive parameters of female rat (*Ratus Norvegicus*) and the effect of hydrophobic character of big biomolecules²⁻³ (eccrine) and its interactions with the various alkali and alkaline earth metals on the stability pattern of Lyotropic series⁴ (Hofmeister series). Copper being a toxic cumulative poison, experiments were conducted at an oral chronic dose of (30 mg/kg/day) for 60 days on adult female rats (*Rattus Norvegicus*) and its effect on the reproductive functions in relation to the biochemical effects on various organs was studied. Copper exist in two forms of cuprous (Cu⁺, Cuprous Chloride) and cupric (Cu²⁺, Copper Sulphate), while the higher oxidation species, Cupric (Cu²⁺) is found to be more toxic as compared to lower oxidation state, Cuprous salts (Cu⁺). It was observed that the chronic dose of copper caused an elevation in the level of proteins, acid phosphatase, alkaline phosphatase, alanine aminotransferase and aspartate aminotransferase in all the soft tissues studied indicating tissue damage as similar with the toxicity of lead (Table 1). It also inhibited the level of acetylcholinesterase in all the tissues. However, the trend appears as follows:

Cupric ions (Cu²⁺) > Lead (Pb²⁺) > Cuprous ion (Cu⁺)

Fertility tests by pairing treated females with males showed that lead treated female showed irregular oestrous cycle and the fertility rate dropped to 47 % as female pups of mothers showed loss in weight, high mortality rate, poor growth rate and late vaginal opening.

The higher charge copper (Cu²⁺) is more toxic as compared to lower oxidation state (Cu⁺). This fact is based on the Hofmeister series⁴ (higher charge cation interact more strongly with the biomolecules as compared to smaller one). The present study revealed that copper caused great tissue damage and affected reproductive performance of female rats at a chronic dose.

Introduction

Copper is known to be very potential toxic. However its effect as compared to environmental pollution is very less as compared to the number of suicidal cases are reported in literature which shows the toxicity of copper salts. Occupational hazards due to copper exposure produce reversible changes in mood and personality as fatigue, irritability, depression, deficits in vascular motor functioning, memory and verbal ability²⁻³. There is no literature found which shows maternal blood copper level as an environmental factor is an apparent factor of low birth weight and child body mass ratio⁵ and low to moderate environmental exposure increases the risk for spontaneous abortion. However, no evidence is being found that copper is present in maternal blood. Copper has no known biological function and any copper absorbed by man or animals may be potentially toxic and very fatal results in immediate death. Copper has high affinity for various complexing groups such as imidazole, amino group of lysine and cysteine sulfhydryls. By interacting with big biomolecules, copper may interfere with biochemical processors through disruption of substrate binding. The toxic effects are many, ranging from morphological tissues damage

at higher concentration to lesser biochemical effects at lower concentrations⁵⁻¹⁶. Since the absorption of copper indicated toxicity in humans is very less due to the intake through food, air, and water, it became imperative to carry out a systematic study on the effect of chronic oral dose of copper on the functioning of various organs of rat and also to record the various enzymatic changes in rats. These findings would be useful in understanding the various effects on sensitive species and also extrapolating, with care the results for humans.

Material and Methods

Disease free albino rats 2-3 months were maintained on rat feed (Ashirwad Industries, Chandigarh-India) and black gram. Water was provided *ad libitum*. Blood samples were drawn into heparinised tubes and plasma was separated after centrifugation at 3000 rpm for 5 minutes at room temperature. The plasma was diluted in the ratio of 1:10. The tissue samples were homogenized in the homogenizer in potassium phosphate buffer in the ratio of 1:10. The effect of copper on aspartate aminotransferase, alanine aminotransferase, acid phosphate and alkaline phosphatase was estimated by the method of Wootton (1964). The cholinesterase activity was determined according to the method of Voss and Sachsse¹⁷ (1970) and total proteins were determined by Lowry et al. (1951). Statistical significance of biochemical parameters was obtained by students t- tests at 1% level (P<0.01) and at the 5% level (P<0.05). The sections were stained with haematoxylin eosin and stained serial sections of ovaries were examined under light microscope and morphological characteristics of normal and arteric follicles observed.

Fertility tests were conducted by treating female rats continuously for three months with copper (@ 30mg/kg/day) and housed with mature normal untreated males. The males were separated from females after formation of vaginal plug. The female were observed for entire gestation period of 28 days and the parameters of birth rate, litter size, morphological alterations, survival rate of pups, body weight from birth to 30 days, and vaginal opening in female pups for the litter were recorded. The surviving pups were then administered copper @ 30 mg/kg body weight after weighing up to 60 days of age.

Results and Discussions

Biochemical parameters: Daily oral administration of copper (30 mg/kg/day) for 60 days produced a significant increase in the levels of acid phosphatase in liver, kidney and ovary and a non-significant increase of enzyme in plasma following daily exposure of lead. Acid phosphatase is a lysosomal enzyme and is stimulated in cases of tissue damage¹⁴. Increase in level of acid phosphatase in liver and kidney might be suggestive of increase physiological phagocytosis¹⁵ and the moderate amount of acid phosphatase activity in regressing luteal cells of the ovary indicated lysosomal activity in luteolysis¹⁶. Alkaline phosphatase helps in ionic movement across the cell membrane and is also associated with secretory and

absorption processes of the cell¹⁸. Wise (1987) in bovine follicles also postulated AKP as an excellent indicator of atresia since AKP activity was greater in ovary. The changes in enzymes system had been correlated with the steroid biosynthesis in the granulosa cells of maturing follicles of mammalian ovary¹⁷. The increase in acid phosphatase activity estimated biochemically would therefore mean a destruction of the luteal cells which is in support of the fact that absence of acetylcholinesterase activity in ovary also causes lack of steroidogenesis. Ryan (1981) had also associated a relationship of acid phosphatase being a lysosomal enzyme playing a phagocytic role in follicle cells during atresia. It has been further suggested that in follicle cells, lysosomal enzymes affects estrogen receptor by dephosphorylation which led to atresia and also the enzyme acid phosphatase is an excellent indicator of atrophy¹⁷. Copper (30 mg/kg/day) caused a significant increase in alkaline phosphatase level (Table 1) in plasma, liver, kidney and ovary. It has been suggested that an increase in alkaline phosphatase level occur due to the damage of the cells of liver, kidney, small intestine and bone resulting in liberation of this enzymes in the blood systems (Zimmerman 1969). Copper (Cuprous chloride & Copper sulphate) at the dose rate of 30 mg/kg/day for 60 days produced an overall increase in the levels of alanine aminotransferase in plasma, liver and ovary and a non significant rise in its level kidney (Table 2). Alanine aminotransferase is present in liver, kidney, heart, skeletal muscles, intestines and RBC (Doxy 1971) and its increased values are specific indicator of hepatocellular (liver) damage (Kaneko 1989). Copper also produced significant increase in aspartate aminotransferase in liver, plasma and ovary (Table 2). Aspartate aminotransferase SGOT occur mainly in muscles (Doxey 1971) and increase in its activity related to the leakage of enzyme from muscles because of muscular activity induced

by intoxication. Direct effect of lead on muscles increasing the permeability of cell membrane cannot be excluded (Thomson 1971). Elevation of both alanine and aspartate aminotransferases in blood had been used also as an indicator of altered permeability of plasma membrane (Ramazzotto and Carlin 1978), cellular damage (Drotman and Lawhorn, 1978) and altered metabolism during insecticide toxicity (Malik et. al 1980). Daily oral administration of different salts of copper produced significant decrease in AChE level in liver, kidney and ovary and non significant decrease in plasma (Table 3). It was considered that decrease in AchE activity was responsible for behavioural and locomotor changes recorded in lead intoxicated calves (Golter and Michelson, 1975). Acetylcholinesterase in the luteal cells of ovary hydrolyses acetylcholine in the production of acetic acid which is used subsequently in the pathway for production for steroidogenes for hormone production in the goat ovary (Bhattacharya, 1978). Thus decrease in AChE activity in the rat ovary might be an indicator of the lack of steroidogenesis resulting in poor fertility²⁰⁻²². Significant increase in the levels of proteins in liver, kidney, ovary and non-significant increase of proteins in plasma were observed following daily oral dosing of lead (Table 3). The elevation of proteins is reported to occur in conditions when the cells are subjected to wide variety of environmental assaults including toxins, poisons and pollutants and is mainly due to stimulation of the synthesis of acute phase protein and corresponding m-RNA (Puga and Rodrigues, 1974) which buffer them from harm (Welch, 1993). Elevation of proteins might also be due to destruction of tissues, which cause release of proteins.

The above study concluded that copper has interaction with the vital body functions and reproductive parameters in rats. The dosage administered caused significant biochemical alterations and reduction in the weight of pups as well as the treated mothers. Copper caused high mortality rate in pups and also slows down their growth rate.

Table 1: Effect of cupric (Cu²⁺), cuprous (Cu⁺) and lead (Pb²⁺) on tissue phosphatases

Organ	Control	Treatment					
		15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
Acid phosphatase (n mol phenol liberated / min/ml) (Mean ± S.D.)							
Plasma	0.691±0.2001	0.633 ± 0.989 (A) 0.622±0.092 (B) 0.609 ± 0.078 (C)	0.699 ± 0.078 (A) 0.656±0.061(B) 0.649 ± 0.078(C)	0.684 ± 0.189 (A) 0.670±0.273(B) 0.589 ± 0.378(C)	0.705 ± 0.143 (A) 0.699±0.158 (B) 0.601 ± 0.143 (C)	0.799 ± 0.088(A) 0.715±0.099 (B) 0.609 ± 0.85 (C)	0.829±0.043(A) 0.867 ± 0.068 (B) 0.998 ± 0.078 (C)
Liver	118.93±2.95	120.01 ± 0.99 (A) 119.41 ± 1.92 (B) 118.23 ± 0.99(C)	118.23 ± 3.45 (A) 116.43 ± 2.48 (B) 121.23 ± 2.33 (C)	133.22 ± 0.99 (A) 130.72 ± 0.97 (B) 129.66 ± 0.88 (C)	129.99 ± 3.21 (A) 125.30±2.69 (B) 123.45 ± 3.32(C)	149.09 ± 3.21 (A) 147.92 ± 2.40 (B) 145.34 ± 3.34 (C)	201.22 ± 2.23(A) 196.52 ± 3.69(B) 195.33± 2.32 (C)
Kidney	9.315±0.258	8.982 ± 2.322 (A) 9.283 ± 2.240(B) 8.99 ± 1.256 (C)	14.232 ± 2.99 (A) 15.590 ± 3.12 (B) 14.44 ± 2.99 (C)	25.782 ± 2.66 (A) 26.326 ± 1.77 (B) 25.55 ± 1.99 (C)	28.99 ± 1.899(A) 26.058 ± 2.88(B) 25.233 ± 1.99 (C)	29.98±0.898 (A) 25.550±0.938(B) 23.232±0.787(C)	28.189 ±1.238(A) 29.055 ± 1.301(B) 30.78 ± 1.567(C)
Ovary	4.069±0.65	4.789 ± 0.089(A) 4.527±0.078(B) 4.322 ± 0.079(C)	5.12±0.078(A) 4.222 ± 0.056(B) 4.001 ± 0.078(C)	5.23 ± 0.399 (A) 4.54 ± 0.403(B) 5.78 ± 0.230(C)	6.73 ± 0.709 (A) 5.73 ± 0.698 (B) 6.78 ± 0.787 (C)	10.09 ± 0.166 (A) 9.71 ± 0.146 (B) 9.09 ± 0.177 (C)	22.99 ± 0.789(A) 21.934 ± 0.639(B) 19.98 ± 0.567(C)
Alkaline Phosphatase (n mol phenol liberated / min/ml) (Mean ± S.D.)							
Plasma	13.81±0.215	15.09 0± 0.909(A) 12.602 ± 0.880 (B) 13.121 ± 0.789 (C)	19.987 ± 0.898(A) 18.487±0.955(B) 19.09 ± 0.880 (C)	24.342 ± 1.088A 22.214 ± 1.090B 20.099 ± 0.099C	27.898 ± 1.20A 24.535 ± 1.190B 20.099 ± 0.099C	32.16 ± 0.399A 29.54 ± 0.455B 28.89 ± 0.322C	42.672± 0.299A 40.912 ± 0.346B 39.982 ± 0.238C
Liver	27.15 ± 0.786	29.99 ± 0.789(A) 27.950 ± 0.673(B) 26.77 ± 0.289(C)	33.23 ± 0.099(A) 29.530 ± 0.600(B) 25.542 ± 0.599C	32.097 ± 0.998A 35.091 ± 1.630(B) 32.898 ± 2.201(C)	32.78 ± 0.299A 30.630 ± 0.304B 28.86 ± 0.299(C)	39.89 ± 0.099 A 35.841±1.013(B) 33.21 ± 1.001(C)	44.09 ± 1.211A 42.349 ± 1.960(B) 40.89 ± 1.211(C)
Kidney	1630.003± 12.930	2012.299±32.199(A) 1846.310±24.140(B) 1799.211±25.678(C)	1921.56±19.987A 1857.760±20.980B 1801.34±19.988(C)	1999.89±19.098A 1801.551±18.490 ^{ab} B 1707.78±19.098(C)	1989.688±40.098A 1874.277±39.950 ^{ab} B 1801.356 ± 40.098(C)	2015.232±22.324(A) 1964.194±21.380 ^{ab} B 1899.234±22.232C	2999.456±20.099(A) 2846.250±19.330 ^{ab} (B) 2789.232± 20.098 (C)
Ovary	12.193 ± 3.050	19.899 ± 0.345 (A) 14.280 ± 0.495(B) 13.234 ± 0.453(C)	22.343 ± 7.654 (A) 21.550 ± 7.690(B) 20.098 ± 5.788(C)	25.456 ± 2.456(A) 22.261 ± 2.480(B) 20.098 ± 3.212(C)	33.234 ± 3.212(A) 26.998 ± 2.970(B) 30.098 ± 3.211(C)	35.345 ± 0.4098 (A) 31.460 ± 0.500(B) 30.123 ± 0.399(C)	46.567 ± 8.909(A) 45.260 ± 9.900(B) 40.098 ± 8.988(C)

