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# Consumer Protection Act: Awareness in Medical Professionals

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## ABSTRACT

**Background:** To safeguard interests of consumers, consumer protection act was passed in 1986 in India. After commencement of CPA, drastic changes have occurred. Number of litigations increased, large number of patients and consumer originations are approaching consumer courts for the redressal of grievances against doctors and hospitals. The present study was designed to assess the awareness of CPA in medical professionals. **Material and Method:** A cross-sectional, questionnaire-based study was carried out among 186 doctors. The data was analyzed for number and percentage. **Results:** We found that although 178 (95.6%) doctors were aware about the existence and inclusion of CPA 156 (83.9%), only 23 (12.4%) doctors were actually having mean awareness score greater than 60%. Maximum doctors 128(68.8%) scored very poor to poor. Doctors of clinical faculty 43(45.3%) were having higher moderate to good mean awareness. **Conclusion:** Doctors need to be aware about various laws related to medical profession including CPA and its amendments to protect them.

**Keywords:** Consumer protection act, medical professionals, awareness, litigations.

## INTRODUCTION

Consumer, in medical profession, means a patient who pays to get services of a doctor or a hospital or any person who pays for the patient. Consumer protection act (CPA) consists of laws and regulations to ensure the rights of consumers. Unlike other laws which are protective in nature, the provisions of CPA are compensatory in nature<sup>1</sup>. The practice of medicine is considered as the most virtuous profession worldwide where doctor is given a place next to God<sup>2</sup>. The doctor-patient relationship is based on trust and confidence. Due to fast pace of commercialization and globalization on all spheres of life including medical profession, this relationship has depreciated leading to increase in litigations

against doctor day by day<sup>3-4</sup>.

To safeguard interests of consumers, worldwide countries have developed consumer protection organizations. In India, consumer protection act was passed by the Parliament in 1986 for better protection of interest of consumers<sup>5-6</sup>. The act has been marginally amended on 1991 and substantially in 1993 and 2001 with a view to make it more effective<sup>7</sup>. The effective implementation of the CPA commenced since 1990. Before commencement of this act all the disputes related to negligence of doctors or hospitals were filed under the relevant sections of Indian Penal Code to claim the damages or to get the negligent punished. These claims were time consuming and expensive.

After about a decade in 1995, medical profession was also included within the ambit of CPA by Supreme Court of India in a landmark case of Indian Medical Association vs. VP Shantha to protect the interests of the patients in case of any unethical treatment rendered by the doctor or hospitals<sup>8-9</sup>. All services rendered to a patient by a medical practitioner are covered under CPA except when

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the services are provided free of cost, especially in government hospitals or charitable hospitals.

This act introduced three-tier quasi-judicial consumers dispute redressal mechanism i.e. district level, state level and national level as below<sup>10</sup>:

#### 1. District Consumer Dispute Redressal Forum:

- Situated at each district headquarters.
- Pecuniary jurisdiction: Grant compensation up to Rs. 20 Lakhs.
- Can appeal against order of district forum to the State commission within 30 days of receipt of the order.

#### 2. State Consumer Dispute Redressal Commission:

- Situated at capital of each state.
- Pecuniary jurisdiction: Grant compensation from Rs. 20 Lakhs to Rs. 1 Crore.
- Can appeal against order State Commission to the National Commission within 30 days of receipt of the order.

#### 3. National Consumer Dispute Redressal Commission:

- Situated at New Delhi.
- Pecuniary jurisdiction: Grant compensation > Rs. 1 Crore.
- Can appeal against order of National Commission before Supreme Court of India within 30 days of receipt of the order.

After commencement of CPA, drastic changes have occurred. Number of litigations increased, large number of patients and consumer originations are approaching consumer courts for the redressal of grievances against doctors and hospitals. So it becomes imperative on the part of medical professionals to have adequate and updated knowledge and awareness about CPA and its implications on their profession which in turn will be beneficial to patients, doctors and society as a whole.

Moreover, studies on awareness of CPA among medical professionals have rarely been reported in literature and in Indian scenario there is paucity of the data exploring these issues. With this in mind, the present study was designed to assess the awareness

of CPA in medical professionals.

## MATERIAL & METHOD

After obtaining approval from Institutional Ethics Committee, a cross-sectional, questionnaire-based study was carried out at NKP Salve Institute of Medical Sciences and Research Centre, Nagpur, from July 2014 to December 2014.

The study was conducted on 200 doctors selected by simple random sampling of which 14 were excluded from the study for incomplete filling of questionnaire. A structured and validated questionnaire having 20 questions related to various aspects of consumer protection act was used for the study to collect information. Before starting the study, it was pretested on a group of 15 doctors, 5 from each stream, who were excluded from final analysis. Those who were not willing to participate were excluded from the study. So the final sample size was 186 of whom 22 were from preclinical, 36 were from paraclinical and 128 doctors were from clinical faculty. Prior to administering the questionnaire, they were addressed regarding the purpose and process of data collection. They were informed that data collected would be anonymous and their participation would be voluntary. Questionnaires were distributed among the participants after taking informed consent.

For the purpose of analysis, each correct answer was given one mark. The individual score was summed up to yield a total score and the score was converted into percentage. Based on the percentage, grading was done as very poor (<35%), poor (35-50%), moderate (51-60%), good (61-75%), and excellent (>75%). Then the data was analyzed using EPI-Info statistical software version 6 for number and percentage.

## RESULTS

The present study was carried out among 186 doctors out of whom 22 were from preclinical, 36 from paraclinical and 128 were from clinical faculties. We found that although 178(95.6%) doctors were aware about the existence of CPA and 156(83.9%) were aware about inclusion of doctors in CPA, only 23(12.4%) doctors were actually having mean awareness score greater than 60% and very few of

them 55(29.6%) were aware about its provisions. Out of total faculties, maximum doctors 128(68.8%) scored very poor-to-poor and 58(31.2%) scored moderate-to-good. Doctors of clinical faculty 43(45.3%) were

having higher moderate-to-good mean awareness score as compared to preclinical 7(31.8%) and paraclinical 8(22.2%) doctors (Table 1).

**Table 1: Awareness about CPA**

Faculty	< 35% (Very poor)	35%-50% (Poor)	51%-60% (Moderate)	61%-75% (Good)	> 75% (Excellent)	Total
Preclinical	4(18.2%)	11(50%)	5(22.7%)	2(9.1%)	0(0%)	22(100%)
Paraclinical	8(22.2%)	20(55.6%)	4(11.1%)	4(11.1%)	0(0%)	36(100%)
Clinical	30(23.5%)	55(42.9%)	26(20.3%)	17(13.3%)	0(0%)	128(100%)
<b>Total</b>	42(22.6%)	86(46.2%)	35(18.8%)	23(12.4%)	0(0%)	186(100%)

We observed that Paraclinical doctors were having low mean awareness score as compared to preclinical and clinical doctors though the difference is marginal (Table 2).

**Table 2: Faculty wise awareness about CPA**

Faculty	Mean awareness score
Preclinical (n=22)	9.68
Paraclinical (n=36)	9.08
Clinical (n=128)	9.57
Total (n=186)	9.49

It can be concluded that mean awareness score was more in senior doctors as compared to junior ones in all faculties (Table 3).

**Table 3: Experience wise awareness about CPA**

Faculty	Experience in years	Mean awareness score
Preclinical (n=22)	0- 5	7.75
	6-10	9.87
	11-15	11.33
Paraclinical (n=36)	0-5	8.25
	6-10	8.8
	11-15	13.67
Clinical (n=128)	0-5	9.37
	6-10	9.46
	11-15	12.6
Total (n=186)	0-5	8.94
	6-10	9.38
	11-15	12.54

About time limit for filing a complaint in consumer court, which is up to 2 years from the date of action, only 52(27.9%) were aware and about time limit for giving justice to patients, only 57(30.6%)

doctors were aware. When asked about maximum time limit for appeal at various levels, only 48 (25.8%) were aware for the same. It was surprising to note that very few 44(23.6%) knew the location of Consumer Dispute Redressal Forum in their own area and only 68(36.6%) were aware about maximum compensation that can be claimed by the patient. Regarding the need to discuss various aspects of CPA in CME, workshop or seminar, 182(97.8%) doctors were of opinion that this will definitely help them to keep pace with progress in medical science.

## DISCUSSION

Consumer protection act was enacted for the better protection of consumers' rights in 1986. In last decade, public awareness about various laws related to medical profession has increased resulting in increase in number of litigations against medical professionals. The present study was an attempt to assess the awareness of CPA in medical professionals.

In the present study, even though most of the participants were aware about existence and inclusion of doctors in CPA, very few were actually having awareness greater than 60%. Similar results were noted in previous studies carried out by Sikka M et al<sup>5</sup>, Ajithkrishnan CG et al<sup>11</sup>, Singh K et al<sup>12</sup>. Very few doctors were aware about time limit for filing a complaint in consumer court which is in conformity with findings of previous work done by Santosh CS et al<sup>3</sup>, Sikka M et al<sup>5</sup>, Prasad S et al<sup>13</sup>, however, on the contrary maximum doctors were aware about time limit for filing a complaint in consumer court in a study conducted by Shenoy Ramya et al<sup>14</sup>. It was

surprising to note that very few were aware of the location of Consumer Dispute Redressal Forum in their own area which is in accordance with findings of Prasad S et al<sup>13</sup> and Shenoy Ramya et al<sup>14</sup>. About maximum compensation that can be claimed by the patient, findings noted by Sikka M et al<sup>5</sup> and Prasad S et al<sup>13</sup> were in agreement with findings of the present work.

Out of total faculties, maximum doctors scored very poor-to-poor score which is in concordance with a study conducted in Punjab by Singh Virendar Pal et al<sup>8</sup>, but not with the findings noted by Sikka M et al<sup>5</sup> where most of the doctors scored 51-75%. We found that mean awareness score was lower in paraclinical doctors as compared to clinical doctors though the difference was marginal, however, in a study carried out by Kachare RV et al<sup>10</sup>, mean awareness score was low in clinical faculties. On the other hand, doctors of clinical faculty were having higher moderate-to-good mean awareness score as compared to others in a study conducted by Kachare RV et al<sup>10</sup>, which is in agreement with our study.

The mean awareness score was higher in senior doctors as compared to juniors in all preclinical, paraclinical and clinical faculties in the present study, which is in concordance with the study conducted by Kachare RV et al<sup>10</sup> and Prasad S et al<sup>13</sup>. This might be due to the experience leading to an increase in knowledge and awareness.

Regarding the need to discuss various aspects of CPA in CME, workshops or seminars, most of the doctors were of opinion that this will definitely help them to keep pace with progress in medical science which is in concurrence with findings of study of Santosh CS et al<sup>3</sup> and Mathur K et al<sup>15</sup>.

### CONCLUSION

To conclude, though majority of the doctors were aware of the existence of CPA, their knowledge about the detailed provisions of the same was found to be low. Hence, orientation programs for doctors through CME, seminars and workshops need to be arranged to update their knowledge on various aspects of the changing laws related to medical profession including CPA. This will help the medical professional to avoid future litigations and to be legally safe.

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# Role of Helmet in Preventing Head Injury among Two Wheeler Occupants in Fatal Road Traffic Injuries

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## ABSTRACT

India, and its cities and towns are experiencing an unprecedented and unparalleled motorization in recent times. The motorization pattern in India indicates that nearly three fourths of the total registered vehicles are motorized two wheelers. Even though a significant increase is seen in urban areas, there is a noticeable increase in rural areas also. Road deaths and injuries are increasing at a rapid pace in Bengaluru and other parts of India and are likely to increase if systematic and scientific road safety policies and programmes do not accompany this change. Helmets form an important protective gear in protecting the head among two wheeler riders/ pillion riders in fatal road traffic injuries.

The present study was performed to study the effectiveness of Helmet as a protective gear in preventing fatal Head Injury among Two Wheeler Riders/ Pillion Riders in Road Traffic Injuries. In this study, we studied the usage of Helmet among Two Wheeler Rider/ Pillion Riders, type of Helmet they wore during the fatal day, Head Injury pattern in them among others to find out the effectiveness of Helmet. A total number of 220 cases were included in the study for a period of 3 years. Statistically significant observations were made in the study which proved that a standard ISI standard full face Helmet is very effective in reducing the fatal Head Injury in two wheeler accidents.

**Keyword:** *Helmet; Two Wheeler; Road Traffic Injury.*

## INTRODUCTION

There is a classic line that goes, "Buy your son a motorcycle for his last birthday" This, in a way, summarizes motorcycle accidents. The motorcycle, by its design, is intrinsically dangerous. An accident that might result in minor injuries with an automobile can result in death with a motorcycle. Approximately 6% of all traffic fatalities involve motorcycles. In accidents involving automobiles, the most dangerous thing that can happen to an individual is to be ejected from the vehicle. Motorcycles involved in accidents always eject their operators or passengers. Individuals dying in motorcycle accidents typically die of either head or neck injuries, with the former more common<sup>1</sup>.

While motorcycle Helmets reduce the incidence of head trauma in low-speed accidents, at moderate and high speeds their sole function is to prevent

brain matter from being spread over the highway. In Bengaluru, the number of vehicles has increased by nearly 5 times in the previous decade. (1980: 0.2 million; 1998: 1.13 million; 2008: 3.13 million) The number of motorcycles has increased from 0.8 million in 1998 to 2.5 million in 2007. Consequently, the number of road deaths and injuries has been on the increase, as motorcycle riders and pillions are at an increased exposure and are also unprotected while on roads<sup>1,2</sup>.

## INJURY MECHANISM

During a motorcycle crash, the brain and its contents are damaged through direct contact and through acceleration -- deceleration forces, with each resulting in different types of injuries. In a crash, the rider is thrown forwards / backwards or falls to the side hitting an object depending on collision patterns. When a rider's head hits an object, the forward

motion of the head is stopped but the brain continues to move until it strikes the inside of the skull. It then rebounds hitting the opposite side of the skull. The resulting damage can vary from minor head injuries to instantaneous death depending on the amount of energy transferred to the injured person in a crash. If the rider is unprotected, the amount of energy transfer will be much higher and injuries severe.

**Helmet mechanism:** A Helmet primarily reduces the impact of the collision and thereby consequent injury to the brain by

- ❖ Reducing friction / resistance.
- ❖ Acting as a mechanical barrier between the skull and the impacting object.
- ❖ Reducing the deceleration of the skull, and hence the brain movement.
- ❖ Providing a cushioning effect through the padding thermocole lining which absorbs the impact and brings the head to a halt slowly.
- ❖ Spreading the force of the impact to a larger area so that energy is distributed through the outer shell of a Helmet.
- ❖ The shell also protects against penetration of the skull by any sharp pointed objects.
- ❖ Keeping the Helmet on the head in a crash through chinstraps<sup>3</sup>.

**Available Helmets:** Generally, there are different types of Helmets used by the people. These are full-face Helmets, open face Helmets and half head Helmets. In India, different types of Helmets are available even for children to be used during cycling and other sports activities. Half head Helmets do not offer any protection in the event of a crash<sup>3</sup>.

**Helmets and Head Injury:** As per WHO, "wearing a Helmet is the single most effective way of reducing head injuries and fatalities resulting from motorcycle crashes. Motorcyclists who do not wear Helmets are at a much higher risk of sustaining head injuries and from dying from these injuries". Research in the past two decades has shown that wearing a Helmet reduces the risk of severity of injuries by about 72%, decreases the likelihood of death by 39% and consequently brings down the costs of healthcare. Previous studies by NIMHANS have shown that the risk of death and severe brain injury increases by more than 2 times in the absence

of Helmet, neurological disability is increased by one and half times, and the extent of hospitalization and healthcare costs are considerably higher for care of an injured person due to a crash<sup>3,4</sup>.

### **Helmet registration in Karnataka:**

Since November 2006, the city of Bengaluru and parts of Karnataka have legislation in place covering riders of motorcycles. Similar laws exist in few other states and cities of India. Even though Indian Motor Vehicles Act has mandatory Helmet legislation, the notification and implementation of the law is the responsibility of individual states. For Helmet legislation and enforcement to be really effective, it is important to have random -- visible -- uniform enforcement across the entire geographical area. Secondly, it is equally important that almost all motorcyclists wear Helmets<sup>3-5</sup>.

## **MATERIALS & METHOD**

The present study has been carried out in the Department of Forensic Medicine and Toxicology, Victoria Hospital, attached to Bangalore Medical College and Research Institute, Bengaluru during the period October 2010 to September 2012. All the cases of Death due to Road Traffic Injury were selected for the study. The study did not involve any removal of organs or mutilation of bodies, which is prohibited by the ICMR guidelines. The clearance for the study was obtained from the college ethical committee. Demographic information regarding the deceased including the Post-mortem number, age, gender, religion, date and time of injury, date and time of admission, date and time of death, date and time of autopsy conducted, police station, place of injury, activity at the time of crash, type of crash, use of Helmet and other parameters were collected.

### **Inclusion criteria:**

- ❖ Fatal road traffic injuries resulting in deaths of two wheeler riders / pillions due to motor vehicle crashes reported to Department of Forensic medicine, Victoria hospital, Bengaluru from Oct 2010 to Sept 2012.

- ❖ Deceased in the age groups of 16 – 60 years of either sex.

### **Exclusion criteria:**

- ❖ Road traffic injuries which have been treated

for more than 30 days.

- ❖ Fatal pedestrian injury.
- ❖ Decomposed cases.

### OBSERVATION & RESULTS

A total number of 7347 autopsies were performed in the Department of Forensic Medicine and Toxicology, Victoria Hospital, Bangalore Medical College and Research Institute, Bengaluru, over a period of 24 months from October 2010 to September 2012. There were 998 cases (13.58%) of deaths due to Road traffic injuries and only 220 cases were included in our study based on the inclusion and exclusion criteria.

Among the cases included in our study, all the cases involved in two wheeler injuries were males, with majority (46.8%) of them aged between 21-

30years (Table 1). Among the road user category of the person at the time of crash, two wheeler riders are the major contributors for road traffic injury (Table 2). In our study, 50.90% of two wheeler rider/ pillion rider were wearing Helmet at the time of crash and among them, 24 persons out of 112 were wearing a full face Helmet, 9 were wearing open face Helmet and 79 persons were not wearing any Helmet. It is further observed that among 112 cases studied in our study, only 15 persons were wearing ISI standard full face Helmets (Table 3). Among 15 cases who were wearing ISI standard Full face Helmet, none of them had head injury which reflects the protective accountability of Helmets in two wheeler riders/ pillion riders. Injuries to other parts of the body during two wheeler accident, shows that limbs are the most common site to be injured (Table 4). According to ICD-10 classification, head injury among Helmet wear users, superficial injury to Head accounts the most common injury (Table 5).

**Table 1: Shows sex-wise & age-wise distribution of cases.**

Age group	Males	Females	Total	Percentage
16-20yrs	25	0	25	11.3%
21-30yrs	103	0	103	46.8%
31-40yrs	47	0	47	21.3%
41-50yrs	28	0	28	12.7%
51-60yrs	17	0	17	7.7%

**Table 2: Shows road user category**

Road user category	Number	Percentage
Two wheeler rider	186	84.5%
Two wheeler pillion rider	34	14.5%

**Table 3: Type of Helmet use among two wheeler riders/ pillion riders**

Use of Helmet among riders/ pillion riders				Number	Percentage	
Yes	Full face Helmet	ISI Standard	15	24	112	50.9%
		Non-ISI standard	09			
	Half face Helmet	ISI Standard	00	09		
		Non-ISI standard	09			
	Half head Helmet	ISI Standard	00	79		
		Non-ISI standard	79			
No				108	49.09%	

**Table 4: Shows parts of the body injured during Road Traffic Injuries.**

Parts	Total number	Percentage
Head	180	81.8%
Neck	21	9.5%
Upper limbs	211	95.9%
Abdomen	60	27.7%
Lower limbs	210	95.4%
Chest	103	46.8%
Spine and Vertebral column	26	11.8%

**Table 5: Shows injury to head according to the ICD-10 Classification.**

Injury	Two wheeler rider/ pillion rider						
	With Helmet						Without Helmet
	Full face Helmet		Half face Helmet		Half head Helmet		
	ISI	Non-ISI	ISI	Non-ISI	ISI	Non-ISI	
Superficial injury to head	0	5	0	6	0	73	96
Open wound of head	0	5	0	5	0	73	47
Fracture of skull and facial bones	0	3	0	6	0	68	96
Dislocation and sprain of joints and ligaments of head	0	0	0	6	0	31	34
Injury of cranial nerve	0	0	0	2	0	19	78
Injury to eye and orbit	0	0	0	1	0	30	27
Intra-cranial injury	0	5	0	6	0	73	96
Crush injury to head	0	0	0	0	0	19	24
Avulsion and traumatic amputation of head	0	0	0	0	0	0	0
Other and unspecified injuries of head	0	0	0	0	0	0	0

### DISCUSSION

The United Nations General Assembly adopted a resolution on road safety on October 26, 2005 which invites Member States to implement the recommendations of the World Report on Road Traffic Injury Prevention; to participate in the first United Nations Global Road Safety Week; and to recognize the third Sunday in November of every year as the World Day of Remembrance for Road Traffic Victims<sup>6</sup>. The situation in India is not very different. About 82,000 persons were killed on Indian roads in 2002<sup>7</sup>. Official statistics regarding serious injuries are not reliable as they underestimate the actual number<sup>8</sup>, but it is estimated that the number of people hospitalized may be 15-20 times the number killed<sup>9</sup>.

In the present study, all the cases involved in two wheeler injuries were males, with majority (46.8%) of them aged between 21-30years and highest rate of injuries were seen among the age group of 21-30years, followed by 31-40years, both groups constituting around 2/3rd of the cases. Similar findings were noted in Gururaj G et al<sup>10</sup> (84% males, 76% injuries were in 15-44years age group), Arvind K et al<sup>11</sup> (88.22% males, 54.24% in the age group of 21-40 years), Singh B et al<sup>12</sup> (85% males, 58% in the age group of 11-40 years) and Mohammad KH et al<sup>13</sup> (76% males, 47% in the age group of 16-25years).

Only 50.90% were wearing Helmets at the time of crash. Gururaj G et al<sup>10</sup> reported that Usage of protective devices like Helmets (< 50%) were extremely low among those injured & killed, despite the presence of laws. Mohammad et al<sup>13</sup> reported that only 2% were using Helmets at the time of crash. Timothy MP et al<sup>14</sup> observed that use of Helmet in Motor cycle users was 63%. Daniel CN et al<sup>15</sup> reported that use of Helmet was 50%. Bela S et al<sup>16</sup> reported that only 25.2% were wearing Helmet at the time of crash.