A: Cupric Salts (Cu²⁺), B: Lead (Pb²⁺), C: Cuprous Salts (Cu⁺),

a-Statistically significant different (P<0.05) when compared to values of control animals,

b-Statistically significantly different (P<0.01) when compared to control animals,

All values given are the mean of 3 animals except control, Control values given are the mean of 4 animals.

Table 2: Effect of Cupric (Cu²⁺), Cuprous (Cu⁺) and Lead (Pb²⁺) on tissue aminotransferases.

Organ	Control	Treatment					
		15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
Alanine aminotransferase (n mol pyruvate formed / min/ml) (Mean ± S.D.)							
Plasma	12.22±0.22	4.2300 ± 0.197 ^{ab} (A)	15.890±0.36(A)	14.906 ± 0.060(A)	14.220±0.620(A)	18.280 ± 0.370(A)	20.235 ± 0.770(A)
		3.9300±0.187 ^{ab} (B)	12.880 ± 0.160(B)	12.966 ± 0.050(B)	13.430±0.720(B)	15.420 ± 0.260(B)	19.315 ± 0.410(B)
		3.2300±0.137 ^{ab} (C)	11.280 ± 0.030(C)	11.826 ± 0.078(C)	12.780±0.328(C)	12.280 ± 0.390(C)	18.242 ± 0.310(C)
Liver	428.310 ± 19.64	599.106±13.09(A)	708.740±4.790(A)	609.890 ± 28.86 (A)	523.080±3.980(A)	598.044±30.89(A)	666.090±13.26(A)
		570.146±16.07(B)	658.940±5.380(B)	477.900 ± 21.17(B)	491.070±2.570(B)	541.090±40.17(B)	566.090±11.56(B)
		566.125 ± 15.07(C)	643.830±3.380(C)	407.880 ± 20.47(C)	482.050±3.48(C)	540.089±29.97(C)	589.040±13.86(C)
Kidney	52.400 ± 10.73	58.344 ± 0.350(A)	58.899 ± 3.220(A)	62.190 ± 12.11(A)	63.612 ± 2.328(A)	66.238 ± 4.390(A)	71.236 ± 8.810(A)
		55.240 ± 0.650 (B)	59.930 ± 4.480(B)	60.500 ± 13.09(B)	58.600 ± 8.900(B)	65.620 ± 6.250(B)	68.996 ± 9.610(B)
		52.390 ± 0.350(C)	55.330 ± 2.390(C)	59.230 ± 15.11(C)	55.124 ± 3.240(C)	63.590 ± 5.24 (C)	64.236 ± 8.890(C)
Ovary	6.560 ± 0.180	11.789±0.299 ^{ab} (A)	17.66 ± 9.660 ^{ab} (A)	20.38 ± 9.99 ^{ab} (A)	29.80 ± 0.660 ^{ab} (A)	24.93 ± 6.779 ^{ab} (A)	38.92 ± 0.599 ^{ab} (A)
		9.490 ± 0.310 ^{ab} (B)	15.87 ± 8.650 ^{ab} (B)	17.47 ± 10.30 ^{ab} (B)	24.78 ± 0.760 ^{ab} (B)	20.83 ± 5.480 ^{ab} (B)	31.83 ± 0.630 ^{ab} (B)
		8.020 ± 0.580 ^{ab} (C)	13.78 ± 6.890 ^{ab} (C)	12.39 ± 11.77 ^{ab} (C)	23.99 ± 0.380 ^{ab} (C)	19.98 ± 6.340 ^{ab} (C)	31.77 ± 0.289 ^{ab} (C)
Aspartate Aminotransferase (n mol pyruvate formed / min/ml) (Mean ± S.D.)							
Plasma	2.15 ± 0.04	6.99 ± 0.26 ^{ab} (A)	5.29 0.88 ^{ab} (A)	7.93 ± 0.53 ^{ab} (A)	7.99 0.88 ^{ab} A	9.99 ± 0.28 ^{ab} (A)	7.09 ± 1.98 ^{ab} (A)
		5.09 ± 0.46 ^{ab} (B)	4.30 0.79 ^{ab} (B)	5.93 ± 0.53 ^{ab} (B)	5.92 ± 0.77 ^{ab} B	5.78 ± 0.05 ^{ab} (B)	6.99 ± 1.02 ^{ab} (B)
		4.22 ± 0.36 ^{ab} (C)	3.23 0.88 ^{ab} (C)	4.33 0.23 ^{ab} (C)	4.88 0.68 ^{ab} C	7.99 ± 0.25 ^{ab} (C)	5.62 ± 2.23 ^{ab} (C)
Liver	263.10 ± 21.57	368.21 ± 13.69(A)	299.89±7.995(A)	309.99±13.88(A)	318.03 ± 12.89 A	374.88 ± 32.99(A)	365.77 ± 28.94(A)
		275.91 ± 12.57(B)	294.82±9.210(B)	299.92±12.32(B)	298.03 ± 11.24(B)	304.44 ± 33.62(B)	313.81 ± 26.74(B)
		259.79 ± 13.78(C)	292.19±6.390(C)	209.68±13.45(C)	269.23 ± 13.89(C)	289.32 ± 32.38(C)	303.61 ± 28.74(C)
Kidney	209.60 ± 10.11	299.67 ± 12.99(A)	269.99±2.459 ^{ab} (A)	299.99±13.99 ^{ab} (A)	292.68±12.82 ^{ab} (A)	399.97±13.88 ^{ab} (A)	401.88 ± 13.35(A)
		231.94 ± 13.85(B)	263.412.050 ^{ab} (B)	292.75±11.56 ^{ab} (B)	294.07±13.82 ^{ab} (B)	319.76±12.27 ^{ab} (B)	344.35 ± 14.41(B)
		230.89 ± 12.69(C)	253.91±1.030 ^{ab} (C)	2802.75±14.99(C)	285.44±11.99 ^{ab} (C)	309.94±17.99 ^{ab} (C)	340.02 ± 12.88(C)
Ovary	4.03 ± 0.74	4.999± 0.39(A)	8.99 ± 0.49 ^{ab} (A)	9.998 ± 0.89 ^{ab} (A)	21.88 ± 0.39 ^{ab} (A)	15.99 ± 3.05 ^{ab} (A)	35.99 ± 8.74 ^{ab} (A)
		4.140± 0.62(B)	7.120 ± 0.49 ^{ab} (B)	7.520 ± 0.13 ^{ab} (B)	12.93 ± 0.58 ^{ab} (B)	15.15 ± 2.05 ^{ab} (B)	22.74 ± 1.74 ^{ab} (B)
		4.140± 0.62(C)	7.120 ± 0.49 ^{ab} (C)	5.345 ± 0.22 ^{ab} (C)	10.03 ± 0.88 ^{ab} (C)	12.85 ± 4.05 ^{ab} (C)	20.04 ± 0.24 ^{ab} (C)

A: Cupric Salts (Cu²⁺), B: Lead (Pb²⁺), C: Cuprous Salts (Cu⁺),

a-Statistically significant different (P<0.05) when compared to values of control animals,

B-Statistically significantly different (P<0.01) when compared to control animals,

Control values given are the mean of 4 animals.

Table 3: Effect of lead on tissue acetylcholinesterase and proteins

Organ	Control	Treatment						
		15 Days	30 Days	45 Days	60 Days	75 Days	90 Days	
Acetylcholinesterase (n mol Acetylcholine hydrolysed / min/ml) (Mean ± S.D.)								
Plasma	0.1075 ± 0.09	0.055 ± 0.033(A)	0.077 ± 0.038(A)	0.095 ± 0.042(A)	0.097 ± 0.030(A)	0.099 ± 0.039(A)	1.09 ± 0.066(A)	
		0.045 ± 0.029(B)	0.060 ± 0.030(B)	0.070 ± 0.024(B)	0.090 ± 0.080(B)	0.076 ± 0.067(B)	0.056 ± 0.070(B)	
		0.035 ± 0.032(C)	0.059 ± 0.022(C)	0.067 ± 0.024(C)	0.070 ± 0.034(C)	0.56 ± 0.045(C)	0.052 ± 0.069(C)	
Liver	3.70 ± 0.56	0.698 ± 0.089 ^{ab} (A)	0.990 ± 0.075 ^{ab} (A)	0.897 ± 0.065 ^{ab} (A)	0.952 ± 0.088 ^{ab} (A)	0.999± 0.076 ^{ab} (A)	1.013 ± 0.023 ^{ab} (A)	
		0.500 ± 0.050 ^{ab} (B)	0.7680 ± 0.088 ^{ab} (B)	0.647 ± 0.068 ^{ab} (B)	0.552±0.070 ^{ab} (B)	0.909 ± 0.066 ^{ab} (B)	0.713 ± 0.050 ^{ab} (B)	
		0.403 ± 0.029 ^{ab} (C)	0.620 ± 0.078 ^{ab} (C)	0.545 ± 0.049 ^{ab} (C)	0.501±0.069 ^{ab} (C)	0.809 ± 0.057 ^{ab} (C)	0.793 ± 0.250 ^{ab} (C)	
Kidney	0.560 ± 0.05	0.636 ± 0.294 ^a (A)	0.743 ± 0.020 ^{ab} (A)	0.833 ± 0.063 ^{ab} (A)	0.989±0.095 ^{ab} (A)	0.710 ± 0.088 ^{ab} (A)	0.556 ± 0.034 ^{ab} (A)	
		0.417 ± 0.064 ^a (B)	0.263 ± 0.010 ^{ab} (B)	0.464 ± 0.073 ^{ab} (B)	0.246±0.095 ^{ab} (B)	0.310 ± 0.048 ^{ab} (B)	0.156 ± 0.034 ^{ab} (B)	
		0.378 ± 0.054 ^a (C)	0.202 ± 0.090 ^{ab} (C)	0.408 ± 0.029 ^{ab} (C)	0.209±0.0235 ^{ab} (C)	0.278 ± 0.028 ^{ab} (C)	0.106 ± 0.024 ^{ab} (C)	
Ovary	0.459 ± 0.07	0.199 ± 0.087 ^{ab} (A)	0.207 ± 0.023 ^{ab} (A)	0.499 ± 0.058(A)	0.589 ± 0.034(A)	0.775 ± 0.023 ^{ab} (A)	0.849 ± 0.088 ^{ab} (A)	
		0.257 ± 0.057 ^{ab} (B)	0.157 ± 0.040 ^{ab} (B)	0.367 ± 0.047(B)	0.388 ± 0.047(B)	0.275 ± 0.017 ^{ab} (B)	0.149 ± 0.090 ^{ab} (B)	
		0.178 ± 0.056 ^{ab} (C)	0.123 ± 0.032 ^{ab} (C)	0.222 ± 0.023(C)	0.299 ± 0.023(C)	0.262 ± 0.005 ^{ab} (C)	0.123 ± 0.088 ^{ab} (C)	
Proteins (g/100ml) (Mean ± S.D.)								
Plasma	0.83±0.056 (A)	0.089±0.032(A)	0.092±0.003(A)	0.099±0.007(A)	1.021±0.002(A)	1.032±0.068(A)	1.056±0.029(A)	
		0.77±0.096 (B)	0.076±0.005(B)	0.079±0.004(B)	0.082±0.008(B)	0.086±0.002(B)	0.081±0.077(B)	0.092±0.033(B)
		0.73±0.088 (C)	0.069±0.025(C)	0.069±0.042(C)	0.079±0.005(C)	0.076±0.001(C)	0.079±0.056(C)	0.089±0.029(C)
Liver	0.435±0.0196(A)	0.423±0.014(A)	0.409±0.024(A)	0.542±0.050 ^{ab} (A)	0.588±0.039 ^{ab} (A)	0.535±0.029 ^{ab} (A)	0.599±0.042 ^{ab} (A)	
		0.385±0.0176(B)	0.381±0.010(B)	0.388±0.023(B)	0.450±0.020 ^{ab} (B)	0.476±0.052 ^{ab} (B)	0.437±0.012 ^{ab} (B)	0.441±0.002 ^{ab} (B)
		0.245±0.0276(C)	0.299±0.020(C)	0.354±0.035(C)	0.399±0.034 ^{ab} (C)	0.389±0.036 ^{ab} (C)	0.408±0.029 ^{ab} (C)	0.399±0.001 ^{ab} (C)
Kidney	0.398±0.013 (A)	0.332±0.029 (A)	0.399±0.022(B)	0.445 ± 0.047 ^a (A)	0.534±0.046 ^{ab} (B)	0.470±0.025 ^{ab} (B)	0.477±0.011 ^{ab} (B)	
		0.298±0.016 (B)	0.284±0.004 (B)	0.286±0.032(B)	0.403 ± 0.057 ^a (B)	0.464±0.016 ^{ab} (B)	0.470±0.025 ^{ab} (B)	0.477±0.011 ^{ab} (B)
		0.156±0.009 (B)	0.199±0.023 (B)	0.198±0.057(B)	0.198± 0.043 ^a (B)	0.389±0.023 ^{ab} (B)	0.390±0.003 ^{ab} (B)	0.397±0.025 ^{ab} (B)
Ovary	0.0934±0.029(A)	0.0904±0.0039(A)	0.099±0.0083(A)	0.023±0.003(A)	0.189 ± 0.023(A)	0.299±0.025(A)	0.245±0.032(A)	
		0.0715±0.038(B)	0.0710±0.0049(B)	0.094±0.0125(B)	0.068±0.004(B)	0.154±0.036(B)	0.161±0.004(B)	0.170±0.023(B)
		0.0699±0.029(C)	0.0699±0.0022(C)	0.086±0.0139(C)	0.059±0.004(C)	0.132±0.016(C)	0.101±0.002(C)	0.161±0.019(C)

A: Cupric Salts (Cu²⁺), B: Lead (Pb²⁺), C: Cuprous Salts (Cu⁺),

a-Statistically significant different (P<0.05) when compared to values of control animals.

b-Statistically significantly different (P<0.01) when compared to control animals.

All values given are the mean of 3 animals except control.

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Sexing of Human Clavicle of North Karnataka Zone by its Volume

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Abstract

The sex determination of the individual is primary criterion of identification but, this is very difficult problem and becomes even more challenging when only a single bone like clavicle is available. The traditional methods of sexing bone are subjective and not of much help in medico-legal cases where 100% accuracy is needed. Thus metrical analysis of sexing of clavicles by volume measurement is done. For this purpose, volume of 160 adult human clavicles of known sex was measured by hydrostatic method. The volume of the right side male clavicles ranges from 11.2ml to 25.9ml (mean of $17.52\text{ml} \pm 3.78$), where as that of right side female clavicles ranges from 7.2ml to 21.6ml (mean of $12.57\text{ml} \pm 3.23$). The volume of left male clavicles ranges from 11.3ml to 33.4ml (mean of $17.86 \pm 4.09\text{ml}$) and that of left female clavicles ranges from 6.3ml to 19.6ml mean of $11.30 \pm 2.80\text{ml}$). The volume of clavicles has high statistical significance in sex differentiation ($P < 0.001$). The prediction of correct sex by volume of clavicle alone is 77% for male and 83.30% for female right clavicles and 74% male and 87.50% female left clavicles. On applying concept of 'demarking point' only 15.4% of right male and 28% of left male clavicles are sexed correctly but no (0%) female clavicles are identified as such.

Key Words

Anthropology, human identification, morphometry, skeletal remains, clavicular volume, demarking point, hydrostatic method.

Introduction

Determination of the sex is an important and essential step towards establishing identity unknown human from skeletal remains. The correct determination of the sex of a dead person is a critical requirement in the physical anthropology¹. While establishing the identification, the age, sex, stature and race of the person are the primary criteria's (big fours) of identification. Among them, the determination of the sex is statistically the most important criteria, as it immediately excludes approximately half of the population, where as the age, stature and race each provides the points within a wide range of variables². As the obvious sex differences become apparent only after puberty, it is not a difficult task to determine the sex of an adult deceased, when a complete or almost complete skeleton is available for examination. However, the accuracy of assessment of sex of the skeleton is directly proportional to number of bones available³.

According to most authors; the female clavicle is shorter, thinner, less curved and smoother. The clavicle is thicker and more curved in manual workers and ridges for muscular attachment are better marked. These traditional, non-metrical methods are not always helpful as these methods depend on experts' ability and experience and shows subjective variations⁴. While, metrical sexing of clavicle by volume measurements will give good results⁵. As the cortical index of the clavicle increases up-to the age of 30 years and then decreases steadily i.e., with the advancing age the compact bone, gets replaced by cancellous bone, will result in a decrease in the weight of the bone. Thus it is logical to presume that even though the weight decreases, the volume of the bone will remain constant. Therefore the volume of the clavicle should give the better results in sexing the

clavicle than its weight⁶. Till now, only two studies in north India, by Yadav & Agarwal(1983)⁷ and Singh D & Jit I(1996)⁸, are available on sexing of clavicle by volume measurements. As a general rule, the morphometric standards should be used with reference to the group from which they were drawn and upon which they are based and are not ordinarily interchangeable This aspect necessitates to build a contexts of references for any given population¹. Even though many workers studied the morphometric data of the clavicles extensively at the various parts of the world, the available literature clearly shows that there is a paucity of metrical data of the clavicle in this geographical region. Hence the present study is undertaken with a view to study the sexual differences in volume of adult human clavicle of known sex. This study is based on the measurement of volume of clavicles of the known sex from this region (North Karnataka) and later comparing these values with clavicles of unknown individual can properly identify their sex and will help to build context of reference values for the population of this geographical region.

Demarking points: When near 100% accuracy of sexing is required in normal distribution, it is advisable to calculate maximum and minimum limits by using the formula $\text{Mean} \pm 3\text{SD}$, where $\text{Mean} + 3\text{SD}$ gives maximum value, and $\text{Mean} - 3\text{SD}$. gives minimum value. This would cover about 99.75% of the sample variables. By this formula, the maximum and minimum values of each measurement on the clavicles for males and females can be fixed separately. From the calculations of mean and mean $\pm 3\text{SD}$, it is noted that the maximum and minimum points of the range of males are higher than that of the females. Thus it is statistically possible to fix a measurement above which no female clavicle can be found another measurement below which no male clavicle can be found. This measurement ($\text{Mean} \pm 3\text{SD}$) can be termed as 'demarking point'^{9, 10, 11, 12}. If volume of any clavicle of unknown sex crosses this point, would definitely identify the sex with 100% accuracy⁷.

Aims and Objectives

We have undertaken the present study at SSIMS & RC, Davangere with the following objectives:

- 1) To study the sex related differences in the volume of adult human clavicle.
- 2) To study the utility and limitations of clavicular volume as a Parameters in sex differentiation.
- 3) To find out 'Demarking Points' of sex differentiation for Volume of the clavicles.

This present study is aimed to determine whether sexing of unknown clavicles can be done by applying values of the volume generated by present study on clavicles of known sex

Material and Mehtods

The total 160 dried clavicles of adult human bodies of known sexes (85male and 75 female) were obtained from cadavers of the Anatomy Department, S.S.I.M.S. and R.C, Davangere, J.J.M. Medical College, Davangere. S.N.Medical College, Bagalkot, and Sri.B.M.Patil Medical College, Bijapur.

The present study is conducted at Department of Forensic medicine, S.S.I.M.S. and R.C, Davangere. Before the measurements were taken the clavicles were macerated, cleaned and dried. Out of 85 male clavicles; 39 were of right side and 46 were of left side and out of 75 female clavicles; 35 were of right side and 40 were left side.

Inclusion criteria: Clavicles of adult human of known sex with complete ossification and fusion, without any deformity.

Exclusion criteria: The clavicles which are incomplete in ossification and fusion and those showing deformities like fracture, tumors, degradation, etc., have been excluded.

The volume of clavicle is measured in milliliters(ml) by water displacement technique (hydrostatic technique)^{7,8}. For the purpose of measuring the volume of clavicle, a glass

cylinder of 500ml capacity having side nozzle at the top and diameter sufficient to accommodate a clavicle within it was used. The cylinder was filled with water till it started coming at through the side nozzle. After ensuring that no further drop of water was coming out of the side nozzle, the clavicle suspended with long thread at one end was immersed in the water filled cylinder by slowly lowering the bone in it. Amount of water displaced by the bone was measured with the help of another measuring cylinder and a pipette. The average of three measurements thus obtained was taken for each clavicle and considered as correct volume of the bone.

After all the measurements and observations, these data are statistically analyzed by univariate discriminate analysis. The demarking points are calculated using the formula $\text{Mean} \pm 3\text{SD}$. The findings thus generated are compared with previous

Table 2: DISCRIMINANT ANALYSIS OF VOLUME (ml) OF CLAVICLES

	Details of measurements	Right		Left	
		Males	Females	Males	Females
1.	Sample size	39	35	46	40
2.	Range	11.2-25.9	7.2-21.6	11.3-33.4	6.3-19.6
3.	Mean	17.52	12.57	17.86	11.30
4.	SD	3.78	3.23	4.09	2.80
5.	't' Value	5.7		8.5	
6.	P* Value	P<0.001 HS		P<0.001 HS	
7.	Probability of prediction	77%	83.30%	74%	87.50%
8.	Identification point	>21.6	<11.2	>19.6	<11.3
9.	% of identified bones	15	27	27	48
10.	Mean+/-3SD	6.2-28.9	2.9-22.3	5.9-30.1	2.9-19.7
11.	Demarking Point (DP)	>22.3	<6.2	>19.7	<5.9
12.	% clavicles beyond D.P	15.4	0	28	0

studies by different authors.