Only 15 persons out of 112 were wearing an ISI standard Helmet during the time of crash. Among 15 cases who were wearing ISI standard Full face Helmet, none of them had head injury which reflects the protective accountability of Helmets in two wheeler riders/ pillion riders. It should also be noted that, simply wearing a non-standard half head Helmets while riding two wheelers is of no use as it is clearly visible in the study that when compared to non-helmet users, there is not much of a difference in pattern of head injury sustained in non-standard half head helmet users.

### CONCLUSION

With this study, it is clear that the use of protective equipment like Helmets play a pivotal role in preventing fatal Head Injury among two wheeler

occupants in Road Traffic Injuries. Therefore, to conclude, we recommend full face ISI standard Helmet to be made compulsory for both two wheeler riders and pillion riders to effectively reduce the fatality due to road traffic injuries involving two wheelers, instead of Non-ISI standard Helmets and half Helmets which are commonly seen in Indian population. So, along with this, a multi-disciplinary approach is required to tackle this issue and therefore proper attention towards their prevention, accurate diagnosis and satisfactory management is mandatory.

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# Prevalence of Domestic Poisoning in a Rural Area of Tamil Nadu

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## ABSTRACT

**Objective:** To find out the prevalence of domestic poisoning in a rural village of Tamil Nadu.

**Material and Method:** A community based cross-sectional study was conducted during the month of October, 2015 in a rural village of Tamil Nadu. Sociodemographic information and details of domestic poisoning were obtained from a sample of alternately selected 398 households (housing 1251 individuals) using a semi structured questionnaire.

**Results:** The three months period prevalence of domestic poisoning was found to be 11.9 per 1000 persons. Majority (61.5%, 8/13) of domestic poisoning cases were due to scorpion sting. Others were inhalation of pesticides while spraying (2/13), consumption of poisonous seeds (2/13) and a case of snake bite. Except one case of scorpion sting which occurred while the victim was sleeping, rest all cases of scorpion sting had occurred during performing household works like gardening, cleaning, lifting a brick etc.

**Conclusion:** Awareness should be generated among community members focusing on prevention of domestic poisoning. Specific activities like health education on adopting preventive measures while handling pesticide will prevent unintentional poisoning due to pesticides. Awareness should be spread on availability of mental health services and same should be offered to the family having mental health issues.

**Keywords:** Domestic poisoning, prevalence, community based study, scorpion sting.

## INTRODUCTION

Mortality due to poisoning varies from 1% in developed countries to as high as 30% in developing countries like India especially in rural areas.<sup>[1]</sup> Easy access to toxic substances, physiological changes due to old age, illiteracy and ignorance make the population prone for poisoning. In developing countries consequences of unintentional domestic poisoning can be very serious following ingestion of kerosene, caustic agents, pesticides or medicines especially among children.<sup>[2]</sup> A hospital based study

from Andhra Pradesh reported that nearly 75% of the poisoning cases consumed poison in the domestic front. Srivastava et al reported highest incidence of poisoning due to domestic agents like pyrethroids, rodenticides, drugs etc among the poisoning cases reported to a tertiary care hospital.<sup>[3]</sup> Sarker et al has reported kerosene being the most important cause of accidental poisoning among children in India.<sup>[4]</sup> Data on domestic poisoning at community level is lacking in India. Limited availability of good quality data due to lack of toxicovigilance especially at the level of community hampers efforts from the health authorities to address the public health burden posed by poisoning especially domestic poisoning effectively in developing countries like India. The present study aimed to find out the prevalence of domestic poisoning in a rural village of Tamil Nadu.

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## MATERIAL & METHOD

We conducted a community based cross-sectional study during the month of October 2015 in a rural village of Tamil Nadu bordering Puducherry. The purposively selected village Edayanchavady has a population of around 4000 (in 800 households). Majority of the villagers belongs to low socioeconomic status and works as labourer on daily wage basis in nearby factories. Because of feasibility and having adopted a systematic random sampling in which every alternate house was approached, a total of 400 households were selected for the present study. The wife of the head and in her absence any adult member of the household was interviewed using a pre-tested semi-structured questionnaire after obtaining informed consent. The immediate next household was considered when a house refused to participate or found locked. Information on socio-demographic details and details of poisoning in the preceding three months from the date of interview by any household members in and around the house was noted in the questionnaire. For the present study, domestic poisoning was defined as a case of poisoning which occurred inside or in the immediate surroundings of the house which may be intentional or unintentional. Data entry and descriptive analysis was done using software SPSS 16.0.

## RESULTS

A total of 1251 individuals were covered, of which majority were males (53%) and belonged to nuclear family (62%). The details of age, education and socio-economic status of the studied population are given in table 1.

The 3 months period prevalence of domestic poisoning was found to be 11.9 per 1000 population.

No death due to domestic poisoning was reported during the reference period. Majority of the domestic poisoning victims were male (73.3%, 11/15) and had studied up to high school or above (53.4%, 8/15). Two third of the individuals with domestic poisoning were in productive age group (15-59 years) and from middle or lower socio-economic classes.

Table 2 describes the socio-demographic details of victims of domestic poisoning. Details of two domestic poisoning cases could not be obtained. Majority (61.5%, 8/13) of domestic poisoning cases were due to scorpion sting. Other cases were due

to inhalation of pesticide while spraying (2/13), consumption of poisonous seeds (aralivedai) (2/13) and a case of snake bite while collecting woods. Except one case of scorpion sting which occurred while the victim was sleeping, rest all cases of scorpion sting had occurred during performing household works like gardening, cleaning, lifting a brick etc.

**Table 1: Socio-demographic details of studied population from Edayanchavady, 2014 (N=1251)**

Variable	Category	Frequency (%)
Gender	Male	663 (53)
	Female	588 (47)
Age (years)	≤14	270 (21.6)
	15-29	368 (29.4)
	30-44	300 (24)
	45-59	204 (16.3)
	≥60	109 (8.7)
Education* (n=1092)	No formal education	248 (22.7)
	Upto Primary School	138 (12.6)
	Upto Middle School	82 (7.5)
	Upto High School	333 (30.5)
	Intermediate and above	291 (26.6)
Socio-economic status (SES)**	Class I	141 (11.3)
	Class II	369 (29.5)
	Class III	315 (25.4)
	Class IV	238 (19)
	Class V	185 (14.8)
Type of family	Nuclear	776 (62)
	Joint	475 (38)
Religion	Hindu	1247 (99.7)
	Christian	4 (0.3)

\*Individuals aged 8 years and above are considered (n=1092)

\*\*Updated BG Prasad's classification for 2014 is used

**Table 2: Socio-demographic details of individuals with domestic poisoning from Edayanchavady (N=15)**

Variable	Category	Frequency (%)
Gender	Male	11 (73.3)
	Female	4 (26.7)
Age (years)*	≤14	-
	15-29	1 (6.7)
	30-44	5 (33.3)
	45-59	4 (26.7)
	≥60	5 (33.3)
Education	No formal education	5 (33.3)
	Upto Primary School	2 (13.3)
	Upto Middle School	-
	Upto High School	7 (46.7)
	Intermediate and above	1 (6.7)
Socio-economic status (SES)	Class I	1 (6.7)
	Class II	5 (33.3)
	Class III	6 (40)
	Class IV	-
	Class V	3 (20)
Family type	Nuclear	10 (66.7)
	Joint	5 (33.3)
Religion	Hindu	15 (100)
	Christian	-

\*No case of domestic poisoning was reported among individuals aged less than 15 years

## DISCUSSION & CONCLUSION

The present study reported the three month period prevalence of domestic poisoning to be 11.9 per 1000 persons. Most of the domestic poisoning cases in our study reported to occur among people who have studied up to class 10<sup>th</sup> or above and belonged to middle or low socioeconomic status. Similar findings were reported by Dash et al (2005) from Orissa, however they had studied all poisoning cases reported to a tertiary care hospital.<sup>[5]</sup> Majority of domestic poisoning in our study occurred due to scorpion sting, among people from low socioeconomic status and while doing household works. Hence, there is a need to maintain sanitation in and around the house. Consumption of poisonous seeds probably occurred as a result of poor emotional and family support or strained relationship of victim

with family members. Hence, counselling services on mental health should be offered to community. Health education should be directed at precautionary measures to take while handling pesticides.

Data available on poisoning are mostly from the records of emergency department of various health institutions in India. Lack of data on domestic poisoning at community level prevents estimation of actual burden of this problem, comparison across geographic regions and development of specific intervention programmes. The present study is an attempt to find the prevalence of domestic poisoning at the community level in a rural area. However, community based study with a large sample size is needed to define the pattern and risk factors for domestic poisoning.

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**Conflict of Interest:** None Declared

**Ethical Approval:** Verbal informed consent was taken from the head of the village before starting the survey and from the head of the household during survey. The research being a part of educational program ethical approval from ethics body was not obtained.

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# Sexual Dimorphism in Maxillary and Mandibular Canines – a Cross Sectional Study

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## ABSTRACT

Sex determination is considered an important step in reconstructing the biological profile of an unknown individual from the forensic context.<sup>1</sup> The assessment of sex is statistically the most important criterion, as it immediately excludes approximately half the population. In most of the cases, bones are routinely used for sex determination. The teeth can be used as an additional tool for same purpose as the teeth are the hardest and chemically most stable tissues in the body, characterized by extraordinary resistance to putrefaction and the effect of external agents such as physical, trauma, heat, chemical or biological that cause the destruction of the soft parts of the body structure. **Objectives:** To determine the sex of individuals by morphometric analysis of teeth and to evaluate and compare the reliability of mesiodistal and buccolingual dimensions of maxillary and mandibular canines in determination of sex. **Material and method:** The study included the mesiodistal and buccolingual dimensions of 50 south Indian students (25 males and 25 females) in the age group of 18-25years. Measurements were taken on the dental casts of each of the subjects using Sliding Vernier's Caliper. **Results:** The maxillary canines showed highest sexual dimorphism than compared to mandibular canines. The mesio-distal dimension of right maxillary canine exhibited highly significant sexual dimorphism. **Conclusion:** The present study established the existence of statistically significant sexual dimorphism in maxillary canines.

**Keywords-** Buccolingual, Canine, Mesiodistal, Sexual Dimorphism etc.

## INTRODUCTION

Sex determination is considered an important step in reconstructing the biological profile of an unknown individual from the forensic context.<sup>1</sup> The assessment of sex is statistically the most important criterion, as it immediately excludes approximately half the population. Sex determination is difficult in cases of advanced decomposition and skeletal remains. In case of decomposed corpses many features may be partially or wholly lost, but more information can be obtained from a skeletal remains.<sup>2</sup>

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The most commonly used techniques for sex determination are based on the assessment of the morphological characteristics of the pelvis and skull.<sup>1</sup> However, it is not uncommon to recover the pelvis and the skull in a fragmentary state in forensic settings. In such cases, teeth can be used as an additional tool for sex determination. The teeth are the hardest and chemically most stable tissues in the body, characterized by extraordinary resistance to putrefaction and the effect of external agents such as physical, trauma, heat, chemical or biological that cause the destruction of the soft parts of the body structure. Thus teeth make a reliable material in living and non-living populations for anthropological, genetic, odontologic and forensic investigations.<sup>2,3</sup>

Of all the teeth in the human dentition, the canines are the teeth, last to be extracted because of the relatively low incidence of caries and periodontal disease. Furthermore, canines are reported to survive

extreme circumstances such as air disasters and hurricanes.<sup>4, 5</sup> Sexual dimorphism in teeth refers to those differences in size, stature and appearance between male and female that can be applied to dental identification.<sup>6</sup> Hence the present study was taken up with a view to determine the sex using dimensions of canine teeth, which will be of immense help to the forensic facilities and law enforcing authorities in solving various medico legal cases and also to generate population specific anthropological data for sex determination by morphometric measurements of canine teeth.

**MATERIAL & METHOD**

The present cross sectional study included 50 Indian students (25 males and 25 females) in the age group of 18-25 years of S. S. Institute of Medical Sciences and Research Centre, Davangere, Karnataka. The study was conducted after taking the informed written consent from the students. Subjects with fully erupted healthy canines with absence of spacing were included in the study. Subjects with dental or occlusal abnormalities, dental caries, fractured tooth and individuals under orthodontic treatment were excluded from the study.

The alginate casts of both maxillary and mandibular teeth of these 50 Indian students were made. The Mesio-distal and Buccolingual dimensions of canine were measured using Sliding Vernier’s caliper on the cast.

Mesiodistal (MD) dimension measurement is the greatest mesiodistal dimension between the contact points of teeth (Fig. 1). Buccolingual (BL) dimension measurement is the greatest distance between buccal and lingual surfaces of the teeth (Fig. 2). The data collected were entered into Microsoft Excel sheet and subjected to statistical analysis by using SPSS package version 18.0.

Student’s t-test was applied at 5% level of significance to compare the dimensions of canines in males and females. Sexual dimorphism of the teeth was calculated using the formula given below by Garn and Lewis.<sup>7</sup>

$$\text{Sexual dimorphism} = (X_m / X_f) - 1 \times 100$$

Where:  $X_m$  - mean of dimensions of canine tooth in males and  $X_f$  - mean of dimensions of canine tooth in females

**RESULTS**

The following parameters were determined from the study casts of males and females:

- a) Mesiodistal dimension of right and left maxillary and mandibular canines.
- b) Buccolingual dimension of right and left maxillary and mandibular canines.

The mean values were compared using unpaired t-test. The comparison of mean values of parameters showed statistically significant differences between males and females. The mean values of the mesiodistal and buccolingual dimensions of canine teeth were greater in males compared to that in females (Table 1). It was observed that the maxillary canines showed higher sexual dimorphism than compared to mandibular canines (Table 2). Among the dimensions measured, the mesiodistal dimension of right maxillary canine exhibited significant sexual dimorphism ( $p=0.003$ ).

**Table 1: Mean values of the Mesiodistal and Buccolingual Dimensions**

Sl. No.	Dimensions	Sex	Mean	p
1	RUMD	Male	7.880 ± 0.06658	0.003
		Female	6.800 ± 0.15811	0.004
2	RUBL	Male	8.000 ± 0.07071	0.025
		Female	7.480 ± 0.08718	0.025
3	LUMD	Male	7.680 ± 0.05568	0.020
		Female	7.240 ± 0.07234	0.020
4	LUBL	Male	7.840 ± 0.06880	0.088
		Female	7.480 ± 0.07703	0.088
5	RLMD	Male	6.920 ± 0.04000	0.050
		Female	6.640 ± 0.05686	0.050
6	RLBL	Male	7.320 ± 0.08524	0.039
		Female	6.840 ± 0.07461	0.039
7	LLMD	Male	6.760 ± 0.05972	0.470
		Female	6.640 ± 0.05686	0.470
8	LLBL	Male	7.240 ± 0.07789	0.466
		Female	7.080 ± 0.07594	0.466

**Table 2: Sexual dimorphism in the Maxillary and Mandibular Canines**

Sl. No.	Dimensions	Sexual Dimorphism
1	RUMD	14.705
2	RUBL	8.108
3	LUMD	5.55
4	LUBL	4.81
5	RLMD	4.21
6	RLBL	7.01
7	LLMD	1.80
8	LLBL	2.25

**Abbreviations used:**

RUMD - Right Upper Mesiodistal

RUBL – Right Upper Buccolingual

LUMD – Left Upper Mesiodistal

LUBL – Left Upper Buccolingual

RLMD - Right Lower Mesiodistal

RLBL - Right Lower Buccolingual

LLMD – Left Lower Mesiodistal

LLBL – Left Lower Buccolingual

**DISCUSSION**

The accuracy of determination of the sex of skeletal remains varies with the age of the subject, the degree of fragmentation of the bones and biological variability. In such scenario, teeth serve as an important means for sex identification. They are unique as individual as fingerprints. Therefore, individual tooth morphology as well as the restorations that exist in teeth and their durability in the case of fire, trauma and decomposition makes them important tool for human identification.<sup>4</sup> Correct sex identification limits the pool of missing persons to just half of the population.

The present study established the impact of sex factor on the morphometry of both maxillary and mandibular canines.

The comparison of mean values of parameters (mesiodistal and buccolingual dimensions) measured between males and females showed statistically significant differences which are in agreement with the studies done by Sharma I et al<sup>3</sup>, Sharma M et al<sup>8</sup>, Zirahei JV et al<sup>9</sup> and Staka G et al.<sup>10</sup> Mohammed Nahidh et al showed that the mesiodistal width of

maxillary canines were larger in males than females with a high significant difference and concluded that maxillary canines can be used in genders identification as an aid for forensic odontology.<sup>11</sup>

We also observed the existence of a definite statistically significant sexual dimorphism in Mesiodistal and Buccolingual dimensions of maxillary canines and mandibular canines. Maxillary canine showed highest sexual dimorphism as compared to mandibular canines of which right maxillary canine showed significant sexual dimorphism. The finding was unique compared to the previous studies conducted by various researchers.

The study conducted by Saikiran C et al on mandibular canines showed that right mandibular canine exhibited a greater sexual dimorphism than the left mandibular canine.<sup>6</sup>

Palla S et al conducted study on maxillary first molar and mandibular canine which showed that the left mandibular canine demonstrated highest sexual dimorphism than the right.<sup>12</sup> Staka G et al studied permanent maxillary canines and said that the buccolingual diameters of maxillary canines showed greater percentage of sexual dimorphism (6.72%) than mesiodistal diameter (3.71%).

Sharma M et al<sup>8</sup> study showed that the left maxillary canine in age group of 30-50 years and left mandibular canine in age group of 17-30 years demonstrated more sexual dimorphism as compared to right but in the present study, we found right maxillary canine exhibiting highest sexual dimorphism in the age group of 18-25 years. Mohammed Nahidh et al in his study concluded that right maxillary canine exhibited highest sexual dimorphism.<sup>11</sup>

**Figure 1: Mesiodistal dimension**



Figure 2: Buccolingual dimension

### CONCLUSION

In the present study, we found that the mean values of mesiodistal and buccolingual dimensions of both maxillary and mandibular canines were higher in males compared to that in females. Sexual dimorphisms in tooth size are population specific; they may vary among different ethnic groups.<sup>7</sup> The present study established that the right maxillary canine exhibited highest sexual dimorphism. It can be concluded that a mesiodistal canine width greater than 7.3 mm is suggestive of males. The use of dental casts in this study suggests that, it serves as a valuable forensic evidence for sex determination.

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**Conflict of Interest -** None

**Source of Funding -** Self

**Ethical Clearance -** Yes

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# Study of Awareness of Medico-Legal Aspects among Medical Professionals

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## ABSTRACT

Medico legal case (MLC) means a medical case with legal implications for the attending doctor. Many doctors are apprehensive in dealing with such case, may be because of fear, unwarranted laws and regulations, attending the court, harassment by the lawyers, and questions by the police personnel, etc. All medical practitioners must be aware of legal and ethical implications of clinical practice. The study of awareness of common medico-legal issues analyzed by questionnaire method among 70 doctors (clinical and non-clinical) working at Sri Siddhartha Medical College, Tumkur, Karnataka. Among the participants 41 were from pre and para clinical departments and 29 were from clinical section. Analyzing the awareness and knowledge of doctors about medico-legal matters might benefit the doctors in a constructive way.

**Keywords:** Medico Legal Case; Awareness; Consent; Medical professionals.

## INTRODUCTION

Medico legal case (MLC) means a medical case with legal implications for the attending doctor where the attending doctor, after eliciting history and examining the patient, thinks that some investigation by law enforcement agencies is essential. No matter what branch of medicine or surgery the graduate enters he will always have to face medico legal problems one or the other day during his professional life. All medical practitioners must be aware of legal and ethical implications of clinical practice. Many doctors are apprehensive in dealing with such case as may be because of fear, unwarranted laws and regulations, attending court, harassment by the lawyers, and questions by the police personnel, etc. Because of these factors, many doctors either try to avoid these cases or try to dispose of with them as early as possible.

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## MATERIAL & METHOD

The study of awareness of medico legal issues analyzed by questionnaire method among 70 doctors (clinical and non-clinical) working at Sri Siddhartha Medical College, Tumkur, Karnataka. Among the participants 41 were from pre and para clinical departments and 29 were from clinical section and all were professionals in their respective fields with varying experience from 3 years to 40 years. The questionnaire contained 10 questions. Each question was given with four different options. The participants were informed to choose one or more correct options (if any).

## RESULTS & DISCUSSION

The answers given by the participants to each question were as follows;

For the question 'minimum age for a valid consent for physical examination', 44% have marked correct answer and 56% have marked wrong answer among pre and para-clinical staff, and 52% of clinical staff have marked correct answer and 48% have marked wrong answer. According to S.89 IPC a child under 12 years of age cannot give consent for physical examination. In such condition consent of

guardian or parent must be obtained.<sup>1</sup>

For the question 'minimum age for valid consent for surgical procedures', 86% have marked correct answer as 18 years and above, and 14% have marked wrong answer by both pre, para-clinical and clinical staff. According to S.87 IPC a person above 18 years of age can give valid consent to suffer any harm, which may result from an act not intended or not known to cause death or grievous hurt.<sup>2</sup>

For the question 'in operating procedures necessity of the type of consent', 90% have marked correct answer and 10% have marked wrong answer among pre and para-clinical staff, and among clinical staff 80% have marked correct answer and 20% have marked wrong answer. The consent should be free, voluntary, clear, intelligent, informed, written, direct and personal.<sup>2</sup> Written consent is obtained for all major diagnostic procedures and for surgical operations. Consent should refer to only one specific procedure.<sup>3</sup> One should not take blanket consent.

For the question 'poisoning cases requiring police intimation', 3 persons from pre and para-clinical department have ticked the two correct answers (all cases in government hospitals and suspected foul play cases in private hospitals) and 2 have marked one of the correct answer and rest have given wrong answer. Whereas among clinical staff 7 have marked the two correct answers, 5 have marked only one correct answer, while rest have marked the wrong answer. A medical practitioner in private practice is convinced that the patient upon whom is attending is suffering from homicidal poisoning, he is bound under S.39 CrPC to communicate the fact to the nearest police officer or magistrate.<sup>4</sup>

For the question 'how to deal with brought dead cases', 81% have marked correct answer that is to inform police and 19% have marked wrong answer among pre and para-clinical staff, and 80% have marked correct answer and 20% have marked wrong answer among clinical staff.