Results

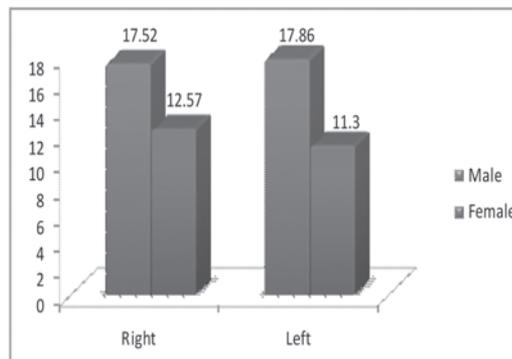
In the present study, the total of 160 dried and cleaned, adult human clavicles of known sexes have been studied by measuring their volume. The values of range and mean of most of the parameter of male clavicles are higher compared to female clavicles, even then there is considerable overlap of the values between male and female clavicles. The clavicles having the volume more than that of the upper limit of range female clavicles is identified as male clavicles. While the clavicles having volume lesser than the lower limit of the range of male clavicles, are identified as female clavicles. The sexing is also attempted by using the 'demarking point'. By this method chances of miss classification of sex are minimal. As the clavicle is one bone, which shows side related asymmetry, it is planned to analyse sex differences of each parameter of right and left side clavicles separately. By finding the demarking point and identification point, the utility and limitations of volume of the clavicles in estimating the sex are presented as follow.

Right clavicle: In the present study, the volume of the right side male clavicles ranges from 11.2 ml to 25.9 ml (mean of 17.52ml \pm 3.78), where as that of right side female clavicles ranges from 7.2ml to 21.6ml (mean of 12.57ml \pm 3.23). Thus the average volume of right male clavicle is more than that of right female clavicles with the mean difference of 4.94 ml which is more for male clavicles. Thus volume of right clavicle is statistically highly significant for sex determination (P<0.001) and prediction of correct sex by volume of clavicle alone is 77% for male and 83.30% for female right side clavicles. The right clavicle with volume measuring more than 21.6 ml is identified as male and that measuring less than 11.2 ml is identified as female clavicle. Thus 15% male and 27% female right clavicles don't show any overlap in their volume measurement are correctly identified as male and female clavicles respectively.

Left clavicle: The volume of left male clavicles ranges from 11.3ml to 33.4ml mean of 17.86ml \pm 4.09) and that of left female clavicles ranges from 6.3ml to 19.6ml (mean of 11.30 \pm 2.80ml). Thus the volume of male left clavicle is more than that of female left clavicle, with a mean difference of volume being 6.56 ml which is more for male clavicles. On statistical analysis, the volume of left clavicles has high statistical significance in sex differentiation (P<0.001). The probable prediction of sex by volume alone is 74% for male and 87.50% for female left clavicles. The left clavicle having its volume more than 19.6ml is identified as male and that having volume less than 11.3ml is identified as female, thus 27% of left male and 48% left female clavicles could be identified as male and female bones respectively.

Demarking points: The calculated range of volume by applying demarking point formula (DP = mean \pm 3SD) is 6.2ml to 28.9 ml for male right clavicles and 2.9 ml to 22.3ml for female right clavicles. Thus the demarking points of volume for male right clavicles is >22.3 ml and that for female right clavicle is <6.2ml. The percentage of clavicles crossing the demarking points are 15.4% of right male and 0% of female as no female right clavicle has its volume less than 6.2ml. For the left side

Graph 1. COMPARISON OF MEAN VOLUME (ml) OF MALE AND FEMALE CLAVICLES



clavicles the calculated range for male is 5.9ml to 30.1ml, and for female is 2.9ml to 19.7ml, thus the left clavicle with volume >19.7ml is definitely of male and that with <5.9ml is definitely of female and percentage of clavicles having their volume beyond their demarking point are 28% in male and 0% in female left clavicles.

Discussion

As coated by Kaur H and Jit I (1990)⁶ the volume of the clavicle should give us better results in the sexing the clavicle than its weight. On measuring the volume of 50 pairs of male & 20 pairs of female clavicles, Yadav and Agarwal (1983)⁷ found that the volume of right male clavicle varied from 16.5ml to 35ml and that of female bare was between 10.2ml to 16ml. Similarly, the volume of the left clavicle varied from 16.9ml to 36ml in males and 10.1ml to 15.8ml in females. According to them, there was no overlap in volume of the clavicles of the two sexes, and concluded that a clavicle volume of more than 16ml (right) and 15.8ml (left) would be at that of male as such they were able to identify the sex of a clavicle in 100% instances. However on applying demarking point (Jit I & Singh S-1966)⁹, Yadav & Agarwal (1983)⁷ could determine the sex of only 70% right & 66% left male clavicles but not even a single female could be identified.

In the work done by Singh D & Jit I(1996)⁸ on the volume of 533 pairs (406 male & 127 female) clavicles by water displacement technique, the volume of right male clavicles varied from 9.30ml to 33.90ml and that of right female varied from 7.50ml to 20.40ml while that of left male clavicle varied from 9.40ml to 33.00ml and left female varied from 7.00ml to 20.00ml. On these bases Singh & Jit could correctly identify 40.39% of right 34.70% of left male and 11.81% of right, 9.44% of left female clavicles. On applying demarking points only 23.39% right and 20.94% left male clavicles could be sexed correctly, but no female clavicles could be identified as such. By multivariate analysis involving volume, length, weight and mid-clavicular circumference, 81.03% right and 80.54% left male and 86.69% female bones of both sides could be identified correctly.

In the present study, the volume of right clavicle varies from 11.2ml to 25.9ml in male and 7.2ml to 21.6ml in female clavicles while on left side it varies from 11.3ml to 33.4ml in male & 6.3ml to 19.6ml in female clavicles(table No:8). This shows there is considerable overlap in the volume of the clavicles in two sexes, with the result that only 15% right male, 27% right female and 27% left male, 48% left female clavicles could be identified by this parameter alone. On applying concept of demarking points only 15.4% right and 28% left male bones could be identified correctly, but no female clavicle could be distinguished. This inability to identify females clavicles based in demarking point tallies with observation of Yadav & Agarwal (1983)⁷ and Singh D & Jit I (1995)⁸. However, the observations of Yadav & Agarwal⁷ regarding the absence of an overlap of the volume of the two sexes appears to be surprising, as all other previous workers including Singh S & Jit I(1995)⁹, Singh & Gangrade(1968)¹¹ and Jit I & Sahni D(1983)¹² have shown that each of the three parameters (Length, weights and mid clavicular circumference) of clavicles in the two sexes have a considerable overlap, thus the overlap of volume measurements in both sexes in this study are bit comparable to the study of Singh D& Jit I(1995)⁸. It is very difficult to give a exact reaction as to why the present study results regarding the volume of the clavicles are not similar to those of Yadav & Agarwal⁷. It may be due to small number of female samples in their study and geographical variation as it

was done on north Indian clavicles.

The in present study, predication of correct sex by volume alone is only 77% in male, 83.30% in female right clavicles and 74% in male & 87.50% in female left clavicles. This shows that volume of the clavicle as a single parameter is of not much value in ascertaining the sex of the bone. These results are similar to the findings of Singh D and Jit I(1996)⁸ who stated that volume of clavicles as a single parameter is of not much value in ascertaining the sex of bones, but when combined with other parameters like length, mid-shaft circumference & weight by multivariate discriminate analysis, the chances of precise sex determination will increase.

Conclusions

The volume as a parameter of sex determination is statistically significant ($P<0.001$) in differentiating the sex of clavicle. This gives better results than weight of clavicle, as weight of the bone varies with age and health status of the individual. However the predication of correct sex by volume alone is only 77% in male, 83.30% in female right clavicles and 74% in male & 87.50% in female left clavicles. This shows that volume of the clavicle as a single parameter is of not much value in ascertaining the sex of the bone in all cases. The prediction of correct sex still decreases on applying demarking point concept, but it gives 100% accurate results, which is most needed in solving medico-legal problems. The prediction of correct sex of the clavicle could increase on multivariate analysis of various morphometric parameters like length, mid-clavicular circumference and weight of the clavicle.

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Muscle Fibers Length Changes During Fixation: A Cadaveric Study

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Abstract

Back ground

When ever the properties of the biological tissue are studied, the work often has to be carried out on tissue that has been preserved in some way. It is quite possible that a major change in muscle length may have taken place during fixation. There appears to be no documentation as to how much, if any, muscle shrinkage occurs when cadavers are fixed in embalming fluid.

Material and Methods

Following muscles where dissected from the fresh cadaver came for the donation of the body to the anatomy department of Government Medical College, Miraj. Gastronomius, soleus, Tibialis anterior, extensor digitorum longus, extensor hallucis longus, peroneus longus. The lengths of the contractile portion of the muscles were measured

Results

By applying the "t" test there is a significant decrease in muscle length if the muscles are fixed off the skeleton. ($P(t > 2.527 \text{ with } 7 \text{ D.F.}) < 0.026$), with the mean shorting of 1.05%. If the muscles are fixed on the skeleton the muscle shrinkage is not significant.

Conclusion

So it is reasonable to assume that when human muscles are fixed on the skeleton, no significant loss of the length occurs. Since all human cadaveric tissue is fixed whilst on the skeleton, we may assume that shrinkage of the muscle in such specimens is negligible.

Key Words

Fixation. Muscles, length, embalming.

Introduction

It is accepted that a muscle brought to position and held there by rigor mortis has the same sarcomere length as that when the muscle has been brought to that position by the active contraction. When ever the properties of the biological tissue are studied, the work often has to be carried out on tissue that has been preserved in some way. It is quite possible that a major change in muscle length may have taken place during fixation. There appears to be no documentation as to how much, if any, muscle shrinkage occurs when cadavers are fixed in embalming fluid.

Dimery in 1985, in a study of sarcomere length during rabbit locomotion, eliminated the possibility of the influence of shrinkage on her results by stitching the muscle fibers to a match stick whilst fixation was taking place, but such a

procedure would not be possible with human cadaver tissue, which is only available when already fixed. The position of the muscles relative to the skeleton in the study of human sarcomere length means that the skeleton cannot be relied upon to preserve the lengths, as was the case in an investigation of bird flight muscle sarcomere lengths.

The purpose of this study was to determine whether or not a correction factor needs to be applied to the sarcomere length of human embalmed tissue in order to extrapolate the result to living tissue.

Material and Methods

Following muscles where dissected from the fresh cadaver came for the donation of the body to the anatomy department of Government Medical College, Miraj. Gastronomius, soleus, Tibialis anterior, extensor digitorum longus, extensor hallucis longus, peroneus longus. The lengths of the contractile portion of the muscles were measured. Then the studied muscles from the one limb were dissected, separated and immersed in standard embalming solution, composing 17 parts of the industrial methylated spirit, 4 parts liquid phenol, 2 parts glycerin and 1 part of 40% formalin. The muscles were injected with this solution to ensure thorough distribution through the tissue, and then left for three days. The muscles were then removed from the embalming fluid and their lengths measured again. A standard cadaver used for the study was stored for few months. The possibility of further shrinkage during the storage period was investigated by measuring the muscle lengths again after one and two months storage. The muscle lengths after fixing on and off the skeleton were then compared statistically.

Results

The muscle lengths before and after fixing off the skeleton and after fixing on the skeleton after the various storage periods are shown in table 1. These values refer to the contractile portion of the muscles rather than the entire muscle, including the tendon. By applying the "t" test shows that there is a significant decrease in muscle length if the muscles are fixed off the skeleton. ($P(t > 2.527 \text{ with } 7 \text{ D.F.}) < 0.026$), with the mean shorting of 1.05%. If the muscles are fixed on the skeleton the muscle shrinkage is not significant.

Discussion

When the isolated muscles of the human limbs were fixed in the standard embalming fluid, a small but significant decrease in their length was observed. If the muscles are fixed still intact on the skeleton, the degree of the shrinkage is non-significant. It is region to assume that human muscles do not shrink significantly during fixation on the skeleton. Since the investigation for which this information was required was carried out on cadaveric tissue which had been fixed in situ on the skeleton. So it was concluded that there is not necessary to use any correction factors for shrinkage when extrapolating data from cadaver to living tissue.

Table 1: Human muscle lengths before fixing and after fixing off the skeleton and after fixing on the skeleton.

Muscle name	Length of the contractile portion (mm)		
		Before fixing	After fixing off the skeleton
soleus	345	330	344
Gastronomius	210	200	210
Tibialis anterior	255	242	255
Extensor digitorum longus	315	304	314
Extensor hallucis longus	230	216	230

Conclusion

It has been shown that a small but significant loss in length occurs in human muscles which are fixed after removal from the skeleton. A comparison was made between the loss in muscle length when the muscles were fixed in embalming fluid attached to the skeleton and not attached to the skeleton. The conclusion was that no significant loss of the length occurs when the muscles were fixed intact on the skeleton. Since the length loss occurs when the muscles are fixed in the embalming fluid independently. So it is reasonable to assume that when human muscles are fixed on the skeleton, no significant loss of the length occurs. Since all human cadaveric tissue is fixed whilst on the skeleton, we may assume that shrinkage of the muscle in such specimens is negligible.

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Toxic Epidermal Necrolysis Mimicking Burns: A Case Report

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Abstract

Toxic Epidermal Necrolysis(TEN) / Stevens Johnson Syndrome (SJS) is a drug induced disorder characterized by blisters and epidermal detachment which presents like a case of burns. We present a 38 year old woman of Dravidian descent who presented with history of blisters all over the body which was initially mistaken to be a case of scald burns later confirmed to be a case of ceftriaxone induced Toxic Epidermal Necrolysis. TEN may be mistaken for burns. In unidentified body without proper history, if medico-legal expert is unaware about this condition then cause of death due to Toxic Epidermal Necrolysis may be mistaken for burns.

Introduction

Toxic Epidermal Necrolysis(TEN) / Stevens Johnson Syndrome (SJS) is a drug induced life-threatening mucocutaneous skin disorder characterized by the bullous detachment of the top layer of skin (the epidermis) from the lower layers of the skin (the dermis) all over the body resulting in exfoliation, widespread erythema, necrosis without substantial dermal inflammation leading to possible sepsis and/or death.¹

The term Stevens Johnson syndrome is used to describe patients with blisters < 10% of total body surface area. The term Toxic Epidermal Necrolysis / Stevens Johnson syndrome used to describe patients with 10-30% detachment and Toxic Epidermal Necrolysis is used to describe patients with > 30% detachment.¹

TEN has an estimated annual incidence of 1-2 per million with reported mortality rates vary from 20 to 60 percent.²

Clinical features: Toxic Epidermal Necrolysis / Stevens Johnson syndrome begins with nonspecific prodrome of 1 to 14 days which includes fever, malaise, headache, rhinitis, cough, sore throat, chest pain, vomiting, diarrhea, myalgias, and arthralgias. A macular rash appears first on face, neck, chin and central trunk, it may then spread to extremities. Macules are poorly defined with purpuric or blistering centre. There is rapid progression to areas of confluent erythema followed by blistering and sloughing of large areas of skin. Nikolsky sign that is the ability to extend the area of superficial sloughing by gentle lateral pressure on the surface of skin at an apparently unaffected site may be positive. Entire skin surface may be involved with upto 100% of the epidermis sloughing off. Hairy portion of scalp never affected. Mucous membrane is involved in nearly all patients. Widespread painful erosions cause crusted lips. Skin lesions heal by 3-4 weeks. Complications of TEN similar to burns, depends on extent of massive fluid and electrolyte loss.³

Since a case of Toxic Epidermal Necrolysis / Stevens Johnson Syndrome present like superficial burns, differentiation between two becomes necessary in unidentified body when it looks like a case of superficial burns. If medicolegal expert is unaware about this condition then cause of death due to Toxic Epidermal Necrolysis / Stevens Johnson Syndrome may be mistaken for burns. Herewith we are presenting a case of Toxic epidermal necrolysis which mimic's injury due to burns.

Case Presentation

A 38 year female patient of Dravidian race came with history of blisters all over the body since 2 days. Patient is a known case of diabetes since 6 years and she is on irregular treatment. 2 days back she had hot water bath, few hours after having bath she developed blisters. On examination patient was disoriented. Blood pressure was 94/58 mmHg.

Figure 1



MULTIPLE RAW AREAS DUE TO RUPTURE OF BULLAE

Figure 2



MULTIPLE RAW AREAS DUE TO RUPTURE OF BULLAE

examination revealed a second-degree superficial burn over face, upper limbs, multiple tense bullae and vesicles present over chest, back and lower limbs.

Initial diagnosis of major scald burn was made and treatment started. After 1 day of admission large new blisters developed over back, lower trunk and lower limbs and Nikolsky sign was positive. On further questioning patient gave history of swelling of right leg with pain and fever 8 days back for which she consulted doctor, she was diagnosed to be having cellulites and was put on intravenous Inj. Ceftriaxone 1gm twice daily on outpatient basis. She had taken 10 injections of ceftriaxone before developing blisters.

Investigations

Haemoglobin-14gm%, Total count – 11,500 (N – 70, L- 15, E – 15), Absolute Eosinophil Count – 1623, Peripheral smear shows eosinophilia, Blood urea – 22, serum creatinine – 0.8.

HIV 1 & 2 - Negative

Biopsy report – Lymphocytes collected along the dermoepidermal junction with vacuolated basal keratinocytes, the dermis is devoid of inflammatory cells suggestive of TEN / SJS.

Final diagnosis of ceftriaxone induced Toxic Epidermal Necrolysis was done.

Discussion

Differential Diagnosis.⁴

Stevens-Johnson Syndrome (SJS)

Burns, Erythema multiforme
Viral exanthems
Ampicillin rash
Generalized fixed drug eruption
Morbilliform drug eruptions
Fixed drug eruption
Acute graft-versus-host disease

Toxic Epidermal Necrolysis (TEN)

Burns, Cauterization,
Staphylococcal
scalded-skin syndrome
Toxic erythroderma

Pathophysiology

The mechanisms underlying the severe dermatologic manifestations of Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis (TEN) are poorly understood. Medications are the leading cause (Table 1), although bacterial (mycoplasma) and viral infections also contribute Stevens-Johnson syndrome and toxic epidermal necrolysis.⁵

Exposure to the inciting agent is thought to initially cause activations of cellular immunity, including both cytotoxic lymphocytes and natural killer (NK) cells. Widespread epidermolysis is the result of keratinocyte cell apoptosis—an organized series of biochemical reactions leading to cell changes and cell death.⁵

Involvement of many immunological pathways have been proposed which include ligation of Fas on keratinocyte membranes,⁶ cytotoxic T lymphocyte (CTL)-mediated activation of perforin/granzyme B pathway,⁷ overproduction of T cell and/

- 0 to 1 factor = 3%
- 2 factors = 12%
- 3 factors = 35%
- 4 factors = 58%
- 5 or more factors = 90%

Conclusion

Since burns is one of the major cause of mortality all over the world and medicolegal experts frequently encounter cases of burns, it become extremely important to know about TEN a condition which mimics burns.

Consent

Written informed consent has been taken from the patient in her own language for examination and publication.

Table 1: Drugs Associated with Toxic Epidermal Necrolysis and Stevens Johnson syndrome.¹⁰

Drugs Most Frequently Associated	Drugs Less Frequently Associated
Sulfadoxine, Sulfadiazine, Sulfasalazine, Co-trimoxazole, Hydantoin, Carbamazepine, Barbiturates, Phenylbutazone, Piroxicam, Allopurinol, Aminopenicillins.	Cephalosporins, Fluoroquinolones, Vancomycin, Rifampin, Ethambutol, Tenoxicam, Diclofenac, Ketoprofen, Naproxen.

or macrophage derived cytokines (INF- α , TNF- α , and various interleukins),⁸ and/or CTL release of granulysin (a cationic cytolytic protein).⁹

Estimation of Risk of Death

A severity-of-illness score that estimates the risk of death in toxic epidermal necrolysis (TEN) has been developed and validated (SCORTEN).¹¹

- Age >40 years
- Heart rate >120 beats per minute
- Cancer or hematologic malignancy
- Involved body surface area >10%
- Blood urea nitrogen level >10 mmol/L (28 mg/dL)
- Serum bicarbonate level <20 mmol/L (20 mEq/L)
- Blood glucose level 14 mmol/L (252 mg/dL)

Mortality rates based on the number of positive criteria are as follows:

Table 2 Differentiating features between Burns and Toxic Epidermal Necrolysis / Stevens Johnson syndrome

Sl. No	Toxic Epidermal Necrolysis / Stevens Johnson syndrome	Burns
1.	Hairy portion of scalp never affected. ³	May be affected.
2.	Mucosal involvement is seen in all patients. ³	May not be affected.
3.	Nikolsky sign can be demonstrated. ³	Nikolsky sign negative.
4.	Biopsy shows Lymphocytes collected along the qdermoepidermal junction with vacuolated basal keratinocytes ¹²	Typical features of TEN not seen
5.	Dermis is devoid of inflammatory cells. ¹²	Biopsy shows abundant inflammatory cells in the dermis

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Determination of Sexual Dimorphism in Mandible and Crania Using Lateral Cephalogram and Postero-Anterior Radiograph Among Indian Population

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Abstract

The determination of gender of unknown persons is of vital importance in forensic investigations, mainly when only the skull remains. Standardized radiographic techniques like cephalometry have advantages of being more precise and objective when compared to morphologic methods. The present study aimed at obtaining and comparing the reliability of cranio-mandibular parameters in Indian populations using digital lateral cephalograms and postero-anterior radiographs. A total of 306 individuals comprising 150 males and 156 females, aged 18-30 years were considered. Lateral cephalogram and postero-anterior digital radiographs were obtained. For lateral cephalograms measurements were made for mandibular body length, mandibular length and mandibular height. Mandibular bigonial and bizygomatic distance were determined on postero-anterior view with the help of Adobe Photoshop CS3 extended software. Logistic regression analysis was carried out to determine the accuracy of sex. Bizygomatic width and mandibular length contributed most for sexual dimorphism in the populations and obtained accuracy of 86.3% with bizygomatic and 82% with mandibular height. Thus cephalometric cranio-mandibular parameters can be used effectively to discriminate the sex using logistic regression analysis in Indian population.

Key Words

Mandible, sexual dimorphism, human identification, cranio-mandibular measurements, Forensic science

Introduction

It is not uncommon in India that a person is murdered and bodies buried or thrown in a well or a river and attempts have been made to burn it so that the identity is masked. This has led to the need for methods to improve identification from the skeleton¹. When sexual characteristics of the soft parts are not available, the diagnosis of sex is based only on the characters displayed by the skeleton. Recent research has focused on using various skeletal elements to quantify variation related to sexual dimorphism, mainly for determination of sex in unknown skeletal remains along with age, ethnicity and stature which are used to facilitate forensic identification. There are several methods for determination of gender using different parameters². Skeletal components play significant role in sex determination in forensic and anthropological fields³. Next to pelvis, skull is the most easily sexed portion of the skeleton. The problem of deciding whether a given skull is male or female presents itself under two aspects. Firstly, an opinion may have to be given in case of an isolated skull not re-lated in any known group. Secondly, number of skulls may be available belonging to a known group, and the expert is expected to sort these into male and female⁴. In this regard cranio-facial structures have the advantage of being composed largely of hard tissue which is relatively indestructible⁵.

As a component of the skull, mandible shares this characteristic, but its indicia of sex are not as abundant as those of the calvarium, nor are they as reliable for sex determination by visual appreciation. Several anthropologists have described sex-differentiating features of a qualitative nature in the mandible (Houton, '96; Krogmart, '62; Stewart, '52) but there is no doubt that anatomical sexing of isolated mandibles is difficult. Cites and Elliot measured 265 mandibles of known sex of White and Negroes and obtained accuracy of 85% in determining the sexual dimorphism using multivariate discriminant function technique⁶. Similarly Robinson and Bidmos evaluated 5 discriminant function equations, in the crania and mandible of South African whites, on three different European descendant groups of South Africans and obtained accuracy of 72-95.5%⁷. But the accuracy of gender differentiation depends on which particular elements of the skull are present and their state of preservation. Since only a constellation of diagnostic traits permit sexing of adult skull, there can be alteration in above mentioned range⁸.