For the question 'cases in which death certificate can be issued', 71% have marked correct answer and 29% have marked wrong answer among pre and para-clinical staff, and 69% have marked correct answer and 31% have marked wrong answer among clinical staff. A doctor should not certify the cause of

death in the following instances like person brought dead to casualty, person dying in casualty, persons dying after admission but before making diagnosis, all cases of unnatural deaths, deaths due to animals, snake bite etc. and anesthetic deaths.<sup>5</sup>

For the question 'maintenance of OPD records of patient', 30% have marked correct answer that is for three years<sup>3</sup> and 70% have marked wrong answer among pre and para-clinical staff, and 42% have marked correct answer and 58% have marked wrong answer among clinical staff.

For the question 'maintenance of hospital inpatient records', 25% have marked correct answer and 75% have marked wrong answer among pre and para-clinical staff, and 52% have marked correct answer and 48% have marked wrong answer among clinical staff. One has to maintain the inpatient case records for a minimum period of 5 years.<sup>3</sup>

For the question 'maintenance of medico-legal records', 93% have marked correct answer and 7% have marked wrong answer among pre and para-clinical staff, and 94% have marked correct answer and 6% have marked wrong answer among clinical staff. Medico-legally important records should be preserved up to 10 years<sup>2</sup> and some insist to maintain them till the judicial disposal of the case.

For the question 'in medical negligence cases doctor will be booked under', 54% have marked correct answer and 46% have marked wrong answer among pre and para-clinical staff, and 62% have marked correct answer and 38% have marked answer among clinical staff. According to S.304-A IPC whoever causes the death of any person, by doing any rash or any negligent act not amounting to culpable homicide shall be punished with imprisonment for a term which may extent to two years or with fine or with both.

## CONCLUSION

All medical practitioners must be aware of legal and ethical aspects of clinical practice. Analyzing the awareness and knowledge of doctors about medico-legal matters might benefit the doctors in a constructive way. Doctors should not be apprehensive in dealing with the medico-legal cases. To avoid any litigations arising out of clinical practice better to consult a medicolegal expert in case of doubts or for clarifications.

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**Conflict of Interest:** None

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# Cut Throat Injury by Manja String - a Case Report

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## ABSTRACT

Cut throat injuries can be suicidal, homicidal or accidental. Suicidal and homicidal cut throat injuries are common. Cut throat injuries are generally caused by the sharp edged weapons or objects. It is not uncommon that kite flying 'Manja' strings also cause such cut throat injury. Kite flying is the common time pass activity of the children. In order to strengthen the kite's string, a paste made of glass powder, glue and the grain flour named "MANJA" is applied on the kite string and dried, before using to fly the kites. While flying the kites, the children attempt cutting high flying kites by rubbing the opponent's kite string with the help of their high flying kite's string, to prove their supremacy in the sky. During such instances, both ends of the cut kite string may get entangled and become taut. When it gets positioned across the road, it would act as a sharp weapon and cause accidental cut throat injuries to the road users and birds. In this case report, a four year old child sitting on the petrol tank of the motor bike rode by her father, sustained cut throat injury, involving the left internal jugular vein, by the kite string coated with 'Manja' stretched across the road.

**Keywords:** Accidental cut throat injuries, manja, kite flying string, deal.

## INTRODUCTION

Manja is an abrasive mix used for roughening the strings of fighter kites. They are gummed, coloured and coated with powdered glass. It is practiced in Afghanistan, Bangladesh, Chile, India, Nepal, Pakistan and in Brazil<sup>1</sup>.

Kite fighting may be practiced during special kite flying festivals or throughout the year. Two fighters will entangle the glass powder coated manja string while flying their kites in the sky and try to cut off the string of each other's kites by pulling it. The winner's kite keeps flying while the loser's kite gets cut and drifts away with the wind. Children and adults run after a cut kite and try to capture it when it falls to the ground. This practice of running after drifting kites in the sky that have been cut loose in battle with other kites is called 'Kite running'<sup>1</sup>.

In India the kites are generally flown and fought from the rooftops of houses and in open places. When the kites fall off the rooftops while flying they may get positioned and taut across the road and prove fatal to the road users, especially two wheeler riders. Handling the manja reels vigorously by pulling or releasing it during the battle is dangerous not only to humans but also to birds .

## CASE REPORT

On 13<sup>th</sup> September of 2014, a four year old girl was travelling on the petrol tank of a two wheeler along with her parents to Marina beach. While travelling near Chrompet, Chennai a stray piece of sharp " **MANJA STRING** " used for flying kites slashed her neck. She was shifted to a hospital nearby in an unconscious state, where she was declared brought-dead. Next day, a requisition was received from the Inspector of police, Chrompet, Police station at 10.30 A.M to our Department of Forensic Medicine, to conduct the autopsy on the body of that four year old girl.

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## AUTOPSY

### External examination:

1) A cut injury measuring 12 x 0.5-5 x 0.2-0.7 cm on the left side of the neck extending from the anterior midline of the neck to the posterior midline. The upper margin was 5cm below the chin and the lower margin 8cm above the suprasternal notch.

2) A cut injury 1.5x 0.5-1x 0.7 cm on the palmar aspect of base of the right middle finger exposing the underlying soft tissues.

3) A linear reddish brown abrasion 6 x 0.5 cm on the right side of the neck.

### Internal examination

Dissection of the neck revealed extravasation of blood into the neck muscles of left side exposing the cut ends of underlying platysma and left sternocleidomastoid muscle. The lower part of left submandibular salivary gland and left internal jugular vein were cut. Left carotid artery was intact.

Hyoid bone, larynx, trachea, thyroid and cricoid cartilages were intact. All structures in the right side of the neck were normal. All the internal organs were normal in size, Cut section was pale.

## OPINION

The deceased would appear to have died of shock and hemorrhage due to cut throat injury.



Fig -1: A cut injury measuring 12 x 0.5-5x 0.2-0.7 cm on the left side of the neck.



Fig -2 :A defence cut injury of size 1.5x 0.5- 1x 0.7 cm on the palmar aspect of the right middle finger.

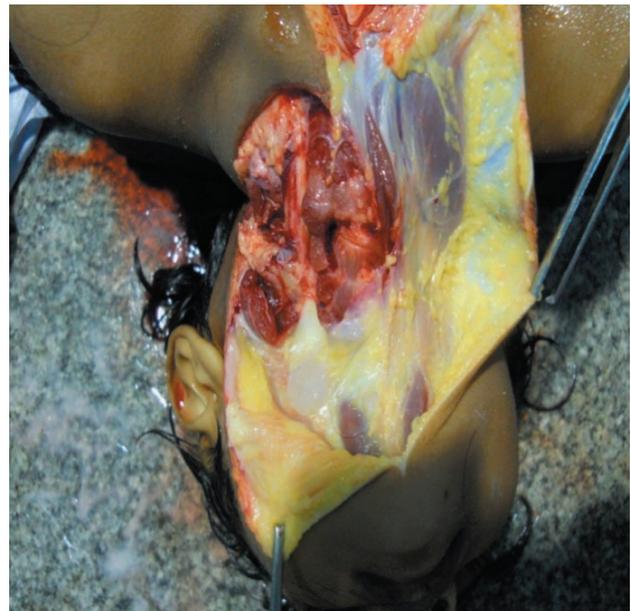


Fig -3 : Dissection of the neck showing the cut ends of left internal jugular vein.

## DISCUSSION

Cut injuries of the neck can be accidental, homicidal or suicidal. Homicidal and suicidal cut throat injuries are common, whereas accidental cut throat injuries are relatively uncommon. Cut throat injury causes immediate death from haemorrhage, air embolism and trickling down of extravasated blood in to the respiratory tract. Contact between manja string and human skin can lacerate the skin and the deep fascia of the neck and injure internal cervical structures, such as the carotid arteries,

jugular veins, larynx, and trachea. The severity of the injury is related to the speed at which the manja string and the victim came into contact<sup>2</sup>.

### KITE FESTIVALS

Kite flying is a popular game for children and adults all over the world. It was first introduced 3000 years ago in China. In India, Pakistan, and Bangladesh, people celebrate the arrival of spring by celebrating a kite festival. These kite festivals include a game of kite fighting, in which participants attempt to use their kite to cut the string of a rival kite. Manja, an abrasive material is often coated on the string of the kites to increase its durability and ability to cut other kite strings. Two kite fighters, while flying their kites in the air, entangle their kite strings coated with manja and try to cut off the strings of each other's kite, which is called as "DEAL" in the game. Winners kite keeps flying while losers kite gets cut and drifts away with the wind.

### INJURIES ASSOCIATED WITH KITE FLYING

Kites are associated with various injuries, including accidents that occur during the preparation of the threads, electrical injuries from high tension currents, falls that occur during the game, or injuries caused to road users during kite flying, especially injuries to those riding motorcycles are more severe than those of pedestrians. The severity of the injuries to the two wheeler riders depends on both the speed of the vehicle and the kite string. Palmar aspect of the hand is the commonest site of injury to a kite-flyer or even to those who try to catch the kite string. The killer string if it is white in color is more dangerous than the coloured thread because of its invisibility. As this thread moves very fast and is not easily visible, two wheeler riders are bound to get injured<sup>3,4</sup>. A news report says, 10 people were killed by accidents involving kite flying in Ahmedabad on Makar Sankranti. Among those three were decapitated by manja and seven were killed after falling off terraces or being run over by vehicles while chasing stray kites<sup>5,6</sup>.

### INGREDIENTS OF MANJA

**Manja** is an abrasive mix used for roughening the strings of fighter kites. It can be prepared by mixing various materials with powdered glass. The ingredients is unique with every individual maker

and it is kept secret. The most common ingredients of manja in Chennai are

- Finely powdered glass
- Industrial adhesive
- Maida flour
- Aluminium oxide, an abrasive
- Zirconia alumina, an abrasive
- Colouring agent

The industrial adhesive is boiled with water, to which a paste of maida and finely powdered glass pieces are added to make a thick colloidal solution, then the colouring agent is added. After that it is stirred to make a thick paste without sedimentation of the glass and abrasives. Broken Tube lights, broken soda bottle glass is used for making glass pieces. After making a paste of manja, the cotton thread was made to pass through it and dried<sup>7</sup>.



Fig -4: Preparation of Manja.



Fig -5: Cotton threads coloured and glass coated.

**MANJA BANNED**

Manja string is extremely deadly to birds flying in the sky and to humans. Flying of kite string coated with manja in overcrowded places was first banned in the city of Chennai in 2006 under section 71 (14) of Madras City Police Act and a case was also registered under section 304 (A) (causing death due to negligence). This was banned by the department of environment and forests to protect the humans and birds from harmful injuries. Unfortunately, even after this legislation, many people have been injured in similar incidents. People found violating this ban will be prosecuted under Section 5 of the Forest and Environment Protection Act. If any merchant is found selling these killer threads, his goods will be seized and the offenders will be punished with a fine. Flying kites in residential areas is now a non-bailable offence and is punishable with a fine up to Rs1,000 and imprisonment up to three months. The law was made stricter after the many serious injuries recently.

**CONCLUSION**

Many Preventive programs are implemented to reduce the number of kite-flying related invalidating sequels. The kite flying in public places are banned under Section 71 of the City Police Act. The offenders are punishable under non-bailable Sections 336 and 337 of the IPC, (causing hurt by act endangering life or personal safety of others). Section 5 of the Environment Protection Act says any chemical substance that causes harm to living beings is a violation of the law. It gives administrative authority to the state to take action against the trade of such substance<sup>8</sup>. Educational and preventive measures are necessary to avoid potentially fatal injuries. Precautions include choosing a safe location and keeping a safe distance from electricity cables, trees, roads and crowded places. A total ban on the sale of manja string would be the only solution to this endangering event.

**Acknowledgement** - Nil**Conflict of Interest** - None**Source of Funding** - Self**Ethical Clearance** - Obtained from Institutional Ethical Committee**REFERENCES**

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# Profile of Unnatural Female Deaths in Jammu Region - an Autopsy based Study

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## ABSTRACT

The profile of unnatural death of a female in a region determines the condition of the society as well as the law and order situation of that area. The present study was an autopsy based study conducted in the Department of Forensic Medicine and Toxicology, GMC Jammu, on a total of 948 unnatural female deaths from a period of Jan 2010 to Dec. 2014. In the present study, the first of its kind in Jammu region, we tried to find out the various causes of unnatural death in a female and other variables associated with it. Majority of the unnatural female deaths were in the age group of 21-30 years (32.59%) married Hindu females belonging to rural areas. Most common causes were vehicular accidents and accidental burns followed by suicidal poisoning.

**Keywords:** *Unnatural, Deaths, Female, Autopsy, Dowry.*

## INTRODUCTION

Death is unnatural when caused prematurely against the order of nature by injury, position or any other means<sup>1</sup>. Unnatural female deaths in a population of a region reflects the state of the society, various socio economic, cultural and legal factors related to them. The unnatural death of a female poses a major challenge to the police, the health personnels dealing with it and also to the legal system. Unnatural deaths of married women amongst total female deaths have been increasing trend in the Indian society during the recent past years<sup>2</sup>.

Female foeticide, falling sex ratio, gender inequality, low literacy rates, early marriage and burden of motherhood are the important factors which drive a female towards an unnatural death. Female foeticide, inspite of strict rules and regulations is still predominant and not only denies a girl from basic human right to be born, but also turns a woman into a silent victim.

Many socio economic factors like marital disharmony, demands for dowry, ill treatment by in-laws, domestic violence, lack of economic independence and maladjustment leads a female towards suicides and homicides.

Dowry deaths or Bride burning cases, well known in our country are the outcome of such imbalances in the life of a female.

Crime rate analysis has clearly shown a sharp increase in crime rate 8.8% in 2007 to 9.4% in 2011 which is a serious matter for the safety and security of Indian women. These are mainly due to an increase number of Dowry deaths, torture to women and sexual offences<sup>3</sup>.

The present study was conducted to know the various causes and manner of unnatural female deaths in Jammu region, J&K State and to provide awareness to the society and law agencies so as to maintain the honour of a female before birth till her old age.

## MATERIAL & METHOD

The present study was carried out in the Department of Forensic Medicine and Toxicology, Govt. medical college Jammu J&K State, a tertiary health care hospital of the state. The study is retrospective and comprised of medicolegal autopsies

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conducted on the cases of unnatural female deaths in the mortuary of Govt. Medical College, Jammu for a period from Jan 2010 to Dec. 2014. 948 cases of unnatural female deaths were studied out of a total of 4190 autopsies done during this period and were taken as materials of study.

The information regarding name, age religion, marital status apparent circumstances, motive and manner of death of the deceased females were taken from postmortem records available in the Department of Forensic Medicine and Toxicology, GMC, Jammu, which was taken from the relatives of the deceased, hospital records and police personnals at the time of conducting the autopsy. The final cause of death was then concluded from the record of postmortem reports , along with viscera chemical analysis report and histopathological reports wherever required. The data was compiled and then analyzed with respect to age, religion, marital status, rural urban subdivide, cause and manner of death.

**OBSERVATION**

Out of a total of 4190 autopsies done from a period of Jan. 2010 to Dec. 2014, the number of unnatural female deaths were 948. (Table-1)

**Table 1: Year wise distribution of unnatural female deaths.**

Year	Total No. of Autopsies	Unnatural Female Deaths	Percentage %
2010	763	174	22.80
2011	866	188	21.70
2012	882	205	21.35
2013	812	187	23.02
2014	857	194	22.63

Age wise distribution in the present study shows that most of the incidences of unnatural female deaths were in the age group of (21-30 years) 32.59% (Table-2)

**Table 2: Age wise distribution of unnatural female deaths.**

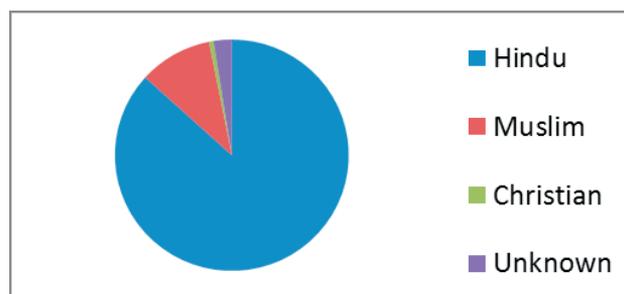
Age Group (Years)	No. of Females	Percentage%
0-10	45	04.74
11-20	202	21.34
21-30	309	32.59
31-40	178	18.77
41-50	92	09.70
51-60	59	06.22
>60	43	06.64

In the present study the marital status of the females revealed that 648 females (68.35%) were married as compared to 276 (29.11%). Marital status could not be ascertained in 24 females (2.5%) (Table-3)

**Table 3: Distribution as per marital status.**

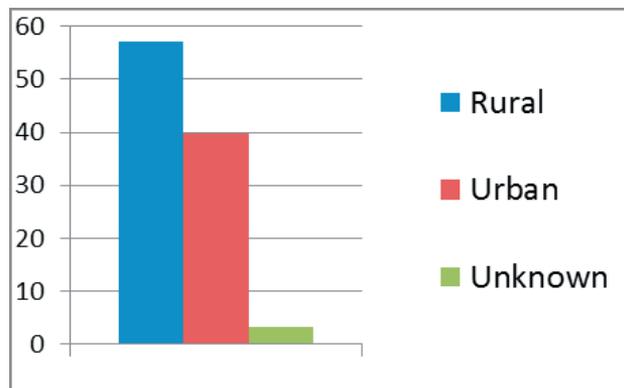
Marital status	No. of Cases	Percentage%
Married	648	68.35
Unmarried	276	29.11
Unknown	24	2.54

Religion wise distribution showed that there were 821 Hindu females (86.60%) as compare to 96 Muslim females (10.12%) and 6 Christian females(0.60%). Religion could not be ascertained in 25 (2.50%) of the females in the present study.( Fig.-1)



**Fig. 1: Religion wise Distribution**

Among the rural urban subdivide 539 females (57.00%) belonged to a rural area as compared to 377 (39.70%) Urban area and rural urban subdivide could not be established in 32 females (3.30%) (Fig.-2)



**Fig.2: Rural Urban Distribution**

Vehicular accidents 284 (30%) were the most important cause of death followed closely by burns 269 (27.3%) in the present study.

The other common causes were poisoning 209 (22%) and asphyxial deaths 103 (10%). Hanging was the commonest form of asphyxial death, comprising

of 74 cases (7%). Other causes of asphyxial deaths were drowning 18, strangulation 7 throttling 2, smothering 1, traumatic asphyxia 1

Electrocution, firearm injury, assault and blast injuries comprised of 2.30% of the causes of unnatural female deaths. Cause of death could not be ascertained in 6% of cases. Natural death was reported in 0.9% of cases. (Fig.-3)

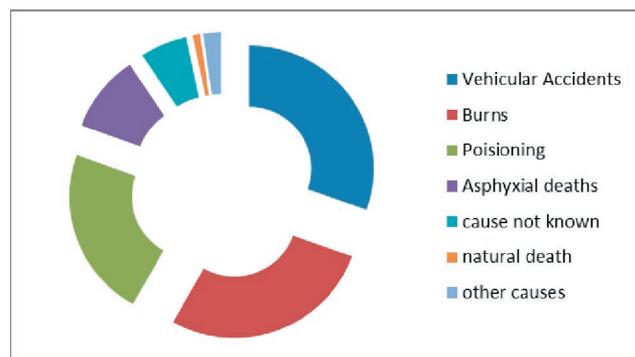


Fig. 3: Distribution of unnatural female deaths as per cause of death

Manner of death was mostly accidental 543 (61.30%) cases with vehicular accidents and burns comprising the main causes. Suicidal deaths were seen in 322 (36.20%) of the cases, with poisoning, hanging and burns as the main causes. Homicidal deaths were 23 (2.50%) of the total cases reported in the present study and in the rest of the cases the manner of death was undetermined. (Fig.-4)

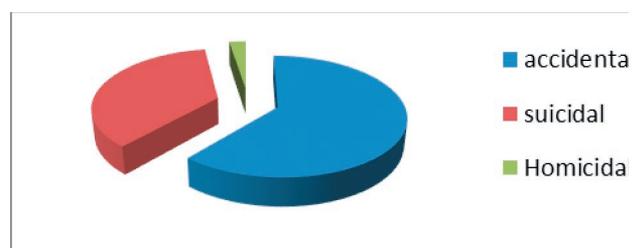


Fig. 4: Manner of death

## DISCUSSION

Unnatural death is one of the indicators of the level of social and mental health<sup>4</sup>. The society and the legal agencies should be aware of these challenges and should assist in preventing unnatural deaths and crime against women.

In the present study maximum number of cases 309 (32.50%) were observed in the age group of 21-30 years. Manoj Bhausahab, Parchake et al. in their study of unnatural female deaths in Southern Marthwada region in India reported maximum deaths in 21-30 years<sup>5</sup>. Similar findings were also reported by Sachil

Kumar, Anup Kumar Verma, Wahid Ali, Abhishek Pande et al. who concluded maximum number of female deaths in 16-30 years in their study on unnatural female deaths at Lucknow<sup>6</sup>.

Our study is also in concordance with that of Pankaj Prajapati, Gourang Patel, Ganesh Gonekar AK, who in their study of unnatural female deaths in South Gujarat reported maximum incidents of female unnatural deaths in 21-30 years (35.13%)<sup>2</sup>.

Majority of the females in our study were married 648 (68.35%) as compared to unmarried female 276 (29.40%). A study conducted by Rajesh C Dere, Col. M M Rajoo at Rural Medical College, Loni reported 83.22% of married female unnatural deaths as compared to 16.78% unmarried females<sup>7</sup>. A study by Bhullar et al. revealed a higher percentage i.e. 92.86% of married females as compared to 7.14% of unmarried females<sup>8</sup>. Similar findings were also reported by many other authors of different studies<sup>2,5,6,9</sup>.

The incidents of unnatural female deaths in this period of life can be explained on the fact that being immature, in the marriageable age and married females are vulnerable to dowry related issues, maladjustment and ill-treatment by in-laws, love failures and have a higher tendency to succumb to these and finally end up their lives.

A study carried out by Mandar R S and Arvind K revealed maximum number of deaths in 3<sup>rd</sup> decade, 54.66% and thus this age group forms important and crucial time in the life of a woman<sup>10</sup>.