Thus establishing the identity of sex from a defleshed skull, lateral cephalograms (LC) and postero-anterior (PA) radiographs assumes a predominant role. They can provide architectural and morphological details of the skull, thereby revealing additional characteristics and multiple points for comparison. Various workers have claimed that identification of sex by skull radiograph is a reliable method which provides accuracy up to 80-100%³. Krogman stated that radiographic projections for endocranial capacity help in gender determination with accuracy of 100%, if antemortem and postmortem skull radiographs are available⁹. Patil and Modi studied 10 linear measurements on cephalometric radiograph among central Indian population with accuracy of 99%³. In most of the studies investigators have focused mainly on cranial parameters, but use of cranio-mandibular parameters has been advocated in few cephalometric studies^{3,7-9}. Thus the study was designed to determine sexual dimorphism by measuring cranio-mandibular parameters using LC and PA view and also to determine the accuracy of sexual dimorphism using logistic regression analysis in adult Indian population.

Material and Methods

A total of 306 subjects with 156 females and 150 males, with mean age of 25 years were considered. The study was commenced after obtaining Institutional ethical clearance.

Patient with full set of dentition were considered for the study. Those with a history of ortho-dontic treatment, orthognathic surgery, trauma and surgery of the skull, history or clinical characteristics of endocrine disturbances, nutritional diseases, and hereditary facial asymmetries were excluded from the study. After obtaining individual consent, LC and PA view digital radiographs were taken following standard manufactures instruction using Kodak radiographic film, size 18 x 24 cm. Teloradiography was performed with an Rx Telefunk X-15 apparatus with a distance of 1.52 m from source to film, using an exposure of 80 KVP and time of 1.2 seconds at 20 mA. All radiographs were taken by same radiologist to overcome technical error. The radiographic images were transferred to Adobe photoshop CS3 extended software and measurements on LC were done for mandibular body length (distance between Gonion and Gnathion), mandibular length (distance between

condyle and gnathion) and mandibular height (distance between condyle and gonion) (Figure-1). Bigonial distance and bizygomatic

Figure 1

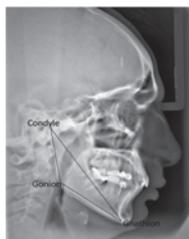


Figure 2



width were determined on PA radiograph (Figure- 2).

Statistical analysis was done by deriving mean values; standard deviations and coefficient of variation for all the variables. The values were compared between both the sexes using Student's t-test. Subsequently, logistic regression model was de-veloped using SPSS software version 10.0. In Logistic regression analysis the sex of a specimen can be determined from the formulae by multiplying the value of e using the formula $y = a + bx$ where x stands for width. Individuals with scores greater than the 0.5 sectioning point are classified as male, while individuals with scores less than 0.5 are classified as female. Closer the value is to 1, greater the probability that the specimen is male, while a value closer to 0 indicates a greater probability of the specimen being female.

Results

The results obtained for males and females with means are presented in Table 1. Student's t-test showed significant of differences between the means of the male and female for all the variables studied ($p < 0.001$). The means for the measurements of the males were consistently greater than

Table 1: Showing Means, standard deviation and p value (Student's t-test) for two independent samples.

RADIOGRAPHS	VARIABLE	GENDER	MEAN	STANDARD DEVIATION	P VALUE (STUDENT t-TEST)
POSTERO- ANTERIOR VIEW	Bigonial	MALE	8.5	0.53	0.000 (S)
		FEMALE	8.1	0.51	
	Bizygomatic	MALE	11.8	0.50	0.000 (S)
		FEMALE	10.3	0.88	
LATERAL CEPHALOGRAM	Body Length (Go-Gn)	MALE	6.7	0.42	0.000 (S)
		FEMALE	6.1	0.54	
	Mandibular Height(CO-Go)	MALE	5.2	0.43	0.000 (S)
		FEMALE	4.8	0.45	
	Mandibular Length(Co-Gn)	MALE	10.7	0.57	0.000 (S)
		FEMALE	9.7	0.55	

p value = < 0.001- Significant (S), p value= >0.001- Non-Significant (NS).

those of the females (Table-1).

Descriptive statistics including the mean and standard deviation, as well as maximum and minimum values, were then computed for each dimension. After establishing that highly significant differences exist between male and female, the logistical regression equations derived associated correct classification accuracies (Table-2). The overall classification accuracies for the univariate regression equations ranged from 66% for mandibular height to 82% for mandibular length. Intermediate values were obtained for body length 72.9%. Allocation accuracy rates did not improve when multiple dimensions were incorporated into the analysis. For example, the inclusion of bigonial and bizygomatic in combination using the formula $y = a + b_1x_1 + b_2x_2$ where x_1 is bigonial and x_2 is bizygomatic yielded almost same prediction percentage (88.2%) as that of bizygomatic when used in isolation. Likewise, in stepwise approach only mandibular length was selected for mandible and bizygomatic for crania, thus producing a classification accuracy rate 82% and 86.3% respectively. Based on these criteria, there were strong indications ($p < 0.01$) for the importance of the bizygomatic width and condyle to gnathion distance in the determination of gender. Based on this population specific equation was derived for each variable used, for example $y = a + bx$ for bizygomatic width can be calculated by $y = 42.696 - 3.788Zy - Zy$, this can be used to determine sex using unidentified skull of Indian origin.

Discussion

It is a well known fact that skeletal attributes vary among different populations and each therefore needs its own specific standards for assessment¹⁰. Hence physical anthropologists are continually looking for new ways to determine sex from skeletal remains. Determination of sex is done either metrically or descriptively¹¹. Assessing skulls for sexually dimorphism conventionally involves visual methods which are definitely subjective and pose inter-observer variability. However, methods based on measurements and morphometry like cephalometry are more accurate and can be used in determination of sex from the skull³. Moreover data related to cranio-metric measurements using radiographs is limited in Indian population². Hence the present study was ventured to determine sexual dimorphism using cranio-mandibular measurements on LC and PA view in Indians. The mean value of all the variables showed significant difference between males and females. Males showed greater value than females which is in accordance with the study done by Steyn M and Iscan YM on mandible using morphometric method¹⁰.

In the present study we used logistic regression analysis to establish which cranial and mandibular measurements give the most information about the differences between males and females. Bizygomatic width for crania and length (Co-Gn) for the mandibles, were selected as the most discriminatory. Although the two above mentioned linear

measurements contributed significantly, other linear measurements of mandible including bigonial, mandibular body length, and mandibular height were also evaluated. In general the percentage accuracy obtained in this study is comparable with the other groups. Similar study by Barthelemy I et al, on South- West France population found an accuracy of 87.3% in determining the sex¹².

Iscan M.Y et al. found accuracies of 84.1% (cranium and mandible) and 83.7% (cranium only) in Japanese skulls¹³, in comparison with our study we obtained an superior accuracy rate of 86.3% for crania and 82% for mandible using radiographs. Similarly Kranioti E. F studied on skeletal remains of Americans and South Africans and stated bizygomatic breadth as the most discriminatory single dimension and can provide an accuracy rate of 82%¹⁴. Studying South African blacks, Kieser and Groeneveld found 91% accuracies with a combination of two maxillary and two mandibular measurements and two indices thereof, and 78% accuracy when only gonion-gnathion was used¹⁵. Giles E also obtained accuracies approaching 86% in sexing the crania of American whites and blacks¹⁶. In his study, skull measurements performed better than face and mandible dimensions.

For mandibles, all measurements were contributory to sex assessment in the present study. This is in consistent with Loth's study of South African black mandibles. Interestingly, she obtained nearly 92% of accuracy on sample from the Dart collection¹⁷. Giles E included 8 variables for American whites and blacks to reach 84%⁶. Iscan M.Y and Ding S obtained 75% from five dimensions on the Chinese¹⁸. All the above mentioned studies have been carried out on the skull^{6,17,18}. In the present study we used radiographs of the living individual to determine the sexual dimorphism, so that these findings can be used on the unidentified skull of adult Indians. Similar study by Venkatesh G.N et al, using cranio-mandibular parameters on LC and PA view on two populations, found an accuracy of 81.2% and 85.2% in determining the gender in Indian males and females respectively and in Tebetian population they obtained accuracy rate of 85.7% and 91.3% between males and females respectively³. We found higher level of accuracy using radiographs thus suggesting this technique to be effective method in determining the sex. The study has also resulted in the development of population specific osteometric standards designed for sex assessment among Indian population.

But the ongoing debate still exists on whether morphological or metrical methods are the best in distinguishing between the sexes¹⁰. The above statistics, in addition to a plethora of similar studies available in the literature, demonstrate that different populations generally show some variation in the level of sex classification accuracy achieved. This is related to population variability in the magnitude of the expression of sexual dimorphism, which is inherently influenced by the complex inter-relationship of numerous factors, including, but not limited to, access to adequate nutrition, sexual division of labour, and underlying genetic adaptations and selective forces¹⁹. Sex-specific functional requirements and adaptations similarly affect the sex discriminatory power of individual skeletal elements²⁰. However, standards are needed for as many skeletal elements as possible because the optimal sites are not always present.

Conclusion

In the present study bizygomatic width for crania and length (Co-Gn) for the mandible constituted most for sexual dimorphism. But mandibular length (Co-Go) showed poor discrimination for sexual dimorphism. This can be attributed to reduced sample size, contribution of magnification factor

as most of the parameters were linear measurements. Further studies are required to assess the significance of linear cephalometric cranio-mandibular parameters for determining sexual dimorphism.

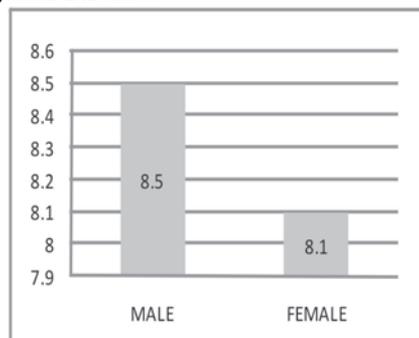
Acknowledgement

Dr Vaishali Keluskar, Professor and Head, Department of Oral Medicine and Radiology for permitting to obtain radiographs and radiology technician Mr. Manohar for his assistance in taking radiographs.

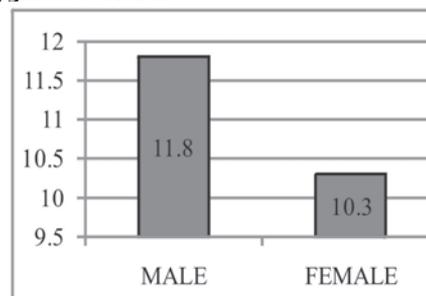
Histogram

Showing standard deviation, mean values between male and female

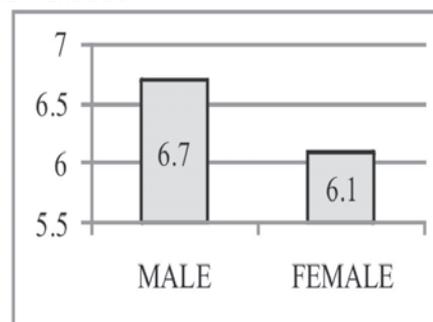
1. Bigonial Distance



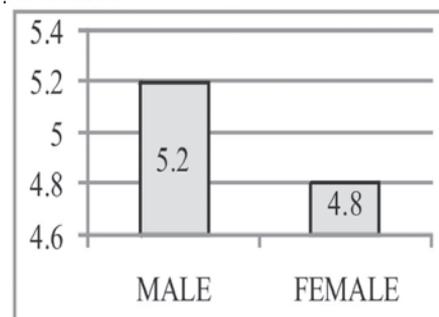
2. Bizygomatic Width



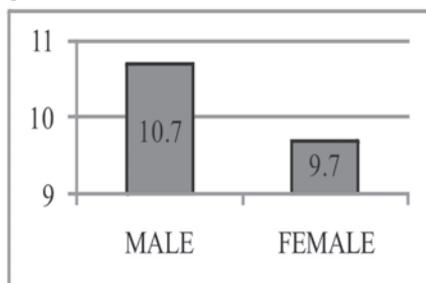
3. Gonion-Gnathion



4. Condyle-Gonion



5. Condyle -Gnathion



Legends for Figures

Figure 1: Lateral cephalogram showing landmarks on the mandible, mandibular body length (Go-Gn), mandibular length (Co-Gn) and mandibular height (Co-Go).

Figure 2: PA view showing landmarks on the skull bigonion (Go-Go) and bizygomatic (Zy-Zy).

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Pattern of Suicides in North Karnataka

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Abstract

Out of 1784 cases brought for medicolegal postmortem examination in the Department of Forensic Medicine, Bidar Institute of Medical Sciences, Bidar during the period of 2005 to 2009 only 148 (8.29%) were of suicide.

Male predominate female and the most commonly adopted method of suicide is hanging (53.37%) followed by poisoning (23.64%). The highest number of suicidal deaths was seen in the age groups of 21-30 yrs (35.81%) and followed by 30-41 years age group (27.02%).

Key Words

Suicide, hanging, poisoning, Law and Health.

Introduction

The history of suicide is almost as old as human society itself. The act of suicide is illegal in India under section 305 and 306 IPC, though in the historical times some states approved of suicide under certain circumstances e.g.: Sati and Johar etc. Suicidal death is emerging as major health problem worldwide and is attracting increasing attention from the medical profession and the public health agencies as well. Suicide is a leading cause of premature death especially among the young adults. For prevention of crimes and maintenance of law and order, the Law Enforcement Agencies require the data of various crime incidences, common nature of death prevalent in the community etc. Suicide being a criminal act as well as an indirect indicator of Mental Health of a community, this study was taken up to establish the incidence of gender, age and commonly adopted means of suicide in North Karnataka. According to WHO statistics, the annual worldwide incidence of suicidal deaths was 16 per lakhs persons in 1995. In India, the prevalence is 10 per lakhs contributing 0.5% to 1 % of all deaths as per National Crime Records Bureau, 1993. Besides being an indirect indicator of mental health of a community, it may be committed with an ulterior motive e.g. to avenge someone by planning his own death in a manner that resembles homicide.

Material & Methods

In the present study a total number of 148 suicidal deaths brought for autopsy in the department of Forensic Medicine, BRIMS, Bidar during 2005 to 2009 were studied. The particulars of the deceased such as age, sex and caste were collected from near relatives and investigating officers. The method of suicide was determined from the history and P.M. findings in consideration with circumstantial and physical evidences. The data thus obtained were analyzed and the findings are presented in this paper.

Results

Out of 1784 medicolegal autopsies conducted during 2005 to 2009, 148 cases (8.29%) were of suicide. The year-wise incidences of suicide are shown in Table No. I. Though,

the yearly percentage of suicide was highest in the year 2006,

Table 1:

Year-wise incidence of suicides.

Year	Total P.M.E	Total suicidal death
2005	342	29(8.47%)
2006	340	33(9.7%)
2007	371	31(8.35%)
2008	348	27(7.75%)
2009	383	28(7.31%)

the highest number of suicidal deaths was seen in the year 2006. The lowest number of suicide was seen in the year 2008.

Male (99 cases) predominated female (49 cases) with a ratio of 1.98:1. The most commonly adopted method of suicide is

Table 2:

Modes of Suicides and Sex Distribution.

Mode of suicide	Male	Female	Total	%
Hanging	49	30	79	53.37%
Poisoning	20	15	35	23.64%
Firearm 12	0	12	12	8.10%
Others**	18	4	22	14.86%
Total	99	49	148	100%
	66.89%	33.10%		

** Burning, Jumping from a Height, Self-Inflicted Wounds & Drowning

Table 3:

Modes of Suicide and Age Incidence.

Mode of suicide	Age range in years						Total
	0-10	11-20	21-30	31-40	41-50	>50	
Hanging	0	16	27	21	9	3	76
Poisoning	0	9	16	6	2	2	35
Firearm	0	1	3	6	2	0	12
Others**	1	7	7	7	2	1	25
Total	1	33	53	40	15	6	148
	0.6%	22.29%	35.89%	27.02%	10.13%	4.05%	100%

hanging (53.37%) followed by poisoning (23.64%) as shown in Table No. II.

Discussion

The incidence of suicide was 8.29%, which is lower than that of other studies^{1,2,3}. This can be due to under report of the incident. The sex incidence of male predominance over female in all modes of suicide is in agreement with the findings of other workers^{1,2,3,4}. The highest number of suicidal deaths was seen in the age groups of 21-30 years (35.81%) followed by 30-41 years (27.02%) which is consistent with the findings of other studies^{1,2,3,4}. This particular age group is the most active and explosive group. Instead of facing defeat, they might have preferred to end their life. Hanging was the commonest method of choice, which is in sharp contrast to some other studies, where the most preferred method is poisoning^{1,2,3}. It may be attributed to: simplicity of the act, easy availability of the materials needed for the act, guaranteed fatality and the belief of a prompt and painless death. Suicide by firearm was the method of choice among the security personnel, which is in agreement with Fimate et al⁴. Incidence of suicidal deaths by firearm and cut throat has been observed in this study which is not observed in the study

conducted by Sahoo et al. The common causes of suicide are alcohol and drug addiction, failure in career, unemployment, disappointed love, marital problems, family quarrels and poverty etc.

Conclusion

The present study reveals a comparatively decreasing tendency of suicidal deaths from 2008 onwards, the lowest been in 2010 (7.31%). Hanging is the commonest method of suicide. Suicide is highest among the age group of 21-30 and 31-40 years, which incidentally represent the most active and productive section of the community. If the trend of suicide is left unchecked the loss will be invariably insurmountable both economically and socially. Suicide is a major health problem and the medical profession has to take a role in the management of this health

problem.

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Rare Case of Endosulfan Intoxication Induced Refractory Status Epilepticus & Hyperkalemia

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Abstract

Endosulfan is a widely used insecticide that is associated with a high fatality rate in humans when ingested accidentally or with the aim of suicide. We are reporting a case of endosulfan poisoning with refractory status epilepticus (RSE) severe life threatening hyperkalemia with metabolic acidosis and acute renal failure successfully treated with Levetiracetam and emergency hemodialysis. We suggest that if acute repetitive seizures, especially in the rural areas, endosulfan intoxication should be considered when the etiology is uncertain even in the absence of any signs of intoxication.

Keywords

Endosulfan poisoning, refractory status epilepticus, RSE, insecticide

Introduction

Endosulfan (6,7,8,9,10,10- hexachloro 1,5,5a,6,9,9a-hexahydro-6-methano-2,4,3-hexadithioxanthiepin 3-oxide) is an organochlorine compound that is used as an insecticide. This colourless solid has emerged as a highly controversial agrichemical. It is still used extensively in many other countries including India. Endosulfan is one of the most toxic pesticides on the market today, responsible for many fatal pesticide poisoning incidents around the world. India the world's largest user of endosulfan.^{1,2}

Case Report

Thirty five year male patient presented with history of consumption of endosulfan (suicidal) with Endosulfan, presented to the Emergency Department with status epilepticus. On examination patient was in status epilepticus with hypotension (blood pressure: 88/40 mm.Hg) low oxygen saturation (SpO₂:70%). Heart sounds were soft, bilateral extensive crepitations.

Investigations

Hb: 11.8 gm%, TC: 8710, platelet count: 2.35 lac, BSL: 56 mg%, BUL: 98 mg%,

Sr. Creatinine: 4.2 mg%, Na: 136 meq/l, K: 10.9 meq/l, Urine micro: normal. Arterial blood gas analysis was suggestive of metabolic acidosis with low bicarbonate and low PCO₂ with PH of 6.7.

Cerebrospinal fluid study was with normal limits. Electrocardiogram was showing: peak / tall tented 'T' waves with loss of 'P' wave with broad 'QRS' complexes and sine wave pattern (image No:1). Chest radiograph was suggestive of aspiration pneumonitis with features of ARDS (image No: 2). Arterial blood gas analysis (ABGA) was suggestive of metabolic acidosis. An electroencephalogram (EEG) showed diffuse bilateral epileptogenic activity. Computerised tomography (CT) brain was normal.

After initial clinical and laboratory assessment patient was treated with intravenous fluids as per requirement and input output charting. Ryles tube was inserted and aspiration

of stomach content was done. Smell of endosulfan was present. First stomach sample was preserved for chemical analysis. Gastric lavage was performed with activated charcoal (30 grams activated charcoal). Fluid therapy and inotropic support was given for shock. Patient was intubated kept on artificial ventilator. Standard protocol was started to control status epilepsy in the form of 12 mg lorazepam, 4 mg diazepam and a loading dose of 800 mg phenytoin but seizure were could not be controlled even after 30 minutes. We labeled this status epilepticus as a **Refractory status epilepticus (RSE)**.

Considering preexist ion respiratory depression and renal failure we avoided the thiopental and propofol for this patient and started on intravenous Levetiracetam. One gram of intravenous levetiracetam was given over 15 minutes diluted in 100 ml normal saline and by 25 minute the seizure were stopped. Initially glucose-insulin drip was started to correct hyperkalemia. In view of anticipation cardiac arrhythmias emergency hemodialysis was done to treat life threatening hyperkalemia (10.9 meq/l) for total three cycles over period of 36 hours. After three cycles of hemodialysis repeat potassium level was 4.3 meq/l and PH was 7.39 by arterial blood gas analysis. After hemodialysis renal function tests were returned to the normal level with blood urea level of 42 mg% and serum creatinine level of 1.4 mg%. Patient was put on broad spectrum antibiotics to treat the aspiration pneumonitis. Appropriate nursing care was taken to prevent hypostatic pneumonia, decubiti, aspiration and other complications of patients with unconsciousness. Patient was continued on Levetiracetam 500 mg twice a day and was seizure free at 14th days.

Along with supportive line of treatment intravenous levetiracetam to control Refractory status epilepticus hemodialysis was attempted to correct severe life threatening hyperkalemia, metabolic acidosis and acute renal failure. After starting treatment patient regained consciousness after 72 hours and slowly weaned off from the ventilator in next 24 hours. Initially he had anuria in 48 hours of admission. He was off the inotropic support after 72 hours. Patient was discharged on fourteenth day in ambulatory state with no seizures, normal serum potassium level and normal renal functions. Before discharge patient's psychiatry opinion was taken as patient consumed endosulfan probably because of major depression.

Discussion

Endosulfan is a chlorinated insecticide that causes central nervous system hyperstimulation. It is absorbed from the gastrointestinal tract, skin, and respiratory tract. The seizures with endosulfan poisoning were classified as acute symptomatic or provoked seizures. Endosulfan present with nausea, vomiting, paraesthesia, giddiness, convulsion, coma, respiratory failure and congestive cardiac failure. Endosulfan intoxication associated with hepatic, renal and myocardial toxicity, agranulocytosis, aplastic anemia, cerebral edema, thrombocytopenia, and skin reaction. Endosulfan poisoning is also associated with refractory hypotension, intravascular hemolysis, disseminated intravascular coagulation (DIC), metabolic acidosis and, finally, cardiac arrest and death also have been reported.^{3, 4, 5} Pulmonary toxicity associated with endosulfan poisoning has been reported as an important manifestation.⁶

This case report is unique and unusual as endosulphan

poisoning was associated with severe hyperkalemia. Severe life threatening hyperkalemia with endosulfan poisoning is not documented in the literature. The reason for development of hyperkalemia is possible on the basis of acute anuric renal failure metabolic acidosis and rhabdomyolysis, also status epilepticus leading to lactic acidosis can be contributory.