Dowry was the most common precipitating factor in the deaths of married women in a study conducted by CK Pawar, D S Bhullar, S S Oberoi and K K Aggarwal<sup>11</sup>. A study by Sharma BR et al. noted a higher incidence of unnatural female deaths in the age groups of 21-25 (27.22%)<sup>12</sup>

Maximum number of females belonged to Hindu religion as compared to Muslims. 6 cases of unnatural deaths were seen in Christians. This can be explained by the fact that Jammu region is a Hindu dominated region of the State and Dowry practices are more prevalent amongst Hindus as compared to Muslims. Similar findings were also seen in other studies by different authors<sup>2,9,13</sup>.

Most of the female deaths were seen in the rural

areas as compared to urban. The findings are in concurrence with that of C K Pawar, D S Bhullar, S S Oberoi and K K Aggarwal who reported 55% of the unnatural deaths from rural region<sup>11</sup>. Naresh Karukatla et al. reported 82% of the rural female deaths as compared to 18% urban in their study<sup>14</sup>.

The higher percentage of female deaths in rural areas can be attributed to more of gender inequality, low literacy rate, less of employment avenues and more of economic dependence in these regions.

The commonest cause of death was vehicular accidents 30% followed very closely by burns 27.37%. The other causes were poisoning 22% and hanging 7%.

Sachil Kumar, Anoop Kumar, Wahid Ali, Abhishek Pande reported 37.5% of unnatural female deaths due to vehicular accidents followed by poisoning 20.6% and burns 12.5%<sup>6</sup>.

Burns were the 2<sup>nd</sup> most important cause of death in our study. These results are in concordance with others where the main cause of death were due to burns.

Pankaj Prajapati et al. reported 41.69% of the cases due to burns as the commonest cause of death. Manoj Bhausahab et al. observed that most common cause of deaths were due to burns 61.99%<sup>2,5</sup>.

Majority of the deaths in the present study were accidental 61.3% followed by suicidal 36.2%. Homicides constituted 2.50% of the deaths. Rajesh C Dere, Col. K M Rajoo reported 63.22% of accidental deaths followed by 24.83% of suicidal deaths and homicidal deaths constituted 3.88%, which are similar to the results in our study<sup>7</sup>.

Pankaj Prajapati et al. also attributed maximum cases in their study - accidental 61.12% suicidal 32.22% and homicidal 3.90%<sup>2</sup>. However, the manner of death was discordant in a study done by SriVastava et al. in which the manner of death was mostly suicidal in nature<sup>15</sup>.

## CONCLUSION

To know the cause of unnatural death in a female is an important part of health institutions which provides an insight to the health planning system, police and legal agencies to improve the opportunities for support of a female with economic

independence, essential education, awareness and adequate legal help whenever required. The present study emphasizes on the role of law and order agencies to implement stringent measures to enforce the laws laid down for female protection and their implementation in the society.

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# Sex Determination Through Mastoid Process among South Indian Skulls by Heron's Formula

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## ABSTRACT

**Background and objectives:** Sex determination of human or human skeletal remains is considered an initial step in its identification. In cases of fragmented body, it is difficult to identify the body. The mastoid process characteristics are of great utility in the diagnosis of sex. The purpose of this study was to evaluate the significance for sex determination by the measurement of the area formed by 3 craniometric points related to the mastoid process.

**Method:** 100 skulls, 50 male and 50 female, were analyzed. The three craniometric points were marked to demarcate a triangle on the mastoid process. The area (mm<sup>2</sup>) of the mastoid triangle for each side of the skull was obtained, and the total value of these measures (T) was calculated.

**Results:** The mean total area of mastoid triangle in males was 1393.88 ± 121.51 mm<sup>2</sup> and in females 1095.88 ± 90.11 mm<sup>2</sup>. The analysis of the differences between males and females in right (R), left (L) and total areas (T) was statistically significant (p value < 0.001). The overlapping of the values for the total area between male and female skull was 14%.

**Conclusion and interpretation:** The total areas show less overlapping of the values between the sexes and significant results were obtained in 3 studied areas R, L and T. Hence, this can be used for sexing human skulls. The values of the total area that were greater than or equal to 1360.48 mm<sup>2</sup> belonged to male skull and that were less than or equal to 1120.85 mm<sup>2</sup> belonged to female skull.

**Keywords:** Sex determination, mastoid process, heron's formula, fragmented bone, craniometry, Forensic.

## INTRODUCTION

Identification means "determination of the individuality". In number of civil and criminal matters identification of the individual, either living or dead, is required and the establishment of identity is required for unidentified bodies, mutilated and skeletonized material.<sup>1</sup>

In such circumstances the identification of human skeletal remains a critical issue. The pelvis is considered the reliable bone to determine the sex

of an individual. When the pelvis is unavailable the skull is the second best choice to estimate the sex of the dead body as stated by Bass<sup>2</sup>, Byers<sup>3</sup> and Pickering and Bachman<sup>4</sup>. Krogman states that skull is the most dimorphic and easily sexed portion of skeleton after pelvis, providing up to 92% reliability.<sup>5</sup>

The analysis of the mastoid process characteristics is important in the determination of sex for forensic purposes. The qualitative assessment of the mastoid process has been widely used to estimate the sex of an individual due to characteristics such as their size, ruggedness for muscular inserts, or mastoid process inclination are very good indicators of sexual dimorphism, as it's the subjective and comparative criteria, which makes it less reliable. The mastoid region is considered as it is protected and resistant to damage, due to its anatomical position at the base of the skull.<sup>6</sup>

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Considering the original study of De Paiva and Segre<sup>7</sup>, an attempt is made to know its viability and application in the sex determination of the South Indian population.

**OBJECTIVES**

The objective of this study is to evaluate the significance for determination of sex of fragmentary human skeletal remains of natives of South India, using the three craniometric points of mastoid process i.e. Porion, Mastoidale and Asterion.

**METHODOLOGY**

100 dry skulls from the department museums of Forensic Medicine and Anatomy of Sri Devaraj Urs Medical College were analyzed. Adult skulls, 50 male and 50 female of mature individuals with known sex and age of more than 18 years old, without destruction of the mastoid bone in the region of the craniometrical points were chosen for the study. The skulls that presented evidence of injury/fracture or deformity were excluded from this study.

Three points on the mastoid portion on either side, porion (upper most lateral point of external acoustic meatus pore), Mastoidale [the most inferior point of mastoid process], Asterion [the meeting point of three posterior skull sutures i.e. lambdoid, occipitomastoid and parietomastoid] was selected as area of our study. These craniometrical points were marked by a single investigator. A triangle was prepared/drawn using these three points on skull bone on both sides Porion, asterion and mastoidale

referred as Po, As and Ma respectively. **(Figure.1)** Measurements of the dimensions of the sides of mastoid triangle were carried out using Mitutoya digital vernier caliper **(Figure.2)**. The area (mm<sup>2</sup>) of the demarcated triangle for each side of the skull (right and left sides) were determined by Heron’s formula and the total area (T) of these measures of both sides was calculated as per the method described by De Paiva and Segre.<sup>7</sup>

**Heron’s Formula:**<sup>8</sup>

1. Calculate ‘S’ (half of the triangle perimeter)

$$S = \frac{a+b+c}{2}$$

Where a, b, and c represents the dimensions of the sides of mastoid triangle.

2. Calculate area ‘A’ in mm<sup>2</sup>

$$‘A’ = \sqrt{S(S-a)(S-b)(S-c)}$$

3. Total Area ‘T’ in mm<sup>2</sup>

‘T’ calculated by adding the area obtained on each side.

Using SPSS software ver.22 the data were analyzed using descriptive statistics like mean, standard deviation and confidence intervals. The significance in the mean areas was compared using independent student t test.

**RESULTS**

**Table 1: Analysis of the differences in total area of mastoid triangle between males and females**

Group	n	Range		Mean total area (T) mm <sup>2</sup>	Sd. Deviation	95% confidence interval of the mean difference		t value	P value
		Min	Max						
Males	50	1195.49	1663.21	1393.88	121.51	255.76	340.22	14.00	< 0.001**
Females	50	890.31	1255.40	1095.88	90.11				

\*\* Highly significant

In the 100 analyzed skulls, it was found that the mean total area of mastoid triangle in males was  $1393.88 \text{ mm}^2 \pm 121.51$  and in females  $1095.88 \text{ mm}^2 \pm 90.11$ . The difference in the mean total area of the mastoid triangle between males and females is statistically highly significant ( $t = 14.00, p = < 0.001$ ).

**Table 2: Comparison of the areas of mastoid triangle in right side of males and females**

Side	Group	n	Range		Mean right area (R) $\text{mm}^2$	Sd. Deviation	95% confidence interval of the mean difference		t value	p value
			Min	Max						
RIGHT	Males	50	593.54	798.44	684.75	60.10	114.09	156.94	12.55	< 0.001**
	Females	50	468.89	620.56	549.24	47.08				

\*\* Highly significant

When compared the areas of mastoid triangle in right side of males and right side of females, it was found that the mean total area of right side of males was  $684.75 \text{ mm}^2 \pm 60.10$  and in right side of females was  $549.24 \text{ mm}^2 \pm 47.08$ . The difference in the mean areas of mastoid triangle in right sides of males and females is statistically highly significant. ( $t = 12.55, p = < 0.001$ )

**Table 3: Comparison of the areas of mastoid triangle in left side of males and females**

Side	Group	n	Range		Mean left area (L) $\text{mm}^2$	Sd. Deviation	95% confidence interval of the mean difference		t value	p value
			Min	Max						
LEFT	Males	50	583.44	877.70	709.13	73.93	136.28	188.68	12.30	< 0.001**
	Females	50	421.42	646.37	546.64	57.02				

\*\* Highly significant

When compared the areas of mastoid triangle in left side of males and left side of females, it was found that the mean total area of left side of males was  $709.13 \text{ mm}^2 \pm 73.93$  and in left side of females was  $546.64 \text{ mm}^2 \pm 57.02$ . The difference in the mean areas of mastoid triangle in left sides of males and females is statistically highly significant. ( $t = 12.30, p = < 0.001$ )

**Table 4: Descriptive Statistics**

Group	n	Mean area $\text{mm}^2$	Std. Error (SE)
Males	50	1393.88	17.04
Females	50	1095.88	12.74
Male. Right side	50	684.75	8.49
Female. Right side	50	549.24	6.65
Male. Left side	50	709.13	10.45
Female. Left side	50	546.64	8.06

**Total area by sex = Mean  $\pm$ 1.96\*SE**

It was calculated that value of the lower limit of male mastoid area was 1360.48 mm<sup>2</sup> and upper limit of female mastoid area was 1120.85 mm<sup>2</sup>. The lower limit of the right side of male mastoid area is 668.11 mm<sup>2</sup> and upper limit for right sides of female mastoid area is 562.27 mm<sup>2</sup>. The lower limit of the left side of male mastoid area is 688.65 mm<sup>2</sup> and upper limit of left sides for female mastoid area is 562.43 mm<sup>2</sup>.

The overlapping of the values of the total area (T) between male and female skull is 14%, between the right areas (R) of male and female mastoid triangle is 24% and between the left areas (L) of male and female mastoid triangle is 20%.

**DISCUSSION**

It was observed in our study that the mean total area of mastoid triangle in males was significantly greater than that of females. The difference in the mean total area of the mastoid triangle between males and females is statistically highly significant (p = < 0.001). This result was supported by the studies conducted by Paiva LAS et al.,<sup>7</sup> Suazo et al.,<sup>9</sup> Manoonpol C et al.,<sup>10</sup> Swati S et al.,<sup>11</sup> and Sukumar et al.<sup>12</sup>

In our study, the values of the total area that were greater than or equal to 1360.48 mm<sup>2</sup> belonged to male skull and that were less than or equal to 1120.85 mm<sup>2</sup> belonged to female skull and this is consistent with the result of study conducted by Swati S and Pratik<sup>11</sup>, these values are lower than the mean values of the study conducted by De Paiva & Segre<sup>7</sup>, where in the values greater than or equal to 1447.40 mm<sup>2</sup> belonged to male skull and that were less than or equal to 1260.36 mm<sup>2</sup> belonged to female skull.

The analysis of the differences between males and females in right (R), left (L) and total areas (T) of the mastoid triangle was statistically highly significant (p value < 0.001) and similar observations were made by Swati S and Pratik P.<sup>11</sup>

The overlapping of the values of the total area (T) between male and female skull is 14%, between the right areas (R) of male and female mastoid triangle is 24% and between the left areas (L) of male and female mastoid triangle is 20%, which is significantly lower than the values of the studies conducted by De Paiva & Segre.<sup>7</sup>

It was observed that there was asymmetry of the values of mastoid triangle of right and left sides between skulls and this is due to pneumatization and the size of the mastoid air cell system is determined by the degree of pathological involvement of the middle ear during childhood.<sup>13</sup>

**CONCLUSION**

This study results revealed that the mastoid process can determine the sex in 86% cases. The student t-test was highly significant when male right side was compared with female right side as well as when male left side was compared with female left side indicating that the measurements of the mastoid process can be used as one of the sex determinant. The values of the total area that were greater than or equal to 1360.48 mm<sup>2</sup> belonged to male skull and that were less than or equal to 1120.85 mm<sup>2</sup> belonged to female skull.

**RECOMMENDATIONS**

Similar work with larger sample size is needed to validate the results.

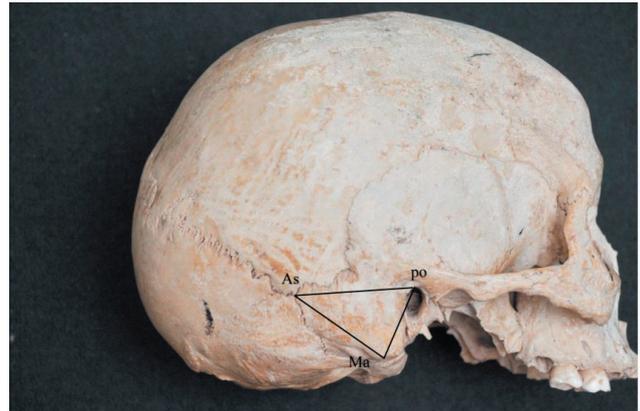


Figure 1. Demarcated triangular area used for the study.



Figure 2. Mitutoyo Digital Vernier Calliper

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# Pattern and Distribution of Injuries among Road Traffic Accident Victims in North Karnataka

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## ABSTRACT

There has been a steady rise in the casualties of road accidents in our country. The pattern of injury sustained by the road users may vary from region to region. The present study was carried out in a tertiary care center of North Karnataka region with an aim to study the pattern and distribution of injuries due to road traffic accidents in this region. The study revealed that males were more vulnerable than females, highest incidence was among the occupants of two wheeler, abrasions were common type of injury and lower limbs injuries were common.

**Keywords:** Road traffic injuries, Pattern of injuries.

## INTRODUCTION

A road traffic accident refers to any accident involving at least one road vehicle, occurring on a road open to public circulation and in which atleast one person is injured or killed.<sup>1</sup> Road traffic injuries are estimated to be the eighth leading cause of death globally, with an impact similar to that caused by many communicable diseases.<sup>2</sup> Rapid rate of motorisation in developing countries like India without concomitant investment in road safety strategies has led to an increase in road traffic accidents. In India, in 2010 total road traffic fatalities were 133938, 85% Males, 15% Females.<sup>3</sup>

Victims of road traffic accident may sustain different types of injuries on different parts of the body depending on various factors such as type of road users, motor rules and regulations of the country. The present study was conducted in the casualty of a tertiary care center with an aim to ascertain the pattern and distribution of injuries sustained by road traffic accident victims. Such

types of studies will help in planning preventive and remedial steps with respect to road traffic accidents including comprehensive legislation on key risk factors for road traffic injuries and proper health care facilities for the victims.

## MATERIALS & METHOD

The present study was conducted at the casualty of a tertiary care center in North Karnataka for a period of one year. The study population included all road traffic accident victims reporting to the casualty. In a pretested proforma, the information regarding the history of accident was collected from victim or the relative or the police as the case warranted. The victim was examined for injuries and the radiological investigation impressions were noted down.

## RESULT

Out of 172 cases of road traffic accident admitted to the Hospital, 147 cases comprised the sample for the study. 25 cases were excluded from the study due to inappropriate history. The highest numbers of victims were equally distributed in the age group of 21 - 30 years and 31 -40 years (Table 1). Out of 147 victims 114(77.55%) were males 33(22.44 %) were females. Two wheeler (42.17%) occupants were the most common victims followed by pedestrians (18.36%), occupants of light motor vehicle (17%), pedal cyclist (12.24%), occupants of heavy motor vehicle

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(6.8%) and others which included occupants of Auto rickshaw and bullock cart (3.4%) (Table 2). A total of 650 injuries were noted from 147 individuals. The injuries were most common in the lower extremities (43.38%) followed by head and neck (20.92%), upper limbs (16.92%), thorax (12.7%), least in abdomen and pelvis (6.15%) (Table 3). Abrasions (44.92%) were the commonest type of injury followed by contusion (20.30%), laceration (16.92%), fracture (11.23%) and others included intracranial Haemorrhages and perforation (6.61%) (Table 4).

**Table 1: Age distribution of Victims**

Age in years	Number of cases
<10	6
11-20	19
21-30	38
31-40	38
41-50	22
51-60	15
> 60	9
<b>Total</b>	<b>147</b>

**Table 2: Vulnerability of road users to road traffic accident**

Road user category	Number of victims (%)
Pedestrian	27 (18.36%)
Pedal cyclist	18 (12.24%)
Two wheeler	62 (42.17%)
Light motor vehicle	25 (17%)
Heavy motor vehicle	10 (6.8%)
Others	5 (3.40%)

**Table 3: Sites of injury in road traffic Accident**

Site of injury	Number of injury (%)
Head and neck	136 (20.92%)
Thorax	83 (12.70%)
Abdomen and pelvis	40 (6.15%)
Upper limb	110(16.92%)
Lower limb	282(43.38%)
<b>Total</b>	<b>650</b>

**Table 4: Type of injury**

Type of injury	Number of injury
Abrasion	292 (44.92%)
Contusion	132(20.30%)
Laceration	110(16.92%)
Fracture and dislocation	73(11.23%)
Others	43(6.61%)
<b>Total</b>	<b>650</b>

## DISCUSSION

In India, the motor vehicle population is growing at a faster rate than the economic and population growth. The surge in motorization coupled with expansion of the road network has brought with it the challenge of addressing adverse factors such as the increase in road accidents.

Between 1970 and 2011, the number of accidents increased by 4.4 times accompanied with 9.8 times increase in fatalities and 7.3 times increase in the number of persons injured, against the backdrop of more than a 100-fold increase in the number of registered motor vehicles and close to a four-fold increase in the road network.<sup>1</sup>

In the present study males were the predominant victims of road traffic accidents than females. Male to female ratio was 3.5:1. This is in accordance with the other studies.<sup>4, 5</sup> Males are most vulnerable, possibly since a male is the earning member and use roads to a greater extent, and commonly vehicles are driven by males. Highest incidence of road traffic accidents was observed in the age group of 21-40 years, while some studies suggest 20-39, and few 16-30 years.<sup>5, 6, 7, 8</sup> However it is the 20-30 year age group which is common in all studies. This may be due to rash driving by this young age group population without precaution. Most of the victims were two wheeler occupants. This finding is concurrent with other studies.<sup>9, 10</sup> As most of the vehicles on roads in this region are two wheelers, they are more prone for road traffic accidents. Injuries to the lower extremities were most common and abrasion was the commonest type of injury. Similar finding were observed in other study.<sup>4</sup>

This study is an attempt to know the pattern and distribution of the injuries due to road traffic accidents in North Karnataka region. Further studies can be carried out involving other factors which has been omitted out in this study.

## CONCLUSION

Dramatic successes in preventing road traffic accident can be achieved through concerted efforts that involve, but are not limited to, the health sector. Governments need to take action to address road safety in a holistic manner that requires involvement from multiple sectors including transport, police, health, education.

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# Hooch Tragedy - an Autopsy Study at Bowring and Lady Curzon Hospital, Bangalore

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## ABSTRACT

A complete medicolegal autopsy was conducted on 51 victims of consumption of illicit liquor were brought to Department of Forensic Medicine and Toxicology, Bowring and Lady Curzon Hospital, Bangalore Medical College and Research Institute, Bangalore. The highest peak of incidence was found in the in the age group of 31 to 40 years (35.29%). 41(80.39 %) were male and 10 (19.61 %) were female. The period of survival after consumption of illicit alcohol shows that most of the fatalities occurred within 13 -24 hours (43.14%) of consumption. The average blood methyl alcohol and ethyl alcohol levels were 21.46 mg% and 14.53% respectively.

**Keywords:** *Illicit Liquor, Methyl Alcohol, Medicolegal Autopsy, Moonshine Tragedy, Liquor, Brew.*

## INTRODUCTION

The 2008 Karnataka-Tamil Nadu hooch tragedy was an incident in the southern Indian states of Karnataka and Tamil Nadu in May 2008 in which 180 people reportedly died after consuming illicit liquor.<sup>1,2</sup> This incident is considered to be the worst hooch tragedy in the country since at least 2000.<sup>3,4</sup> 'Hooch' is a colloquial term for alcoholic beverages (also spelled hootch). Originally used to mean specifically "cheap whiskey" (1897) it is a shortened form of Hoochinoo (1877), a liquor made by the Tlingit, an indigenous people of Alaska. The name comes from a Tlingit(wáan or group called the Xutsnoowú (wáan whose distilled liquor was a favourite with miners in the 1898 Klondike gold rush.<sup>5</sup> In the present context, 'hooch' as a term has acquired a global reference to denote any illegal liquor. Moonshine is another term which was coined nearly the same time when hooch was coined. Moonshine is referred to a white whisky, which is high-proof distilled spirit, generally produced illicitly.<sup>6</sup>

In India term 'Lattha' is used to define any spurious liquor, which contains methanol or any other poisonous substances, which may cause harmful or injurious effect on human body or death to a person .Other names for illicit liquor are Khopadi, Ladda, Dalda, Bewada, French polish, etc.<sup>7</sup>

Methanol may also be found as an adulterant of alcoholic drinks.<sup>8</sup> Methanol is highly toxic following ingestion, inhalation or dermal exposure.<sup>9</sup> Ingestion is the most common route of exposure.<sup>9,10</sup> Methanol, also named methyl alcohol, wood spirit, carbinol, wood alcohol, or wood naphtha, is a colorless and volatile liquid with a characteristic odor, primarily used for manufacturing other chemicals and as a solvent, glass cleaner, windshield washer fluid, carburetor cleaner, antifreeze, de-icing solution, paint remover, varnish, photocopying fluid, canned solid (picnic) fuel, and small engine fuel.<sup>10,11</sup> Susceptibility to methanol poisoning varies greatly and ingestion of 0.25 mL/kg of 100% methanol (pure methanol) would theoretically, assuming complete absorption, results in severe toxicity. Death has also been reported after ingestion of about 15 mL of 40% methanol.<sup>12</sup>

India is a developing nation, where 42 % of its total population falls below international poverty line.<sup>7</sup> Although the GDP (Gross Domestic Product) of India has increased five folds and life expectancy has doubled since independence,<sup>13</sup> still a larger population finds it hard to purchase liquor from authorized shops. This very population ultimately end up in consuming illicit liquor bought from bootleggers at cheaper prices. Unfortunately with repeated hooch tragedies, a system shows its inefficiency in curbing this lethal phenomenon.

Incident : On 18 May 2008, some people from the Bangalore Urban, Bangalore Rural and Kolar district in the state of Karnataka and neighbouring Krishnagiri district in the state of Tamil Nadu, consumed moonshine (illicit liquor) made with camphor and tobacco. This drink contained toxic methyl alcohol,<sup>14</sup> which initially caused the death of 156 people. Of these, 56 were in urban Bangalore, 27 were in rural Bangalore, 32 were in Kolar, and 41 were in Krishnagiri.<sup>15</sup> Several people were hospitalised complaining of stomach pain and vomiting. A small number lost their eyesight. The death toll later rose to 180 as hospitalised victims died.<sup>16</sup> Poor people prefer illicit liquor as it is cheaper than Indian Made Foreign Liquor, which was the main reason for the incident.<sup>17,18</sup>

In this paper, we have tried to focus on the sociological impact, its causes and alcohol levels in this tragedy. Further we have proposed some recommendations.

### MATERIALS & METHOD

A complete medicolegal autopsy was conducted over 3 days on 51 victims of consumption of illicit liquor were brought to Department of Forensic

Medicine and Toxicology, Bowring and Lady Curzon Hospital, Bangalore Medical College and Research Institute, Bangalore, In the month of May 2008. The outbreak occurred in the Bangalore. Information was gathered from the police personnel, police inquest, hospital records and postmortem findings and Forensic Science Laboratory report. History of the incident was studied in detail and a complete meticulous medicolegal autopsy was conducted on each of these victims. chemical analysis of routine viscera and blood preserved at medicolegal autopsy were done and the results were carefully analysed and subsequently evaluated for the preparation of this paper.

### OBSERVATIONS

A total 51 cases were autopsied in our hospital with a history of consumption of illicit alcohol, out of which 41(80.39 %) were males and 10 (19.61 %) were females. The highest peak of incidence was found in the in the age group of 31 to 40 years (35.29%) with a secondary peak in the age group of 41 to 50 years (23.53%). Peak incidence in Male was found in the age group of 31 to 40 years 15(36.59%) and in female it showed similar results in the 3 age groups of 31 -40, 41-50, 51-60 years , that is 3(30%). [Table 1]

**Table 1. Age and Sex distribution**

Sex	Age in Years							Total
	0to 10	11to 20	21to 30	31to 40	41to 50	51to 60	61to 70	
Male	0	0	7	15	9	7	3	41
Percentage	0	0	17.07	36.59	21.95	17.07	7.32	80.39
Female	0	0	0	3	3	3	1	10
Percentage	0	0	0	30	30	30	10	19.61
Total	0	0	7	18	12	10	4	51
Percentage	0	0	13.73	35.29	23.53	19.61	7.84	100

Predominantly Hindu's were the victim's 34(66.67%) followed by Muslim community 11(21.57%), Hindu male's were dominating 26 (76.47%). [Table 2]

**Table 2. Religion and Sex vise distribution.**

Religion	Sex	No of cases	Percentage	Total	Percentage
Hindu	Male	26	76.47	34	66.67
	Female	8	23.53		
Muslim	Male	11	100	11	21.57
	Female	0	0		
Christian	Male	4	66.67	6	11.76
	Female	2	33.33		

All the 51 victims (100%) were treated in the hospitals. The period of survival after consumption of illicit alcohol shows that most of the fatalities 22(43.14%) occurred between the time period of 13-24 hours of consumption And 34 (66.67%) within 24 hours [Table 3]

**Table 3. Treatment details and Period of Survival**

	Period of survival in Hours					Total
	0-6	7-12	13-24	25-48	49-72	
No of treated cases	2	10	22	11	6	51
Percentage	3.92	19.61	43.14	21.57	11.76	100
Within 24 hours		After 24 hours				
No.	34			17		
Percentage	66.67			33.33		

The average ethyl and methyl alcohol level in blood was 21.46 mg% and 14.53 mg% respectively. [Table 4]

Table no 4 clearly depicts the average level of ethyl alcohol and methyl alcohol in various viscera preserved for chemical analysis. It is evident from the table that fatal level of methyl alcohol was present in the blood of all the Victims. [Table 5]

**Table 4. Average Methyl and Ethyl Alcohol level in Mg% in Blood**

	Methyl Alcohol	Ethyl Alcohol
Percentage	21.46	14.53

**Table 5. Chemical analysis of blood and viscera**

	Methyl alcohol alone	Ethyl alcohol alone	Both Methyl and Ethyl alcohol	Total
No	4	0	47	51
Percentage	7.84	0	92.16	100

The cause of death was respiratory failure in all 51 cases (100%). [Table 6]

**Table 6. Cause of Death**

Cause of Death	No of Cases	Percentage
Respiratory Failure	51	100

## DISCUSSION

India has witnessed various hooch tragedies in the past, Except north eastern states of India, almost every other Indian state was affected in the past.<sup>19,20</sup> It proves that law has failed in controlling the illicit liquor trade. In most of the hooch tragedy cases 'methyl alcohol' (methanol) was used as the chief adulterant.<sup>20</sup> Methyl alcohol Being cheap and potent, it is most commonly used as adulterant. Poisoning due to methyl alcohol is always accidental usually resulting into mass poisoning due to consumption of liquor adulterated with methyl alcohol. Consumption of solox (containing shellac, a paint solvent with ethyl

alcohol and methyl alcohol) or Khopadi, a cheap liquor containing methyl alcohol and French polish or similar intoxicating products have given rise to methyl alcohol intoxication in various parts of the country.<sup>21</sup>

The potentially lethal dose of methanol is variable, adverse effects has reportedly occurred at 30 ml.<sup>20</sup> Methanol is rapidly absorbed from the gastric mucosa, and achieves a maximal concentration 30-90 minutes after ingestion.<sup>22</sup> Toxicity of the methyl alcohol manifests as permanent blindness or ultimately death due to respiratory failure.<sup>23</sup> The mortality and morbidity remain very high despite

intensive therapy.<sup>24</sup>

Broadly three types of alcoholic beverages are made and consumed; these are Indian Made Foreign Liquor (IMFL), Country Liquor and Illicit Liquor. IMFL contains maximum alcohol up to 40% and in country liquor it is about 42%. Illicit liquor, which is produced clandestinely without any quality control, alcohol content may go up to 56%. Illicit liquor can be purchased at as low as Rs 7(\$0.13) – Rs 10(\$ 0.18). It is these cheap prices, which lure poor people like labourers, rickshaw pullers and hawkers to consume illicit liquor.<sup>25</sup>

There is no difference in preparation of country liquor and illicit liquor, both are prepared from molasses and other available products. But illicit liquor contains methanol. And when, the bootleggers end up in adding large quantity methanol inadvertently in brew than required, this results in toxic concentration of methanol in brew, leading to mass disaster in the form of hooch tragedy. Hence, it is the 'error of judgment' in mixing methanol to country liquor that leads to catastrophe. It is always poor, who are hit hard in the hooch tragedy. If the sole bread earner is consumed in the hooch tragedy, then it becomes very difficult for the family to sustain.

This article deals with analysis of postmortem findings of 51 victims who died due to fatal methanol intoxication. The present episode took a comparatively a high toll of mortality with 24 cases (58.50%) out of total 41 cases referred. Out of 51 cases 41(80.39 %) were males, as habitual consumption of alcohol is seen mainly in males. This finding is in agreement with other studies where male predominance was seen.<sup>26,27,28,29</sup> Studies done by previous researchers have reported that methanol related deaths occurred mostly in the age group of 30-40 years.<sup>27,28,30</sup> In our study the age group most commonly affected was 31 to 40 years (35.29%). This finding correlates with the work of other researchers.<sup>22,27,28,30</sup>

All cases were admitted in the hospital and effective measures were taken to seek immediate medical intervention by admitting the patients in the nearby hospital. Similar findings were noticed in other studies.<sup>26,31</sup> The majority of them died within 24 hours of consumption of methyl alcohol 34 cases (66.67%) while the remaining 17 cases (33.33%) died within a period of 2 to 3 days. The average fatal period was found to be 24 to 36 hours in majority of

the cases while death was delayed for 2 to 4 days in other cases.<sup>32,33</sup>

The potential lethal dose of methanol is variable. The lowest reported is 30 ml.<sup>27</sup> The fatal blood level of methyl alcohol varies from 60 ml to 200 ml.<sup>32,33,34</sup> Lunds in his study of 5 fatal cases of methyl alcohol poisoning, found blood methyl alcohol and formic acid values varying from 9-68 mg/dl. Although, in most of the reported cases, blood methanol levels were greater than 100 mg/dl, deaths have occurred with methyl alcohol level as low as 5.7 mg/dl.<sup>28</sup> In our study the average fatal methyl and ethyl alcohol level in blood was 21.46 mg% and 14.53 mg% respectively. In this study the cause of death was respiratory failure in all 51 cases (100%) as a result of consumption of methyl alcohol. The same was reported by an author in his study of cases of methanol poisoning.<sup>35</sup>

## CONCLUSION

There have been several such episodes of methanol poisoning in India. Such outbreaks of acute poisoning due to methanol usually carry a very high morbidity and mortality rate. In spite of several such incidences the government and the necessary authorities have failed to take preventive steps to avoid such instances and methyl alcohol is still continuously used as cheap adulterant. Moreover the common public still seems to be unaware about the lethal effects of consumption of adulterated liquor.

In our view 'Education' has a major role to play in preventing hooch havoc. Education provides right orientation to the children of the poor who are major target of this illicit liquor. Right to education to every child in major step forward, this makes it mandatory for parents to send their wards for formal schooling. Regular quality analysis of sample of country liquor in the forensic laboratory can also be considered. Prices of liquor should also be reduced so that poor people can have access to it.

Even though there are rules and laws, some unauthorized dealers will prepare illicit liquor by mixing methyl alcohol to ethyl alcohol and sell these out of their greed. Effective policing on rum-running, exposing adulteration rackets, may help to reduce such type of incidences. In the future, Strict law enforcement by the excise department is the need for our state and country to save lives.

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# Gender Determination by Mental Foramen Using Linear Measurements on Radiographs: A Study in Haryana Population

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## ABSTRACT

**Aim and Objectives:** The aim and objectives of present study was to record the vertical measurements of mental foramen and to correlate them to assess the sensitivity of these parameters in gender determination. **Methodology:** Panoramic radiographs of a 100 individuals including 50 males and 50 females were assessed by using three linear vertical measurements and after that data was statistically analyzed. **Results:** Statistically significant differences were observed in all of the linear measurements between genders where males almost have higher measurements than females. **Conclusion:** This study concludes that the distances from the superior border of alveolar ridge to the superior margin of mental foramen of the mandible exhibit sexual dimorphism in the Haryana population.

**Keywords:** Forensic anthropology, Mental foramen, panoramic radiograph, sex determination.

## INTRODUCTION

Forensic anthropology is the application of the science of physical or biological anthropology to the legal process. Forensic anthropologists apply standard scientific techniques developed in physical anthropology to analyze human remains, and to aid in the investigation of crime. In addition to assisting in locating and recovering human skeletal remains, forensic anthropologists work to assess the age, gender, ancestry, stature, and unique features of a decedent from the skeleton. Skeleton has always aided in genetic, anthropological, odontological and forensic investigation of living and non-living individuals<sup>1</sup>. Distinguishing males from females by analyzing the morphological characteristics of bone is important in the fields of physical and forensic anthropology<sup>2</sup>. Many studies reveal that there exist differences in the skull and other bones of male and female<sup>3</sup>.

Skull bones and pelvis have been majorly used

in gender identification. In the adult skeleton, gender determination is usually the first step of the identification process as subsequent methods for age and stature estimation are gender dependent<sup>4</sup>. The reliability of gender determination depends on the completeness of the remains and the degree of gender dimorphism inherent in the population. When the entire adult skeleton is available for analysis, gender can be determined up to 100% accuracy. If only skull is available for identification which is the most dimorphic and easily sexed portion of skeleton after pelvis providing accuracy rate up to 92%.

But in cases of mass disasters where skull fragments are found, gender determination with 100% accuracy is not possible and it depends largely on the available parts of skeleton. In such type of cases parts of skull such as mandible is of the prime importance for the identification of gender type of an unknown person. The mandible is the strongest bone in the human body and persists in a well-preserved state longer than any other bone<sup>5</sup>. Therefore, the use of morphological features of the mandible is a common approach used by anthropologists and forensic dentists in the determination of gender. It forms the lower jaw and holds the lower teeth in place<sup>6</sup>. Presence of a dense layer of compact bone makes it

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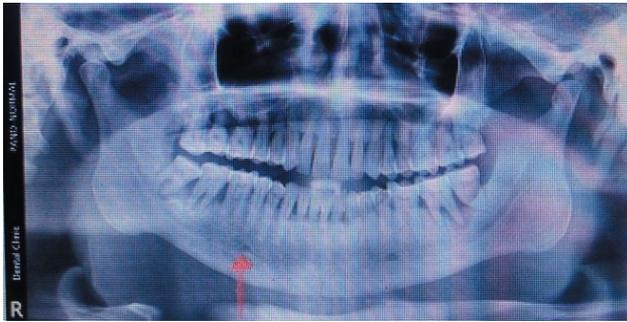
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very durable and very important for identification<sup>7</sup>. There are many parameters of mandible that can be used for gender determination of an individual.

One of mandibular characteristic that can prove very helpful for age and gender determination is mental foramen. It is paired, present lateral to the mental protuberance (chin) on the body of mandible, usually inferior to the apices of the mandibular first and second premolars.

Morphological dimensions of mental foramen can be easily assessed in a living being by taking radiographs. The mental foramen is fairly well depicted on panoramic radiographs<sup>8</sup>. Panoramic radiography is a widely used technique because it has the advantage of providing, in a single film, the image of both jaws, with a relatively low radiation dose, in a short period of time, and at lower cost if compared to more sophisticated techniques. The accuracy of measurements on the radiographs is based on the quality of the radiographs.



**Fig:-1 Panoramic radiograph showing mental Foramen (red arrow).**

### AIMS & OBJECTIVES

Mandible or lower jaw is the largest and strongest bone of the face. Mental foramen is one of the stable landmarks of mandible. Mental foramen through which the mental nerve and blood vessels pass is located on lateral surface of body between the roots of first and second premolars (sometimes below the second premolar). The aim of the present study was to determine the sexual dimorphism on the basis of change in vertical position of mental foramen (MF) by using panoramic radiograph of 100 individuals.

**The objectives are as follows:-**

- To measure the distance between the alveolar crest to the inferior border of the mandible on

left side.

- To measure the distance between the alveolar crest to the superior margin of mental foramen on the left side.
- To measure the distance between the inferior margin of the mental foramen to the lower border of mandible on the left side.
- To compare the above measurements for gender assessment.
- To correlate the vertical measurements of mental foramen and assess the sensitivity of the parameters in gender determination.

### MATERIAL & METHODS

#### Samples

A total of 100 panoramic radiographs, 50 radiographs of males and 50 of female individuals were examined from the Department of Oral Medicine and Radiology of PDM Dental College and a private dental clinic of Haryana. Written consent was taken from each individual who participated in this study. Inclusion criteria and exclusion criteria for the selected radiographs were as follows:-

#### Inclusion criteria

1. All teeth in the region of measurement had to be present.
2. Radiographic images of the mental foramen and the borders of the mandible were distinct, free of artifacts in the site of measurement.
3. Evidence of alveolar crest resorption in premolar and first molar regions was minimum or absent.

#### Exclusion criteria

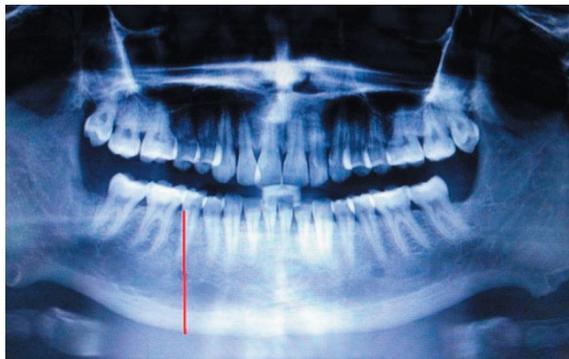
1. Less than 10 years of age because of invisibility of mental foramen due to mixed dentition.
2. Distortion of images.
3. Presence of artefacts.
4. Non-visualization of the mental foramen
5. Presence of missing teeth between the two first mandibular molars.
6. Incomplete eruptions of permanent teeth.
7. Presence of severe crowding or spacing between the two first mandibular molars.
8. Presence of radiolucent lesions between the first mandibular molars on both.

PaX-I Vatech global panoramic radiographic

machine was used for taking radiographs. Kodak green sensitive films with cassette and Kodak lanex intensifying screen were processed by using automatic x-ray processor immediately after the exposure. In present study only one (left side) mental foramen was evaluated. In all the radiographs a total of three vertical measurements related to the mental foramen were determined with the help of Med-light slim light panel radiograph viewer of 23 X 30 cm size. The measurements were made on the tracing paper with 0.5 mm HB lead pencil and measured with stainless steel ruler. These measurements were one on the left side only. All the measurements obtained for each radiograph were expressed in millimeters (mm).

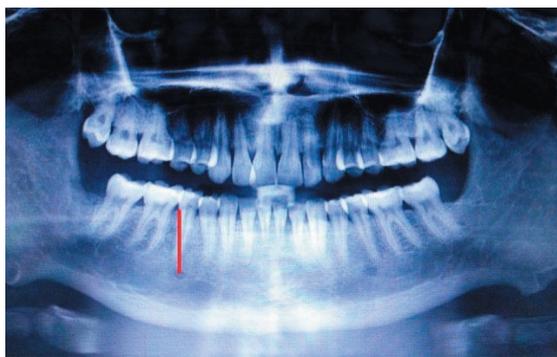
**Parameters assessed-**

**A-B=** vertical distance between superior border of alveolar crest to the inferior border body of mandible passing through the center of the mental foramen (fig:-2)



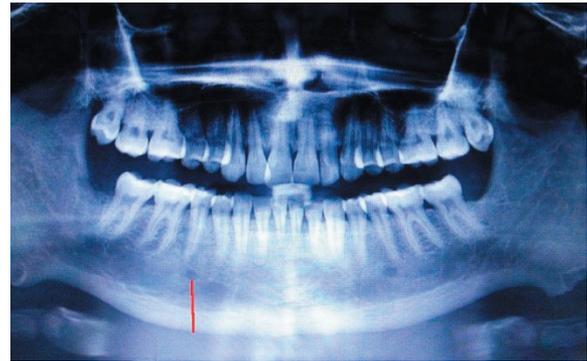
**Fig:-2 Radiograph showing distance between alveolar crest to the inferior border of mandible.**

**C-D=** Vertical distance between alveolar crest to superior border of mental foramen(fig:-3)



**Fig:-3 Radiograph showing distance between alveolar crest to superior border of mental foramen.**

**E-F=** Vertical distance between inferior border of mental foramen to inferior border of mandible (fig:-4)



**Fig:-4 Radiograph showing distance between inferior border of mental foramen and Inferior border of Mandible**

**STATISTICAL ANALYSIS**

The data obtained was subjected to statistical analysis. In the present study unpaired t-test are done for the analysis of data. Collected data was quantitative in nature and there was no pre and post observational relation among the data. The quantitative data was collected from single observations. So this data was tested through unpaired t-test. During testing the level of significance was fixed at 95% and P-value was fixed at 0.01.

**FINDINGS**

A total of 100 panoramic radiographs, were analysed, 50 each belonging to males and females respectively. Significant differences were noticed in males and females especially in the width of mandibular body shown by A-B parameter. In case of males the mean value was found to be 40.50 mm while in case of females this value was 38.66 mm (**Table 1**). Statistically highly significant differences were observed while calculating mean of C point to D point i.e. vertical distance from alveolar crest to the superior margin of the mental foramen in males and females of all age groups included in the study. In males this value was calculated as 20.18mm while in females it was 18.74mm (**Table 2**). Some Statistically significant differences were seen between males and females in vertical distance between lower margin of mental foramen to the lower border of mandible shown by E-F (**Table 3**)

**Table:-1 Comparison of vertical distance between superior border of alveolar crest to the inferior border of mandible in all males and females included in the study.**

Gender	Mean	Std. Deviation	Std. Error of Mean	P-value	Mean Difference	t-test value
Male	40.50	3.24	0.46	0.002**	1.840	3.209
Female	38.66	2.44	0.34			
Unpaired t-test ** Highly Significant difference (p-value≤0.01)						

**Table:-2 Comparison of vertical distance between alveolar crest to superior border of mental foramen in all males and females included in the study.**

Gender	Mean	Std. Deviation	Std. Error of Mean	P-value	Mean Difference	t-test value
Male	20.18	2.59	0.37	0.006**	1.440	2.785
Female	18.74	2.58	0.36			
Unpaired t-test ** Highly Significant difference (p-value≤0.01)						

**Table:-3 Comparison of vertical distance between inferior border of mental foramen to inferior border of mandible in all males and females included in the study.**

Gender	Mean	Std. Deviation	Std. Error Mean	P-value	Mean Difference	t-test valve
Male	15.24	1.80	0.25	0.389 <sup>‡</sup>	0.300	0.866
Female	14.94	1.66	0.23			
Unpaired t-test <sup>‡</sup> Non-Significant difference (p-value>0.05)						

## DISCUSSION

Gender determination plays an extremely important role in identification of an individual. A forensic odontologist can play a role in the identification of gender using facial bones especially mandible, which is considered to be a stronger bone<sup>9</sup>. A 2008 study conducted by Franklin et al indicated that mandible shows sexual dimorphisms and is a durable bone for identification as it is made of dense compact bones<sup>10</sup>.