It is reported that endosulfan inhibits calmodulin-dependent Ca^{++} ATPase activity in the brain and causes fluctuations in the serotonergic system and decreases activity of GABA on neuronal membrane. The decrease in the activity of GABA releases the synaptic inhibition on the neurons and makes the excitation of neurons easy. Endosulfan poisoning caused the hypotension and the abnormalities on electrocardiogram at presentation. Over half of the patients developed complications, such as rhabdomyolysis, hepatic toxicity, and hypotension. These complications resolved without sequelae in the survival group.

Refractory status epilepticus was the most common cause of death in this series (75.0%).^{6, 7} Refractory status epilepticus (RSE) is defined as seizures, which last longer than 60 minutes despite treatment with a benzodiazepine and an adequate loading dose of intravenous antiepileptic drug.⁸

The presently recommended drugs for status epilepsy are midazolam, pentobarbital and propofol; which may necessitate ionotropic and ventilatory support. This arises the need for early control of RSE using safer drugs.⁹ Levetiracetam has a unique profile in lacking drug interactions as well as significant metabolism in the body and may be a good alternative to the recommended drugs.¹⁰ Till date there is no enough data of use of Levetiracetam in endosulfan poisoning with refractory status epilepticus. We are expecting more clinical studies to establish use of Levetiracetam in endosulfan poisoning for refractory status epilepticus. When endosulfan is eliminated from the body, the epileptic seizures stop.

Management of endosulfan poisoning includes, decontamination of skin and gastrointestinal tract, supportive care including treatment of status epilepticus, dysrhythmias, and mechanical ventilation. Mortality and morbidity rates are very high and there is no specific antidote.^{6, 7}

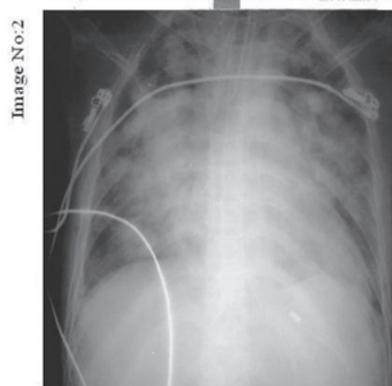
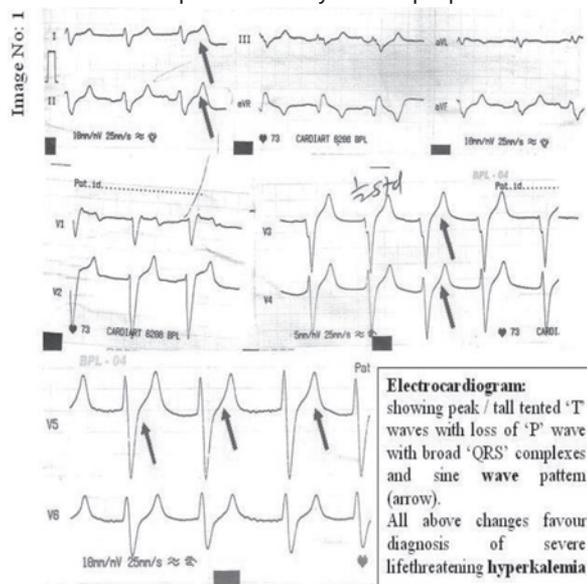
Conclusion

We concluded that if repetitive seizures in patients with consumption of insecticide, Endosulfan poisoning should be suspected in the presence of primary CNS manifestations, with or without clinical or laboratory evidence of other organ dysfunctions. Newer antiepileptic drug like Levetiracetam can be considered in refractory status epilepticus in setting of endosulfan poisoning with associated with respiratory depression and organ dysfunction because of its unique drug profile. At rural health care centre where the facilities of artificial ventilators are lacking, Levetiracetam can be a better option to treat status epilepticus. Unusual presentation like life threatening hyperkalemia one should keep in mind as its treatment is life saving and important predictor of outcome of patient with endosulfan poisoning. The need of hemodialysis in patient with endosulfan can be for hyperkalemia, metabolic acidosis and acute renal failure. Atropine and catecholamines should be avoided. Usually the long-term antiepileptic treatment is not required in patient with endosulfan poisoning.

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Chest radiograph: suggestive of aspiration pneumonia with features of ARDS.

Homicidal Deaths-A Post Mortem Study

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Abstract

The following prospective study of homicidal deaths was conducted in and around southern region of Bangalore for a period of two years. During this study period there were 40 cases of homicides. The incidence of homicidal deaths was 4.76%. The maximum numbers of homicidal deaths were seen in the age group of 21-30 years. Male predominated female in the ratio of 3:1. The most commonly used weapons were sharp force weapons which is followed by blunt force weapons. Out of 40 cases of homicidal deaths, the most common motive for homicide is enmity, followed by financial matters, sex, property dispute and robbery.

Key Words

Homicide, Weapons, Motive, Victims, Methods

Introduction

Though our country in the past was known for its rich heritage, culture, peace and harmony it has shown signs of violence and dreadful act of killing in the recent past to settle down the interpersonal differences. Murder, today has become one of the major threats to the modern society and is increasing, rapidly all over the world. Such a killing of one human being by another human being is termed as "Homicide". This word, "Homicide" has originated from two Greek words "Homos" which means human being and "Cidos" meaning destruction.

Homicide has become one of the heinous crimes due to interpersonal violence and this has been increasing at an alarming rate in India too. This is probably due to rapidly increasing population, unemployment, illiteracy and the widening gap between the rich and the poor. People getting involved in homicide could be of any sex and any age group but the latest study reveals the fact that in many homicidal cases, the younger generation is involved in large numbers. Young offenders are becoming increasingly violent and this is a cause for concern, as they are tomorrow's generation.¹ This is a group that is generally at peak sexual activity, consumes alcohol and carries lethal weapons. Variations in homicide pattern have been attributed to many factors including socio-economic inequalities, availability of guns and dangerous weapons, cultural beliefs and attitude. There is need for urgent intervention.² Homicide is the most serious crime committed against persons and this grave implication makes its detection, solution and adjudication matters of vital importance to every citizen and to the entire community and also to the law enforcement authority, judiciary and bar. In homicidal deaths, society demands that the assailant be promptly identified and apprehended.

To constitute a criminal act, the act that causes the death of another human being must be committed with criminal intent and without lawful excuse or justification. All homicide cases are presumed to be murder until proved otherwise. Thereby, the Forensic pathologists by applying the medical knowledge in the administration of law and justice help to draw a conclusion for the reason of death of the victim by studying the circumstantial evidence, thus helping law to

punish the person involved in committing the crime. The increase in the incidence of homicides worldwide was a matter of great concern all over the world. So homicides are crimes that are unacceptable to all types of society³. The rate and method of homicides vary from country to country and also from one state to other state. So in this present study was done to know the mortality profile of homicidal victims in autopsied cases.

Material and Methods

A two year prospective study was carried out on homicidal victims brought for medico legal postmortem examination to the mortuary of Kempegowda Institute of Medical Sciences Hospital and Research Centre, Bangalore from October 2004 to September 2006. Relevant autopsy findings related to each of these cases were taken for analysis. Further details were obtained from hospital case record and Police record and inquest report submitted with autopsy requisition in each case by the concerned Police Officer. To know the motive behind the alleged offences and other particulars were obtained not only from Police but also by direct interrogation with relatives, friends and others accompanying the deceased. All these homicidal cases were thoroughly examined regarding age, sex, type of weapon used and motive behind it.

Results

Total numbers of medico-legal cases autopsied at Kempegowda Institute of Medical Sciences Hospital and Research Centre, Bangalore from October 2004 to September 2006 were 840. Out of which alleged homicidal cases were 40 (4.76%). Maximum number of homicidal deaths were seen in the age

Table 1:

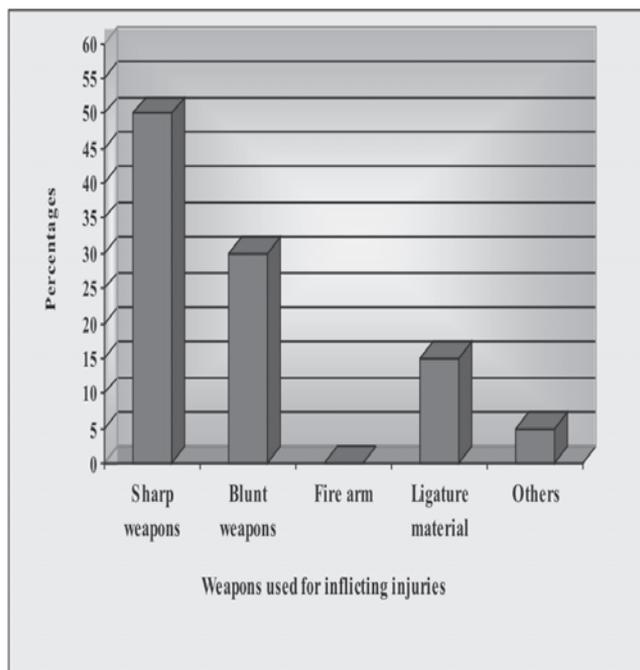
Age in years	Male		Female		All cases	
	No.	%	No.	%	No.	%
0-10	3	10.0	-	-	3	7.5
11-20	2	6.7	2	20.0	4	10.0
21-30	12	40.0	4	40.0	16	40.0
31-40	6	20.0	2	20.0	8	20.0
41-50	2	6.7	2	20.0	4	10.0
51-60	2	6.7	-	-	2	5.0
>60	3	10.0	-	-	3	7.5
Total	30	100.0	10	100.0	40	100.0

Table 2:

Motives	Number (n=40)	%
1. Aggravated assault	2	5.0
2. Enmity	13	32.5
3. Sex	3	7.5
4. Property dispute	3	7.5
5. Financial matters	7	17.5
6. Robbery	3	7.5
7. Not known	9	22.5

group of 21-30 years (40%) (Table-1). Early and late age groups show minimum homicidal incidences. Male predominated female in the ratio of 3:1. In this study the most commonly used weapons were sharp force weapons 20 (50%) cases, followed by blunt force weapons 12 (30%) cases (Figure-1). Out of 40 cases of homicidal deaths, the most common motive for homicide

is enmity 13 (32.5%) cases, followed by financial matters 7 (17.5%) cases, sex, property dispute and robbery constituted 3 (7.5%) cases each (Table-2).
Figure- 1



Discussion

Homicide is the most serious consequence of inter-personnel violence. The incidence of homicide has been increasing probably due to increase in population. In this study of homicidal deaths, observation by both, Indian and Western authors were considered while comparing the results. All the homicidal cases considered were belonged to in and around Bangalore South region.

The main intent of the present study is to evaluate the motive for the offence, trends of homicidal deaths with regards to socio-demographic profile and weapon used to commit the offence. The present study includes 840 autopsied cases during the two years of study period out of which 40 cases (4.76%) were of alleged homicidal deaths.

The maximum number of victims are in the age group of 21-30 years (40%) followed by 31-40 years (20%). The least number of victims were in the age group of 51-60 years. Males predominated in the ratio of 3:1. The present study is consistent with the study conducted by other authors^{4,5}. Males predominated over females and the probable reason for male dominance may be due to excess exposure to the outside environment and nature of their life styles.

Maximum number of victims of homicidal deaths was seen

in the age group of 21-30 years. Young offenders are becoming increasingly violent, and this is a cause of concern, as they are tomorrow's generation. This is a group that is generally at peak sexual activity, consumes alcohol and carries lethal weapons. Variations in homicide pattern have been attributed to many factors including socio-economic inequalities availability of guns and dangerous weapons, cultural beliefs and attitude.

In the present study the most commonly used weapon was sharp weapons 20 (50%) cases, followed by blunt weapons 12 (30%) cases and use of firearms was not detected in any of the cases. This study is in contrast to the study conducted by other authors^{6,7,8}. This is may be explained that in this region there is easy availability of sharp weapons and use of firearms are very rare due strict legislation.

The commonest motive behind homicides in this study is enmity 13 (32.5%) cases, followed by financial matters in 7 (17.5%) cases, sex, property disputes and robbery constituted 3 (7.5%) cases each. This is in consistent with the studies conducted by others⁹. This fact may be due to increase rivalry between groups who try to become dons of each locality which as lead for main cause for homicidal deaths.

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