Study conducted by Rai and Arnad in 2009 indicated that measurements of mental foramina to alveolar ridge can be useful for specifying gender<sup>11</sup>. Wical and Swoope in 1974 described that despite the alveolar bone resorption above the mental foramen, the distance from the foramen to the inferior

border of the mandible remains relatively

constant throughout life<sup>12</sup>. Lindh *et al.* in 1995 and Guler *et al.* in 2005 also suggested that the stability of this region does not depend on resorption of alveolar process above the foramen<sup>13,14</sup>.

Panoramic radiographs were used in this study as they give much better view. In 1992, Philips *et al.* demonstrated that the size of the foramen on panoramic radiographs was slightly larger than that reported on periapical radiographs<sup>15</sup>. In a study conducted by Yosue *et al.* in 1989 also pointed out that mental foramen was seen more consistently on the wide field of view in panoramic radiographs of the mandible than on periapical radiographs<sup>16</sup>.

Vertical distance from superior border of alveolar ridge to the inferior border of the mandible shown by A-B (fig:-2) and vertical distance from superior border of alveolar ridge to the superior border of mental foramen shown by C-D (fig:3) can be used for

gender determination as these distances are showing a greater value in males as compared to females. Vertical distance from inferior border of mental foramen to the inferior border of mandible shown by E-F (fig:-4) shows no significant differences for gender differentiation.

Our results were in agreement with previous studies carried out in other populations by Yosue *et al* (1989)<sup>16</sup>. Al-Khateeb *et al.* showed in a study that there are significant differences in position of mental foramen in males and females<sup>17</sup>. Results of present study are also in accordance with another study conducted by Cagri *et al.* (2011)<sup>18</sup>

According to results of this study the vertical distance from inferior border of mental foramen to the inferior border of mandible (E-F) shows high non significant values. This distance is of least importance for gender determination. Studies carried out by Mahima *et al.* Catovic *et al.* and Thomas *et al* showed that mean values E-F were significantly high in males as compared to females which was not found true for the present study<sup>8,19,20</sup>.

### CONCLUSION

Statistically significant differences were observed in all of the linear measurements between genders where males almost have higher measurement than females. This study concludes that there exists statistically significant difference in the position of the mental foramen in males and females especially in the mean distance between alveolar crest to the inferior border of mandible shown by A-B. Males show a greater value of A-B in comparison to females according to this study.

Two parameters (A-B and C-D) assessed in this study shows highly significant differences in males and females. These parameters should be assessed on a larger population to achieve more significant and less biased results for gender determination.

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**Source of Funding:** Self

**Conflict of Interest:** Nil

**Ethical Clearance:** Written consent was taken from every participant of the study.

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# Role of Histopathology in Medical Autopsies: A 5 Year Study in a Tertiary Care Hospital

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## ABSTRACT

The term autopsy is derived from the greek word autopsies "to see for oneself" derives from autos (one self) and opsis ("eye"). It is a highly specialized surgical procedure that consists of a thorough examination of a corpse to determine the cause of death, assessment of clinical diagnosis as well as a key educational tool. Various histopathological findings, unrelated to the cause of death are noticed in the routine histopathological examination of the medical autopsies. Present study was conducted on 100 medicolegal cases received in the department of Pathology at GGS medical college, Faridkot in last 5 years (2011-2015). The study highlights the utility and indispensability of histopathological examination of autopsies, without which a complete and accurate diagnosis cannot be made.

**Keywords:** Histopathology, Autopsy, Medicolegal.

## INTRODUCTION

Autopsy (autos = self; opus = view) literally means to see for oneself. A medicolegal autopsy (opsy) or post-mortem examination (necros = dead ; opus = view ; post = after ; mortem = death) is a special type of scientific examination of a dead body carried out under laws of the state.<sup>1</sup> Forensic histopathology is a very important branch of forensic medicine which deals with the microscopic analysis of various cellular/ tissue changes of the cause of death.<sup>2,3</sup> The diagnostic procedures like imaging techniques (computed tomography, nuclear magnetic resonance imaging) have made great advances in the past few decades, contributing to the false positive as well false negative diagnosis thus making histopathology as the gold standard for the diagnostic confirmation.<sup>4</sup>

The aim of our present study is to highlight the importance of histopathological examination of the

viscera in medicolegal autopsies as an aid to ascertain the cause of the death and as a learning tool to enrich the medical knowledge. Our study also highlights the various incidental and interesting findings in the autopsies.

## AIMS & OBJECTIVES

1. To determine the histopathological findings related or unrelated to the cause of death.
2. To highlight the incidental findings in the autopsies.

## MATERIALS & METHOD

The present study is a prospective study done between period of 2011-2015 in Department of Pathology in which 100 medicolegal cases were received for histopathology. Clinical findings including the age, sex, suspected cause of death and post-mortem findings were noted from the post-mortem and police papers send along with the viscera. The viscera was received in 10% formalin solution; haematoxylin and eosin staining was done after the routine tissue processing. Special stains including PAS (periodic acid Schiff) and reticulin stain were used wherever necessary. The slides were subjected to light microscopy and positive findings were noted.

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**RESULTS**

This study was conducted on 100 medicolegal cases during 4 year period of 2011-2015. Male preponderance was noted with M:F ratio of 4.9:1. The highest incidence was seen in 3<sup>rd</sup> to 4<sup>th</sup> decade of life with mean age of presentation 34± 4.2 years. Of these, the youngest was 1 hour old newborn baby and oldest was 84 year old.

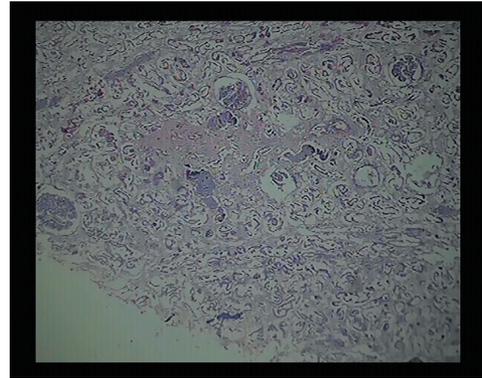
In our study acute tubular necrosis (ATN) was the most common diagnosis (8.7%), on light microscopic examination followed by Pulmonary edema (7.2%) and fatty change of liver (5.7%).[Tableno.1]

**Table no.1 Light microscopic findings in examination of autopsy viscera**

DIAGNOSIS	NUMBER OF CASES	PERCENTAGE (%)
Congestion	213	52.0
Acute Tubular Necrosis	35	8.7
Pulmonary Edema	29	7.2
Steatosis	23	5.7
Autolysed viscera	22	5.4
Atherosclerosis and Dystrophic Calcification	19	4.7
Cardiomegaly	11	2.7
Pneumonia	9	2.2
Old healed infarcts	8	1.99
Chronic Hepatitis	6	1.49
Pulmonary Tuberculosis	5	1.2
Cirrhosis	4	0.99
Focal cellular swelling of kidney	2	0.49
Mural Thrombus	2	0.49
Infarct Kidney	2	0.49
Meningitis	2	0.49
Tuberculosis liver	1	0.24
Adenocarcinoma liver	1	0.24
Metastatic adenocarcinomatous deposits in liver	1	0.24
Tuberculosis spleen	1	0.24
Extramedullary Haematopoiesis	1	0.24
Carcinoma Lung	1	0.24
Myocardial Infarction	1	0.24
Chronic Pericarditis	1	0.24
Fatty Infiltration of heart	1	0.24
Products of Conception	1	0.24

Respiratory System – It is the most common system affected. The maximum number of cases were of Pulmonary edema (70%) followed by pneumonia (21.9%) and tuberculosis (Table no.2).

Renal System – The maximum cases of acute tubular necrosis (89%) were seen followed by equal percentage of cases focal cellular swelling and infarct kidney (5.1% each). [Figure no.1]



**Figure No.1 -Infarct kidney (H&E X 100)**

Liver – The maximum cases of fatty change of liver seen (76%) followed by chronic hepatitis (20%) and cirrhosis (13.3%).

Cardiovascular System – Atherosclerosis and dystrophic calcification was seen in maximum number of cases (70%) followed by cardiomegaly (40%) in which heart size ranged from 400gm to 850gm. [Figure no.2]



**Figure No.2- Old Healed Myocardial Infarction (H&E X 400)**

Central Nervous System – Two cases of meningitis were seen.

Miscellaneous – One case each of extramedullary haematopoiesis, myocardial infarction, chronic pericarditis, fatty infiltration of heart, disseminated tuberculosis in lung, liver, spleen [Figure no.3] and synchronous presence of cirrhosis and metastatic

adenocarcinoma of liver was seen [Figure no.4]. Two cases of mural thrombus in right ventricle were also seen.

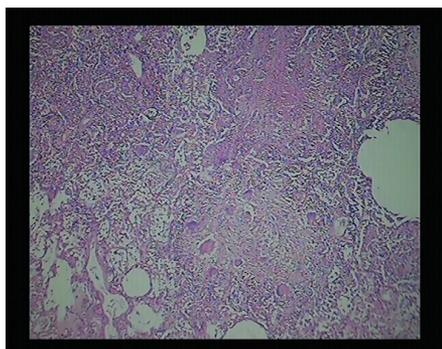


Figure No.3 -Disseminated Tuberculosis(H&E X 100)

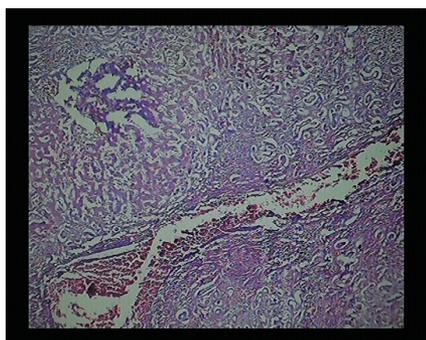


Figure No.4-Cirrhosis & metastatic adenocarcinomatous deposits in the liver (H&E X 100)

**Table No.2 Major Histopathological Findings In Various System Involved**

System	Major Finding	Percentage
Respiratory System	Pulmonary Edema	70%
Renal System	ATN	89%
Hepato biliary System	Steatosis	76%
Cardiovascular System	Atherosclerosis & Dystrophic Calcification	70%

In the present study, 34 cases had more than one histopathological diagnosis as the probable cause of death. Of these, 31 cases (91%) of ATN were seen. Equal percentage of cases with pulmonary edema and steatosis (47% each) were seen in combination with ATN. Nine cases (26%) had a combination of all three i.e. ATN, Pulmonary edema and steatosis, thus highlighting the fact that the terminal event can be any of the above leading to the mortality of the patient. Seven cases (20%) of pneumonia with ATN were also noted.

**Table No.3: Distribution of cases with more than one histopathological diagnosis with age wise comparison**

S.No	AGE (yrs)	Diagnosis 1	Diagnosis 2	Diagnosis 3	Diagnosis 4
1	40 yrs	ATN	Pneumonia	Hepatitis, Steatosis	
2	35 yrs	ATN	Tuberculosis		
3	55 yrs	ATN	Pneumonia		
4	30 yrs	ATN	Pulmonary edema	Hepatitis	
5	55 yrs	ATN	Pulmonary edema	Steatosis	
6	30 yrs	ATN	Pulmonary edema	Steatosis	
7	23 yrs	ATN	Pulmonary edema	Steatosis	
8	23 yrs	ATN	Pulmonary edema		
9	40 yrs	ATN	Steatosis		
10	80 yrs	ATN	Pulmonary edema	Old myocardial Infarcts, Atherosclerosis, Dystrophic Calcification	
11	52 yrs	ATN	Steatosis	Cardiomegaly	
12	30 yrs	ATN	Pulmonary edema	Steatosis	Chronic Cervicitis
13	65 yrs	ATN	Pneumonia	Fatty Change	Meningitis

(Cont...) Table No.3: Distribution of cases with more than one histopathological diagnosis with age wise comparison.

14	50 yrs	ATN	Tuberculosis	Hepatitis	
15	29 yrs	ATN	Pulmonary edema	Fatty Change	
16	28 yrs	ATN	Tuberculosis		
17	30 yrs	ATN	Pulmonary edema		
18	57 yrs	ATN	Adenocarcinoma lung	Atherosclerosis	
19	45 yrs	ATN	Pneumonia	Adenocarcinomatous deposits in the liver	
20	45 yrs	ATN	Hepatitis		
21	30 yrs	ATN	Pulmonary Edema	Steatosis	Mural Thrombus in the right ventricle
22	18 yrs	ATN	Pneumonia		
23	56 yrs	ATN	Pulmonary edema,Pneumonia	Atherosclerosis	
24	27 yrs	ATN	Steatosis		
25	62 yrs	ATN	Pulmonary Edema	Fatty Change	
26	28 yrs	ATN	Pneumonia	Hepatitis,Steatosis	
27	35 yrs	ATN	Pulmonary Edema		
28	45 yrs	ATN	Steatosis		
29	29 yrs	ATN	Pulmonary Edema	Steatosis	
30	31 yrs	ATN	Pulmonary Edema		
31	35 yrs	ATN	Pulmonary Edema	Steatosis	
32	20 yrs	Pulmonary edema	Steatosis		
33	20 yrs	Infarct Kidney	Steatosis	Chronic cervicitis,Proliferative Endometrium	
34	35 yrs	Pulmonary edema	Fatty change		

## DISCUSSION

Hospital based medical autopsies are a well established tool for education and quality assurance. Quality control is a highly important objective in health care and one of the main reasons why necropsy continues to be essential in improving the medical care. Histopathology is the gold standard technique for determination of cause of death and associated disease, assess the quality of care in health services improving the vision and diagnostic setup of clinical

assessment.<sup>4</sup> Over one fifth of unexpected /incidental findings can only be diagnosed histologically i.e by autopsy or biopsy.<sup>3,4</sup>

The present study was conducted between the period of 2011-2015 in which 100 cases were included for histopathological examination. Age and sex wise distribution showed a male to female ratio of 4.9:1 exhibiting a male preponderance which is in concordance with various studies.<sup>2,3</sup> In our study, maximum cases were seen in 3<sup>rd</sup> to 4<sup>th</sup> decade with mean age of presentation 35± 4.2 years which is in

discordance with studies where 4<sup>th</sup> and 5<sup>th</sup> decade of life were mostly affected.<sup>2,3</sup>

In the present study the maximum cases were seen in respiratory system (28%) followed by renal system (27%). This is in discordance with various studies done by Nada et al and Pathak et al where cardiovascular system was most commonly affected followed by respiratory system.<sup>5,6</sup>

In our study, pulmonary edema (70%) was the leading histopathological finding in the respiratory system. Similar study done by Costach et al showed that patients with pulmonary edema had an underlying cardiac or renal pathology, most of them associated with hypertension.<sup>7</sup> A study by Chauhan G et al showed maximum cases of pneumonia (14.6%) followed by emphysema (7.76%) and malignant lesions (2.08%).<sup>8</sup>

In concordance with our study, studies reported by Selvan et al showed that steatosis was the major histopathological finding (26.9%) on autopsy followed by cirrhosis, hepatitis and a rare case of metastatic adenocarcinomatous deposits.<sup>9</sup>

In contrast to studies by Jhajet and Sarviya A, few only (2.7%) of the patients had cardiomegaly in the present study.<sup>2,3</sup> Although rare cases of old healed myocardial infarcts and mural thrombus was seen. In agreement with our studies atherosclerosis and dystrophic calcification were the leading histopathological changes in the cardiovascular system.<sup>2,3</sup>

In the present study, renal system was the second most common system involved with acute tubular necrosis as the leading diagnosis (27%). A study by Jhajj et al similarly reported ATN as the leading diagnosis (22.4%) and important cause of acute renal failure.<sup>2</sup> Alpers CE & recorded causes of ATN into two main categories i.e ischemic and nephrotoxic. This was in concordance with the histopathological diagnosis of ATN was made were of poisoning, trauma (skeletal muscle injury) causing myoglobinuria. One case of each of acute pyelonephritis and chronic pyelonephritis was seen but diagnosis was incidental and made on histopathology.<sup>10,11</sup>

## CONCLUSION

This study highlights the fact that histopathology remains the gold standard in diagnosing the cause of death in spite of the antemortem investigations and also helps in enriching the medical knowledge and making rare and incidental diagnosis.

**Acknowledgment** - None

**Conflict of Interest** – None

**Source of Funding** – Self

**Ethical Clearance**– The above study was conducted on the post mortem viscera under the laws of the state.

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# Using of Bayesian Information as Evidence in Modern Forensic Research: A Probabilistic Thought for a Forensic Expert

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## ABSTRACT

Collecting evidence is an evergreen problem of the sciences of criminal procedure law. The problem is originated on the one hand from the fact that in the criminal proceedings there is a lack of evidences in a typical case. It is to understand, when the practicing of law is seeking to use the few available evidences at the highest efficiency level. The other side of the problem is, that by interpreting evidence the practicing of law draws conclusions as part of the interpretation of evidences, and he defines the facts of the case based on these conclusions. When is to consider, that we have enough evidences, and what method shall we use to interpret this evidences? The most efficient method we use, it is more probable that we will define the correct facts of the case. But is there any method, which leads us, inerrable to the correct facts of the case, or with other words which helps us to draw the right conclusions from the given evidence? There is a discussion about a method in the foreign literature which inserts the evidences in a mathematical equation and it defines the value of the evidences upon that. Investigations require that detectives interpret what evidence tells them about the probability that a suspect committed a crime. In real life situation the forensic experts can not accurately assess what a specific element of information tells them about the likelihood of an outcome. Bayes' Theorem, however, can be used to overcome this difficulty.

**Keywords:** Evidence, Fingerprint, Probability, Odds, Byes' Theorem.

## INTRODUCTION

The connection between Statistics and laws or ethics is increasing day by day in this era. The role of forensic science in criminology seems incomplete in some situation without involvement of chance study or random behavior of happening. In the modern forensic research the role of statistics is quite wide. The probabilistic thought for finger print identification & DNA matching has lead forensic experts towards a new direction identification of suspects. Always we start out with uncertainty about

the hypotheses and the evidence and throughout the investigation we should try and quantify that uncertainty appropriately. This is the origin of the modern Bayesian approach to statistical inference. Bayesian approach is basically to action hypothesis problem with random events. Bayes's theorem is named after Thomas Bayes (1701–1761), who first suggested using the theorem to update beliefs. His work was significantly edited and updated by Richard Price before it was posthumously read at the Royal Society. The ideas gained limited exposure until they were independently rediscovered and further developed by Laplace, who first published the modern formulation in his 1812 *Théorie analytique des probabilités*. After the formulation of bayes' theorem it was used in different terminology of decision science and since that time period it also became

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the interest forensic experts. A landmark paper by Finkelstein and Fairley (1970) represented a further development in the application of Bayesianism to forensic problems<sup>2</sup>. Bayes' Theorem can be used to assess what different elements of evidence actually tell us about the probability that a suspect committed a crime in terms of conditional probability. Klockars stated there are only three ways to establish any criminal guilt: (a) a witness, (b) a confession, or (c) physical evidence<sup>3</sup>.

To initiate the investigation along with probabilistic thoughts by forensic experts they should be familiar with basic probability theory such as basic set theory, events, conditional probability and odds ratio. In forensic science all the clues, information genuine proofs may be used as prior information's. The Probability using in Bayesian theory may be combination experimental and subjective probability both. The very simple process of Bayesian decision is shown in figure 1. In subjective probability the probability of the events is estimated by the individual's opinion. The subjective probability, though practically amounts to views and the degree of belief of a single person, can be valid if the same is unbiased and arrived by logical reasoning. The conditional probability is calculated when we have to find the chance of happening an event given that another supporting event has been occurred. To understand this by forensic experts<sup>6</sup>, Lawyers and judges it becomes tough and sometimes very wrongly interpretation of that information's, which resulted that in 2010, UK Court of Appeal Ruling (known as "R v T") asserted that Bayes theorem and likelihood ratios should not be used in forensic evidence, except for DNA and possibly other areas where there is a firm statistical base<sup>5</sup>. The conditional probability of guilt given the evidence can be represented as  $P(G/E) = P(G \cap E) / P(E)$ . This formula is the very first element of Bayes theorem. The simple Bayes theorem is given by, Prior odds  $\times$  Likelihood ratio = Posterior odds

The odds of an outcome are the ratio of the expected number of times the event will occur to the expected number of times the event will not occur. Put simply, the odds are the ratio of the probability of an event occurring to the probability of no event. The odds ratio is the ratio of two odds. LR= true positive (or negative) rate / false positive (or negative) rate. Likelihood ratios provide a numerical measure of the effect of a result on probability. The Bayes

relationship in terms of conditional probability can be written as,

$$\frac{P(G/E)}{P(G'/E)} = \frac{P(G)}{P(G')} \times \frac{P(E/G)}{P(E/G')}$$

.....1

More simply Baye's theorem for two events,

$$P(A_1/E) = \frac{P(E/A_1).P(A_1)}{P(E/A_1).P(A_2)+P(E/A_1).P(A_2)}$$

.....2

Above formula can be explained as follows,

In this study we tried to use the fundamental concepts of conditional probability and baye's theorem on fingerprint ridges and its application in forensic science, anthropology and criminology.

## MATERIAL & METHOD

Here we firstly emphasis how Bayesian formula works and then represent the detail works of Dhungana and Sahu<sup>4</sup>. The study was conducted in 546 subjects (46% female and 54% male) of age group 18–55 years to collect the fingerprint ridges. The subjects were excluded who were unable to give their finger ridge by any means (either due to hesitation or by any finger injuries and disease) at the time of data collection. After taking print, finger ridges were counted by a high magnifying lens of 12X magnifying power. Obtained number of finger ridges was noted carefully within a pre decided area of 5 mm  $\times$  5 mm. After the collection of data it was analyzed by SPSS Software (IBM) of version 20.0.

## RESULT

The distribution of conditional probability according to ridges count and according to sex was calculated by Bayes' theorem which is obtained in table 1 and graphically represented by figure 2.

For the study of Dhungana and Sahu<sup>4</sup>, Bayes theorem is applied in terms of conditional probability.

By using expression 2, the probability of being male given that number of ridges is 14 is given as,

$$\frac{P(\text{Ridge}=14/\text{Male}).P(\text{male})}{P(\text{Ridge}=14/\text{Male}).P(\text{male})+P(\text{Ridge}=14/\text{Female}).P(\text{female})}$$

$$P(\text{Male}/\text{Ridges} = 14) = 0.13$$

Above formula gives the chance of being guilty of sex male it is given that the number of finger print ridges got at crime spot is 14. Whatever probability comes from this it will be effective information regarding guilt identification. The main challenge of this Bayesian information is that how to understand all this by forensic experts and law experts<sup>6</sup>. The same concept may be utilized in case of DNA matching.

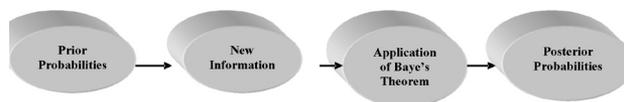
### DISCUSSION

The only coherent way to draw conclusions about source probabilities on the basis of forensic evidence is to apply Bayes' rule, which requires that one begins with an assignment of prior probability- ties to the propositions of interest. Bayes' rule specifies how one ought to combine prior probabilities with the results of a DNA profiling analysis in order to find the so-called posterior probabilities that the defendant is the source of the blood. But the Bayesian approach will only work if the expert can begin with a prior probability. The combination of probabilistic information and forensic evidence may be effective rather than forensic results only. The table 1 shows that the chance of number of finger ridges more than 13 is strongly supported to be a female guilt while less than 13 is likely to be a male guilt. If one use this information throughout the investigation one may reach at result quickly. The use of conditional probability may be a bridge between guilt and crime. The likelihood probabilities may refine the investigation. Recommendations should be that the forensic experts should be aware with probability and statistical tools for the betterment of investigation. The forensic experts should work together with statistician and probability experts.

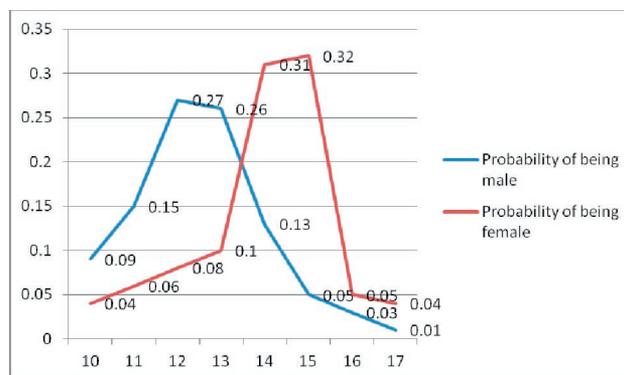
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**Table1. Distribution of Bayesian probability according to ridges count in male and female**

Ridges count	Probability of being male	Probability Of being female
10	0.09	0.04
11	0.15	0.06
12	0.27	0.08
13	0.26	0.1
14	0.13	0.31
15	0.05	0.32
16	0.03	0.05
17	0.01	0.04



**Figure1. Flow diagram in Bayesian decision process**



**Figure 2. Line diagram for probability distribution according to ridges count in male and female X axis is number of finger ridges and Y axis is Probability of being either male or female**

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**Ethical Clearance:** Not Required

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# A Study of Cranial Injuries in Road Traffic Accidents in Tirupati Region

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## ABSTRACT

Death due to Road Traffic Accidents (RTAs) are increasing at an alarming rate world wide thereby possessing a major epidemiological problem. Victims in RTAs sustain large varieties of injuries and occurrence of cranial injuries is extremely high in RTAs. The cranial injuries associated with injuries to vital organ and acute massive haemorrhage are more fatal or more dangerous to life.

The study of cranial injuries associated with fatal outcome helps in the implementation of measures to prevent the fatalities due to RTAs. Hence the present study is conducted to know the pattern of cranial injuries in victims of fatal RTAs, type of victims along with age and sex, survival period, type of offending vehicle

**Keywords :** *Crania injuries, Road traffic accident, Victim.*

## INTRODUCTION

Road Traffic Accidents (RTAs) are as old as Roads. They must have started taking place since the vehicle started moving on the road. The first death due to a motor vehicle was registered in 1896 in UK<sup>3</sup>

Road traffic accident is any vehicular accident occurring on the road way (i.e originating on, terminating on, or involving a vehicle partially on the road way). This included collision of an automobile with a pedestrian or with another automobile or with a non-automobile vehicle on the road or fall from a moving vehicle causing injuries or death of involved victim. The victim involved can be a pedestrian, pedal cyclist, motor cyclist, occupant of a vehicle.

In the recent years, the deaths due to road traffic accidents have been increasing at an alarming rate throughout the world. Thereby, it possess a major epidemiological and medico legal problems.

Road traffic injuries account for 2.1% of total global mortality. The developing countries bare a large share of burden and account for about 85% of

deaths, as a result of RTAs.<sup>6</sup>

India accounts for about 10% of road traffic fatalities worldwide .According to Institute of Road Traffic Education (2006), New Delhi,<sup>4</sup> estimated that 1.4 billion serious road accidents/collisions occur annually in India hardly 0.4 million are recorded. This indicates that the surveillance systems for vehicular accidents is not well established in India.

RTAs are due to mechanization, Industrialization, increase in number of vehicles, continuous growth of population, high speed technology, poor conditions of roads, with other contributing factors like, intoxication influence of drugs, alcohol, inexperience of drivers, without proper driving lessons, neglected use of protective devices, ignorance and intentional/unintentional violation of traffic rules and poor access to health care systems.

Section 304 (A) I.P.C.<sup>7</sup> causing death by negligence "Whoever causes the death of any person by doing any rash or negligent act not amounting to culpable homicide, shall be punished with imprisonment of either description for a term which may extent to two years or with fine or with both"

The present study is therefore conducted to ascertain the incidence of pattern of fatal vehicular accidents and pattern of injuries with emphasis on

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traumatic brain injury among RTA Victims.

## MATERIAL & METHOD

The present study was conducted in the Department of Forensic Medicine, Sri Venkateswara Medical college, Tirupathi from 20013 to 2014. A total number of 100 cases of road traffic accidents are studied. The RTA cases brought to the mortuary directly from the accidental spot or from the department of Neurosurgery, SVIMS Tirupati. or S.V.R.R.G. Hospital Tirupati and other private hospitals, Tirupati.

Cranial injuries by railway accidents, assaults fall from height, accidental fall of wall of a building or any other heavy weights are not included in the present study.

The epidemiological data was obtained with all pathological features of these cases and the forensic aspects of the cranial injuries were investigated. In particular details of scalp injuries pattern of skull fractures, extent and location, intra cranial haemorrhages and their distribution and brain damage only with respect to gross findings were studied.

A good attempt is made to study the findings in the case records, investigations like radiography, ultrasonography and computerized tomography scans, surgical interventions if any.

The inquest reports are studied thoroughly and information was gathered from the police officials, relatives, friends and the nearest kin of the deceased and the eye witnesses of the road traffic accident. Details regarding the age, sex, date, time, place, manner of death and the circumstances of the accident were scrutinized.

In determining the cause of death, all autopsy findings were evaluated and if there are multiple injuries involved, their most obvious and most important finding was considered to be the cause of death.

## FINDINGS

Detailed postmortem study of 100 cases was conducted with regard to cranial injuries in fatal road traffic accidents in and around Tirupati region.

**Age and sex wise distribution: Table – 1.**

The age groups in both sexes were divided in terms of ten years intervals and into 6 groups.

In RTA no age seemed to escape trauma. Out of 100 cases, 80 were males and 20 were females. Male to female ratio was 4:1. Among males the largest number of cases were found in the age group of 21-30 years (30.00%) and 31-40 years (27.5%) followed by 11-20 years (18.75%), and 41-50 years (13.75%) and 51-60 years (6.25%) least being in the age group of 0-10 years. (3.75%). Among females, the largest number of cases were found in the age group of 31-40 years (40%) followed by 21-30 years (15%) and 51-60 years (15%) least being in age group of 0-10 years (10%).

The youngest victim was 6 years old male child and 4 years female child. The eldest victim was 60 years in both males and females. The findings of our study are similar to the results of other studies; Office of Judicial Medical Officer, Colombo<sup>8</sup>, 84.3% of males and females in 11.7%. Commonest age group involved was 21-30 years (27.3%) followed by 31-40 years (20.6%). In another study done at Government Medical College, Jammu<sup>4</sup> majority of the victims were males (88.13%), while females were involved in 11.87% of cases. Office of Judicial Medical Officer, Colombo, 84.54% most commonly involved age group was 21-30 years (30%), followed by 31-40 years (19.2%). In all the above studies

Vehicular incidence in RTAs: Table 2

In our study of 100 cases, out of 110 vehicles involved, the heavy motor vehicles topped the list of offending vehicles 44 (39.99%), followed by medium motor vehicles 32 (29%), motor cycles 18 (16.36%), light motor vehicle 10 (9%), pedal cycles 3 (2.72%), and animal drawn vehicle 3 (2.72%).

The order of vehicles are lorry 26 (23.63%), buses 18 (16.36%), jeep/temp 15 (13.63%), car 11(10%), tractor 6 (5.45%), auto 10 (9%) motor cycles 18 (16.36%), pedal cycle 3 (2.72%), bullock cart 3 (2.72%).

In the study done at KMC Manipal(Karnataka) motor cyclists were involved in maximum number of cases (39.6%), Chandulal study<sup>1</sup> shows that among vehicles lorries were 48% followed by cycles 25%, cars 17%, buses 13%, two wheelers 9%, carts 4%, and auto 0.9%.

**Type of victims involved in Road Traffic Accidents**

Out of 100 victims, 45 were pedestrians, 30 were drivers and 25 were vehicular occupants. The association of the victim with the type of offending vehicle was also analysed.

It showed that pedestrians were more hit by the buses (26.66%), followed by lorries (15.55) and cars (11.11%) drivers of motor cycles or two-wheeler scooter were more involved more in the road traffic accidents (33.33%), followed by cars (13.33%), vehicle occupants of lorries, Autos and the jeeps are more involved.

Present study results are similar to the results observed in the study conducted at Maulana Azad Medical College, New Delhi<sup>8</sup> (39.1%), Government Medical College, Jammu (46.17%); MLN Medical College, Allahabad<sup>10</sup>(35.79%). However, present study result is significantly higher when compared with the results of the done at PGIMS, Rohtak (28.7%); RM College, Loni (27.9%)<sup>1</sup> and significantly lower than study done at Birmingham and Werwickshire (52.28%); Office of Judicial Medical Officer, Colombo (51.4%); AIIMS, New Delhi (50.70%) and Birmingham Accident Hospital, Bermigham<sup>10</sup> (50%). In all these studies majority of victims were pedestrians. In the study conducted at Brisbane, Queensland, maximum number of victims were car drivers (32.98%), which is contrary to present study result.

Fractures of skull in cases of fatal RTAs: Table - 3

Out of 100 cases studied, 75 cases had skull fractures. Among then linear/fissure fractures topped the list of skull fractures 37(49.33%), followed by comminuted fractures 21 (28%),depressed fractures 9 (12%) and least being the crush fractures 8 (10.66%).And other injuries in 25 cases

In a study conducted at Maulana Azad Medical College, New Delhi,<sup>4</sup> out of 104 cases, fracture of skull was present in 78 victims (75%). The combination of both vault and base of skull was commonest (44.8%), followed by fracture of the vault of skull alone (39.74%) and fracture of base of skull alone (10.2%). The commonest type of fracture seen in the skull vault was linear fracture (62%), followed by comminuted (29%). In the base of skull, linear fracture was the most common fracture (77%) and maximum number of fractures was seen in middle cranial fossae (51%). In a retrospective study done at Istanbul, Turkey, a total of 501 victims of fatal RTAs with skull fractures

were analysed. Linear fracture found to be the most common type of skull fracture (46.56%). In another study carried out at AIIMS, New Delhi<sup>4</sup>, in 79.87% of victims skull fracture was present. Fracture of the vault of skull was more common then the base of the skull and most common type of fracture was linear. These results are similar to the results of our study.

#### **Fractures of base of skull in RTAs**

Out of 91 basal skull fractures present, maximum number of fractures occurred in the middle cranial fossa 37 (40.65%) followed by anterior cranial fossa 32 (35.16%) and posterior cranial fossa 22(24.17%).

#### **Intracranial Haemorrhages in RTAs:**

In the present study maximum number of intracranial haemorrhages are subarachnoid 141 (50.3%), followed by subdural haemorrhages 112 (40%), extradural 11(3.92%), intracerebral 7(2.5%), brainstem haemorrhages 5 ( 1.78%), cerebellar 4 (1.42%) and intraventricular haemorrhage 4 (1.42%).

Ghosh P K<sup>2</sup> studied that out of 47 cases, 45.55% had fracture skull with combined intracranial haemorrhage. In 28 cases (12.17%) there were evidences of intracranial haemorrhage without skull fracture.

#### **Cause of Death in cases of fatal RTAs: Table- 4**

Out of 100 cases. 37% of the victims died of cranio-cerabral injures, 31% with haemorrhagic shock, 20% with neurogenic shock, 6% with associated injuries and 3% with septic shock and 3% with diffused axonal injury.

#### **Associated injuries in RTA:**

27 (17.64%) cases were in face/neck region, 48 (31.37%) in chest region, 28 (18.30%) in abdomen region, 50 (32.67%) in limbs.

Out of 100 cases, 6% of cases have associated injuries as per the cause of death.

Solheim K,<sup>12</sup> in his series of 168 pedestrian deaths in a 10 year study period noted that 55% were 60 years old and 12% under 9. 20-40 years age group was the least to sustain pedestrian injuries. Of the injured, more than 20% were alcohol intoxicated. Head injury led the list of cause of death accounting for 79 cases (47%).

## DISCUSSION/CONCLUSION

The present study is based on the observation of 100 cases comprising of road traffic accidents in and around Tirupati area. Various results were arrived after detailed post-mortem examination and of PM reports regarding age, sex, their relation to impacts, various types of skull fractures, intracranial lesions and associated injuries. Causes of death in all the cases were inferred. Epidemiological and scientific analysis of head injury data was done successfully to meet the objectives listed in the study.

RTA related deaths accounted for 56.81% of total medico legal autopsies conducted during the study period. Males out numbered females in the ratio of 4:1. Age group most commonly involved in males was 21-30 years (30%). In females was 31-40 years(40%).

Maximum number of RTAs were recorded in the afternoon hours (27%) and in the summer season (39%). Pedestrians formed the largest group of victims (45%), followed by drivers (30%). Heavy motor vehicles are the commonest offending

vehicle (46%), followed by medium motor vehicles (36%). Maximum number of individuals have died instantaneously or within the time of 6 hours from the time of occurrence.

Majority of scalp injuries are contusions (35.2%) and skull fractures were linear/fissure fractures (58.97%). Middle cranial fossa was most commonly injured in the base of skull (40.05%). Sub dural (40%) and subarachnoid haemorrhages (50.3%) are most common and are mostly associated with skull fractures. Coup lacerations(44%) are more recorded in brain injuries. Cranial injuries were alone responsible for about (44%) of deaths.

Fracture of multiple bones was seen in majority of victims. It was observed that majority of cases, fracture contributed either directly or indirectly to death especially skull fractures. More over, the skull fracture and intracranial injuries cannot be treated successfully, even in tertiary level hospitals, due to anatomical configuration of skull. Hence, fatalities due to fracture can be reduced by preventive the occurrence of such fractures. Therefore, prevention is better than cure.

**Table no.1: Age and sex wise distribution cases of fatal RTAs**

S. No	Age	Male		Female		Total	
		No. of Cases	%	No. of Cases	%	No. of Cases	%
1.	0-10 Yrs	3	3.75	2	10	5	5
2.	11-20 Yrs	15	18.75	2	10	17	17
3.	21-30 Yrs	24	30.00	3	15	27	27
4.	31-40 Yrs	22	27.55	8	40	30	30
5.	41-50Yrs	11	13.75	2	10	13	13
6.	51-60Yrs	5	6.25	3	15	8	8

**Table no.2: Type of vehicle in fatal RTAs**

Sl. No	Type of offending vehicle	No. of Cases	Percentage (%)	
1	Heavy motor vehicles	Lorry	26	23.63
		Bus	18	16.36
2	Medium motor vehicle	Tractor	6	5.45
		Jeep/Tempo	15	13.63
		Car	11	10.00
3	Light motor vehicle	Auto	10	9.00
4	Motor vehicle /scooter		18	16.36
5	Pedal cycle		3	2.72
6	Animal drawn vehicle (bullock cart)		3	2.72

**Table no.3: Type of the skull fractures in cases of fatal RTAs**

Sl. No.	Types of skull fractures	Frontal	Parie-tal	Tempo-ral	Occi-pital	No. of Cases	%
1.	Linear fissure	9	14	8	6	37	49.33
2.	Depressed	1	6	0	2	9	12.00
3.	Communitied	9	7	4	1	21	28.00
4.	Crush	-	-	-	-	8	10.66
5	<b>Other injuries</b>	-	-	-	-	25	100

**Table no 4: Different causes of death in cases of fatal RTAs**

Sl. No.	Cause of Death	No. of Cases	Percentage (%)
1.	Cranio Cerebral Injury (CCI)	37	37
2.	Neurogenic Shock (NS)	20	20
3.	Hemorrhagic Shock (HgS)	31	31
4.	Diffused Axonal Injury (DAI)	3	3
5.	Septic Shock (SS)	3	3
6.	Associated Injury	6	6
7.	Asphyxia	0	0
8.	Others	0	0

### RECOMMENDATIONS AND SUGGESTIONS

Based on our study, we like to stress the importance of the following suggestions:

1. Proper education right from school level regarding the right way of using the roads.
2. Improve the road and traffic sense among road users by camps, road shows, etc.
3. Strict enforcement of traffic rules.
4. Observation of traffic weeks regularly to bring traffic awareness among various sections of population.
5. Improvement of quality of road by widening, incorporation of signal lights, signal boards, road dividers, lane segregation for slow, medium and fast moving vehicles.
7. Drivers should not be allowed to drink drive, use mobile phones or engage in casual attitude while driving. Two wheeler should wear protective helmets. Public transport drivers should be trained in first aid and emergency management techniques.

8. Permissible limits of blood alcohol to be fixed and serious measures with respect to provisions of Indian Penal Code and Motor Vehicle Act to be made to punish drunken drivers.
9. Regular health-check up of drivers to be made compulsory.

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# A Study of Fatal and Non-Fatal Paediatric Poisoning Cases in Bangalore, India

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## ABSTRACTS

Study fatal and non-fatal paediatric poisoning cases was conducted in Department of Forensic Medicine and Toxicology in Victoria Hospital collaboration with the Department of Pediatrics, VaniVilas Hospital and, attached to Bangalore Medical College and Research Institute, Bangalore, India. In our study- 79.7% were ingested poisons and 20.3% were poisoning due to snake bites and scorpion stings. 44% of the total poisoning cases were due to insecticides. Among these snake bites were most common accounting for 84.6%. Most of the pediatric poisoning occurred inside home (69.5%), and least occurred outside home (30.5%). Maximum cases were seen at evening time (36.7%), followed by morning time (25%). In most of the cases the manner of poisoning was accidental (68.8%), followed by suicidal attempts (29.7%). 4 cases (3.1%) cases were succumbed to death.

**Keywords:** paediatric poisoning, ingested poisons, bites and stings, suicidal attempts.

## INTRODUCTION

Poisoning both accidental and intentional is a significant contributor to mortality and morbidity throughout the world. According to WHO, three million acute poisoning cases with 2, 20,000 deaths occur annually. Acute poisoning forms one of the commonest causes of emergency hospital admissions and acute poisoning in children is almost entirely accidental. Pattern of poisoning in a region depends on variety of factors, such as availability of the poisons, socioeconomic status of the population, religious and cultural influences and availability of drugs.<sup>1</sup> In India, while the most and commonest problems remain those related to infectious disease and malnutrition, accidental poisoning is one of the important emergencies encountered in children. 838 children ages 19 and under died from poisonings in 2010.<sup>2</sup>

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To analyse the problem of pediatric poisoning, it is necessary to understand the magnitude of the problem. When assessing the impact of a particular type of injury such as poisoning, epidemiologists examine multiple parameters, such as exposure, morbidity, mortality and cost to measure the effect of the injury; however these parameters are difficult to measure accurately of the reported exposures in children and adolescents, children younger than age 6 years account for 79%, children between 6 and 12 years of age account for 10% and adolescents between 13 and 19 years of age account for 11%. Children are frequently exposed to potentially toxic xenobiotics; fortunately, most childhood exposure are ingestion of non-poisonous xenobiotics or small nontoxic quantities of potentially toxic xenobiotics more likely pharmaceutical or household products.<sup>3</sup>

The present study is therefore conducted to know the changing trends of poisoning in children and to create awareness in parents by educating them regarding preventive methods of keeping household products and drugs away from the children.

## MATERIAL & METHOD

Present study was conducted in the Department of Pediatrics, VaniVilas Hospital and Department of Forensic Medicine and Toxicology, Victoria Hospital, attached to Bangalore Medical College and Research Institute, Bangalore during the period November 2012 to September 2014. All the cases of pediatric cases brought to Department of Pediatrics with history of Poisoning were included in the study. Those with history of poisoning but with no signs or symptoms of poisoning were excluded from study. Similarly, patients with idiosyncratic reactions to drugs were excluded from study. A sum of 128 cases of accidental/suicidal/homicidal poisoning was selected for this prospective study. Study was commenced after Institutional ethical clearance. Informed consent was taken. A proforma containing details of the patient, informant, type and quantity of poison consumed, occupation, monthly income of the parents are noted, patients symptoms after consuming poison, details about the type of snake, site of bite, time, manner of bite, treatment history. In most of the cases history regarding the manner of poisoning is elicited. In succumbed cases a detail medico-legal autopsy was done.

## RESULTS

For purpose of better study, the cases were divided into following groups:

1. Poisoning cases due to ingested poisons
2. Poisoning cases due to snake bites and scorpion stings.

The total numbers of poisoning cases in pediatric age group were 128. Out of which 102(79.7%) were ingested poisons and 26(20.3%) were poisoning due to snake bites and scorpion stings.(Table 1) 44% of the total poisoning cases were due to insecticides which include organophosphorus compounds, rodenticides, chlorinated compounds and pyrethroids.(Table 2) Out of 128 cases of pediatric poisoning cases studied, snake bites and scorpion stings amounts for 26 cases accounting for 20.3% of all poisoning cases studied.(Table 3) Among these snake bites were most common accounting for 22(84.6%). most of the pediatric poisoning occurred inside home 89(69.5%), and least occurred outside home 39(30.5%) usually while playing or within the site of guardians.(Table 4) The time at which children were victim of

poisoning was, maximum at evening time 47(36.7%), followed by morning time 32(25%).(Table 5) In most of the cases the manner of poisoning was accidental 88(68.8%), followed by suicidal attempts in 38(29.7%) cases. 4(3.1%) cases were succumbed to death.(Table 6) Among these 3 cases (75%) dead due to respiratory failure and one case (25%) dead due acute renal failure.(Table 7)

**Table-1: Distribution of study group based on pattern of Poisoning**

Sl. No	Type Of Poison	Number	Percentage
1	Ingested Poison	102	79.7
2	Snake Bite And Scorpion Sting	26	20.3
	<b>Total</b>	<b>128</b>	<b>100</b>

**Table-2: Most common type of poison ingested**

Sl.no	Poison	Number	Percent
1	Kerosene	23	22.6
2	Organo-phosphorus	16	15.7
3	Hypochloride	13	12.7
4	Rodenticide	13	12.7
5	Prescription Medicine	11	10.8
6	Pyrethroids	09	8.8
7	Organochlorines	07	6.9
8	Food Poisoning	04	3.9
9	Others	06	5.9
	<b>Total</b>	<b>102</b>	<b>100</b>

**Table-3: poisoning due to snakebites and scorpion stings**

Sl. No	Animal Bite	Number	Percent
1	Snake Bites	22	84.6
2	Scorpion Stings	04	15.4
	<b>Total</b>	<b>26</b>	<b>100</b>

**Table-4: Distribution of study group based on place of poison consumption.**

Sl.no	Place	Number	Percent
1	Residence	89	69.5
2	Outside Residence	39	30.5

**Table-5: Distribution of study group based on time at which exposure to poison has occurred.**

Sl. no	Time At Exposure To Poison	Number	Percent
1	Morning(6am-12noon)	32	25
2	Afternoon(12noon-4pm)	29	22.7
3	Evening(4pm-8pm)	47	36.7
4	Night(8pm-6am)	17	13.3
5	Unascertained	3	2.3
	<b>Total</b>	<b>128</b>	<b>100</b>

**Table-6: Distribution of cases based on manner of poisoning.**

Sl.no	Manner	Number	Percent
1	Accidental	88	68.8
2	Suicial	38	29.7
3	Homicidal	02	1.6
	<b>Total</b>	<b>128</b>	<b>100</b>

**Table-7: Distribution of study group based on cause of death**

Sl. No	Cause	Number	Percent
1	Respiratory Failure	03	75%
2	Acute Renal Failure	01	25%
	<b>Total</b>	<b>04</b>	<b>100</b>

## DISCUSSION

Intentional poisoning of children is an unusual, though significant, form of child abuse. Intentional poisoning is rarely suspected unless the patient dies and an autopsy is performed, a wide-ranging drug screen is ordered, or the history of bizarre enough to raise suspicion. Accidental poisoning, a common pediatric emergency is one of the important causes of morbidity and mortality in children especially in developing countries. Thousands of innocent children under age of 5 years are poisoned accidentally every year all over the world, mainly due to their innovative and exploratory nature and mouthing tendencies.<sup>4,5</sup>

The total numbers of poisoning cases in pediatric age group were 128. Out of which 102(79.7%) were ingested poisons and 26(20.3%) were poisoning due to snake bites and scorpion stings. The present study shows that 44% of the total poisoning cases were due to insecticides which include organophosphorus

compounds, rodenticides, chlorinated compounds and pyrethroids. The second commonest poison was kerosene 23(22.6%) followed by hypochlorides accounting for 10.8%. The commonest prescription medicine encountered was Benzodiazepines. Snake bites and scorpion stings amounts for 26 cases accounting for 20.3% of all poisoning cases studied. Among these snake bites were most common accounting for 22(84.6%). Similar findings were observed in studies done by Ravindra S honnungar,<sup>6</sup> Nowneeth Kumar,<sup>7</sup> Jayashree M,<sup>8</sup> Paudval BP,<sup>9</sup> Shashidar M,<sup>10</sup> and Gupta SK.<sup>11</sup>

Most of the pediatric poisoning occurred inside home 89(69.5%), and least occurred outside home 39(30.5%) usually while playing or within the site of guardians. And about 90% of snake bites and scorpion sting occurred outside home. Usually children have tendency of exploring and due to their mouthing reflex whatever they found in their reach that will definitely go in to mouth. Similar results were observed in studies done by Ravindra S honnungar,<sup>6</sup> and Senthil Kumar V<sup>12</sup>.

The time at which children were victim of poisoning was, maximum at evening time 47(36.7%), followed by morning time 32(25%). The least cases were seen at night time 17(13.3%). In 3(2.3%) cases the hour of consumption of poison could not be ascertained. Among these approximately two-third of snakebite and scorpion stings was at evening and night time. As people were usually busy during early morning and evening hours for household works the care over the children usually will be less. This results correlates with the study done by Senthil Kumar V.<sup>12</sup>

In most of the cases the manner of poisoning was accidental 88(68.8%), followed by suicidal attempts in 38(29.7%) cases. The least type of manner of poisoning was seen in homicidal manner 2(1.6%) cases. Snake bite and scorpion stings almost all cases were accidental in manner. Most of the pediatric poisoning cases occurred was 1<sup>st</sup> exposure 125(97.7%), followed by 2<sup>nd</sup> exposure in 3(2.3%) cases. Suicidal cases were more commonly seen in age group of 15 to 18 years. There were two cases of suicidal pact where parents along with their children tried to commit suicide. This result correlates with study done by Ravindra S Honnungar,<sup>6</sup> Ganga N,<sup>13</sup> Ahmad KW,<sup>14</sup> Job C,<sup>15</sup> and Nowneet Kumar.<sup>7</sup>

In this study, most of the victims of pediatric

poisoning cases were treated in Department of Pediatrics, Vanivilas Hospital and were discharged healthy 122(95.3%), and two cases (1.6%) were discharged against medical advice and, 4 cases(3.1%) were succumbed(dead)(mortality rate). Among these 3 cases (75%) dead due to respiratory failure as a result of poisoning (2cases of organophosphorus and 1 case of aluminium phosphide) and one case (25%) dead as a result of acute renal failure due snake bite. Similar results were found in studies done by Ganga N,<sup>13</sup> Job C,<sup>15</sup> Nowneet Kumar,<sup>7</sup> and Paudyal BP<sup>9</sup>.

### CONCLUSION

The total numbers of poisoning cases in pediatric age group were 128. Out of which 102(79.7%) were ingested poisons and 26(20.3%) were poisoning due to snake bites and scorpion stings. Insecticides (44%) followed by Kerosene (22.6%) were the most common type of poison noticed. The commonest prescription medicine encountered was Benzodiazepines. Most of the pediatric poisoning occurred inside home i.e. 89(69.5%). Most of the poisoning cases were seen maximum during evening time 47(36.7%). The data available from the present study does not enable the assessment of risk factors. However, by identifying the importance of childhood poisoning as a cause of morbidity as well as the relative importance of different poisoning agents may help in channelling the intervention programmes and further research in the right direction.

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# Forensic Odontology - Pivotal Player in Dentistry: A Mini Review

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## ABSTRACT

Forensic odontology is a Latin word meaning “forum” for legal matter discussion. It’s an area of dentistry where dental knowledge is applied for criminal and civil laws in justification. It is involved in the investigations to identify recovered human remains. It helps in determination of age, race, occupation, previous dental history and socioeconomic status of unidentified human beings. Comparison of ante-mortem and post-mortem dental records assists in identification. Thus forensic odontology has ignited lot of interest in the recent past that it has become a single positive method for identification in solving forensic cases.

**Keywords:** *Forensic, rugoscopy, cheiloscopy, DVI.*

**KEY MESSAGE:** Forensic odontology involves the management, examination, evaluation and presentation of dental evidence in criminal or civil proceedings as well as the natural or man-made disaster. Forensic odontology has a prime role in identification during disasters.

## INTRODUCTION

The science of forensic dentistry is basically confined to the cranio-facial structures.<sup>1,2</sup> The Federation Dentaire Internationale (FDI) defines forensic odontology as that branch of dentistry, which, in the interest of justice, deals with the proper handling and examination of dental evidence and with the proper evaluation, and presentation of dental findings.<sup>3</sup> Harvey defined forensic dentistry as that branch of forensic medicine which in the interest of justice deal with the proper handling and examination of dental evidence with the proper evaluation and presentation of dental findings.<sup>1</sup> 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”.<sup>4</sup> Each natural or man-made disaster presents a different set of circumstances, as a consequence, results in new challenges for identification.<sup>5</sup> The forensic dentist plays an important role in overcoming the

challenge.<sup>1</sup>

Forensic odontology involves the management, examination, evaluation and presentation of dental evidence in criminal or civil proceedings as well as the natural or man-made disaster.<sup>6</sup>

Forensic odontology has a prime role in identification during disasters. Unlike other hard tissues, teeth are often preserved even after death. Being the hardest structures of the human body, teeth are an ideal means of identification in decomposition, fire, massive trauma or disaster.<sup>7</sup>

## HISTORY

Forensic odontology dates back to 66 A.D., when the mistress of the Roman Emperor Claudius, was identified by his wife, Agrippina, based on severe malocclusion and discolored anterior teeth.<sup>7</sup>

In 1775, during the US Revolutionary War, a dentist identified war casualties by their bridgework. This was also used in instances in World War II on Adolf Hitler and Eva Braun, in the New York City World Trade Center bombing.<sup>1,8</sup>

Dr. NC Keep, a dentist who had made a removable partial denture for Dr. Parkman, a professor in Harvard University, was killed and the body was partially burned and dismembered. The body was identified on the basis of RPD in 1849.

In April 1968, a badly mutilated body was identified on the railway line on the basis of upper acrylic denture bearing a name inscribed on it as a patient of Parramatta Mental Hospital who had been missing for weeks.<sup>1</sup>

In 2004, Tsunami victims were identified by DVI team on the basis of forensic odontology. (AM dental records, x-rays, CT scans, dental models, face photographs, mouth guards).<sup>5</sup>

## DENTAL IDENTIFICATION PROCEDURES

Forensic odontology is based on the principles of those of comparison and those of exclusion. It is most useful when antemortem records are available for a deceased person.

Regardless of the methods used to identify a person, the results lead to the following 4 situations.<sup>6</sup>

1. Positive Identification
2. Possible Identification
3. Insufficient Identification
4. Exclusion Identification

## DENTAL RECORDS IN FORENSIC DENTISTRY<sup>6</sup>

### Advantages:

1. Records mention about the number of teeth present, missing teeth.(TPDs, CPDs, crowns , restorations etc)

### Disadvantages/Drawbacks:

1. Changes in the restorations related to passage of time
2. Avulsion of tooth following the trauma at the time of death.
3. Any additional treatments by a second party which is not registered in AM records.

The present review lists different methods to identify a deceased.

### (A) Radiographic Examination:

1. Comparing AM and PM radiographs. When an antemortem record is unavailable, the postmortem chart of the deceased may be used to exclude his or

her identity upon comparison with the available antemortem records of others.

2. Observations of restorations, RCT's, Root tips, tooth and root morphology, sinuses and jaw bones.

Therefore it is essential that routine radiographs exposed during the dental treatment be adequately fixed and washed so that they remain viewable years later.

3. 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. Variations in tooth formation and eruption pattern in human beings has become primary method of age determination. The radiographs shows morphologically distinct stages of mineralization depending on degree of formation of root and crown structures.<sup>6</sup>

### (B) Anthropological examinations:

Anthropological examination of bone includes analysis of calcified structures. Anthropologist and odontologist together can effectively distinguish one person from other, one population from another and determine race, age and sex.

Skull and facial bones can be used as a foundation for reconstruction of facial soft tissues using standard anthropologic measurements. It is sculpted and reconstructed and digitized on computer screen.<sup>6</sup>

### (C) Bite mark evidence:<sup>6,8</sup>

It is considered a vital contribution to forensic science. It identifies the victim or suspect eliminating the risk of failure to identification. Human bites are easily distinguished from non-human ones, differing in alignment and morphology.

Bite marks are usually seen in cases involving sexual assault, murder, and child abuse leading to a conviction. Bite marks are usually found on soft, fleshy tissues of the body. In addition, bite marks can be found on foods present at the scene of a crime.

In 1692 in the United States during the Salem Witch Trials, Burroughs used to bite his victims. His bite marks were compared with those of other

people. Bite marks were accepted as evidence to solve a murder for the first time in the US. In 1870 A.I Robinson was suspected of murdering his mistress as five bite marks were found on her arm and was charged of murdering his mistress. By 1890 bite mark evidence started to be recognized in the science field. In 1930 an infant was murdered with bite mark evidence on the skin in Canada, Quebec.

One of the first published cases on bite marks as evidence was the "Gorringer case", in 1948, in which Robert Gorringer was punished for the murder of his wife Phyllis on the basis of bite marks on the breasts of the victim.

In 1954 a case was filed on *Doyle v. State*, in Texas on the basis of a bite mark on a piece of cheese found at the crime scene, which was compared with bite on another piece of cheese by a dentist. It was concluded that the marks were made by the same set of teeth. Another case was *People v. Marx*, in California in 1975 in which woman was murdered by strangulation after being sexually assaulted. She was bitten several times on her nose.

#### (D) Lip Print:<sup>9</sup>

Cheiloscopy can be defined "as a method of identification of a person based on characteristic arrangements of lines appearing on the red part of lips or as a science dealing with lines appearing on red part of the lips".

Though the lip crease pattern is quite mobile and may vary in appearance with the pressure, direction and method used in making the print. It has individual characteristics like fingerprints. Advanced techniques in crime detection have alarmed the criminals for taking sufficient precautions like the use of gloves. So investigator can make use of an adjuvant technique such as cheiloscopy as supportive evidence provided there has been consumption of beverages, drinks, usage of cloth, tissues or napkin etc., at the crime scene.

The biological phenomenon of systems of furrows on the red part of human lips was first noted by anthropologists; R. Fischer was the first to describe it in 1902

#### Santos classified lip grooves as:

##### 1. Straight line

2. Curved line

3. Angled line

4. Sine-shaped line

According to Suzuki and Tsuchihashi, in 1970

1. Type I: A clear-cut groove running vertically across the lip.

2. Type I : Partial-length groove of Type I.

3. Type II: A Branched groove.

4. Type III: An intersected groove.

5. Type IV: A Reticular pattern

6. Type V: Other patterns.

#### Recording lip prints

1. Suspect's lip Photographs

2. Applying lipstick, lip rouge, and then pressing his or her lips to a piece of paper or cellophane tape or similar surface.

3. Using a roller finger printer.

4. Using a conventional finger print developing powder or with a magna brush and magnetic powder.

#### Processing and Developing of the Lip Prints

Number of different powders or cyanoacrylate used for developing lip prints and photographed.

#### Lip Print in Crime Detection

Lip prints are unique and do not change during life of a person.<sup>10</sup> Traces of lips are usually seen on cutlery and crockery items, on the window or door glass and on photograph or letters, plastic bags and cigarette ends. These are identified during murders, rapes and burglaries. Thus along with other traditional method, cheiloscopy can also serve as a very important tool in identification of a person. A standard and uniform procedure has to be developed for the collection, development and recording of lip prints and the ensuring comparison.

#### (E) Microchip<sup>11</sup>

Simple and inexpensive means of identification in case of complete edentulousness includes standard

denture marking system. Use of RFID –transponders (radiofrequency identification) is the high-tech method which has recently evolved, to be used for forensic purpose in 2004 by Millet Jeannin. The procedures implemented “Read-Write” tags placed in C.

## METHOD

Patient’s data are stored on the microchip measuring 8.5mm×2.2mm. Dentures are processed in a usual manner. A depression is created on a posterior surface of maxillary denture, slightly larger than the proposed size of the chip. Chip is incorporated with the long axis parallel to the occlusal plane followed by sprinkling of clear autopolymerizing resin around the chip.

Denture is again processed in pressurized container with warm water (1008F, 20psi) for 15-20 minutes.

A radiograph of microchip implanted denture showed clear information related to the patient.

### (F) Dental implants<sup>12</sup>

Implants have gained popularity in choice of treatment in replacing individual or entire lost teeth.

Titanium with melting point greater than 1650°C as an implant could potentially assist in the identification of victims in situations of lack of other evidence such as DNA or fingerprints and loss of fragile dental remains.

Extreme heat may destroy teeth and conventional dental restorative materials in victims. Due to their

Physical properties, implants will resist thermal insult although the lack of uniqueness of mass produced objects limits the use of implants in identification. The addition of batch numbers within implants and the ability of these implants to retain their numbers following high temperature assault would increase the weight of evidence.

### (G) Memory Card<sup>4,13</sup>

With the need to record the data regarding the patient, inclusion of memory card has thrown light over the daubing task of forensic experts to identify individuals in crime or mass disaster.

This includes various advantages in using this

labeling system. It doesn’t show any interference with oral function or the strength of the denture because of its small size, cost effective, re-recordable, retains data without power etc. No technical difficulties exhibited, nor does it require any special trained technician. Easy retrieval is the most desired property.

### Steps involved,

1. Complete denture is fabricated following routine clinical and lab procedures.
2. Recess of 18×15×1 mm made on palatal surface using carbide bur.
3. Memory card is wrapped in a cellophane sheet and placed in the recess and covered with pink autopolymerizing resin
4. The denture is processed in a pressurized container with warm water followed by finishing and polishing.

### (H) Lead paper<sup>14</sup>

Several methods of denture labeling have been proposed, out of which lead paper inclusion appears to satisfy all requirements recommended for denture markers

It is biologically inert, durable, inexpensive and easy to retrieve.

Additionally lead paper can withstand heat and placed in an area of denture not subjected to relining which is advantageous over microchip inclusion.

### (I) Engraving<sup>2</sup>

Engraving technique used as dental identification includes procedure for making accurate identification markings on crowns and FPD with minimal cost.

## MATERIAL & METHOD

- an electric engraver
- Mahagani ceramic stains

Steps involved – completion of all the steps of procedure for baking a porcelain crown upto the last bake.

FPD or cast restoration is held firmly resting the arm comfortably with a pen grasp on the lingual side.

Minimal pressure applied while engraving at a slight angle

After engraving porcelain is stained with mahagani stain and is glazed.

It is advantageous when compared to other methods as it has high resistance to all the insults, cemented to the teeth and cannot be readily removed.

#### **(J) Rugoscopy<sup>15</sup>**

The palatal rugae appear during the third month of intrauterine life described as asymmetrical and irregular elevations of the mucosa located in the anterior third of the palate. The study of palatal rugae patterns for human

Identification is known as rugoscopy. Palate rugoscopy was first proposed in 1932 by TROBO HERMOSA. SASSOUNI stated that no two palates are alike in configuration and that palatoprint does not change during growth. It is an alternative method for comparison when identification of an individual by fingerprint or dental record comparison is difficult. Even diseases, chemical attack or trauma leaves the form of rugae unaltered. Their anatomical position inside the mouth preserves them even after third degree burns, protects them from trauma and safe against high temperatures, more resistant to decomposition and thermal effect. Palatoscopy is advantageous over other methods, as they are highly individualistic, unique, and consistent in shape throughout life and be ideally used for forensic identification.

(K) Scraping patients name with the surgical blade on the denture. Advantages being simple quick and cost effective.

**Disadvantage being roughening of the denture.<sup>16</sup>**

(L) Use of copper vapour laser labeling on the cobalt chromium components of the metallic dentures, disadvantage being need for special equipment.<sup>17</sup>

(M) Barcode incorporation – can withstand temperatures above 600°C and can have huge data. Curves in the denture may distort the barcode leading to difficulty in scanning.<sup>18</sup>

(N) Either a paper or a rolled soft metal or stainless steel tape can be incorporated in the denture with the patients information inscribed on it, being simple, quick, and cost effective.<sup>19</sup>

### **CONCLUSION**

The idea of clubbing dental evidence with other evidences in forensic investigations has played a key role in solving forensic cases

Forensic odontology has a major role in identification of victims in mass disasters (Tsunami, aviation, earthquakes, fire, drowning), motor vehicle accidents and in crime investigations. The various methods employed includes tooth prints, radiographs, photographs, cheiloscopy, rugoscopy, denture labeling are all reliable. This review gives an overview of various methods to aid in the identification of process with its feasibilities and limitations.

Each practitioner has a responsibility to understand the forensic implications associated with the practice of his or her profession. Appreciation of the forensic field should give the dental clinician another reason to maintain legible and legally acceptable records, and assist legal authorities in the identification of victims and suspects.

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# Unnatural Deaths in Police Lockup/Prisons of North Maharashtra Region: A 15 Year Retrospective Study

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## ABSTRACT

Preventing torture in custody and ensuring strict compliance of its guidelines in custodial deaths is one of the important agenda of NHRC. This article presents data of 19 deaths in custody/prison in north Maharashtra region from the period of 15 years from 01/01/2000 to 31/12/2014. 12 deaths were caused due to suicide, 2 deaths were caused due to homicide, 5 deaths were caused due to accident. Hanging was the most common means of committing suicide. Items of clothing were the most commonly used objects, for committing suicides by hanging. Based on these findings, several measures for prevention of deaths in police custody are discussed.

**Keywords-** Custody/prison deaths, custodial torture, forensic pathologist, postmortem examination, manner of death.

## INTRODUCTION

Preventing torture in custody and ensuring strict compliance of its guidelines in custodial deaths is one of the important agenda of NHRC. Deaths in police custody/prison are not uncommon. Whenever such deaths occur there is allegation of custodial torture by the relatives of the dead, media and political parties in opposition. Forensic pathologist plays vital role in delivery of justice in such cases by doing meticulous postmortem examination in compliance to guidelines of National Human Rights Commission and the state.

Though majority of the cases in custody die due to natural causes, it is very necessary to rule out custodial torture, sexual offence, and unnatural deaths when death occurs in custody/prison. Custodial death is one of the key sensitive issues with respect to human rights violation. United Nations and international human rights watchdog like Amnesty International also keeps a watch on deaths in custody.

People in custody are more likely to die

prematurely, especially from violent causes, than similar people not in custody. Therefore it is not only the lawful duty but also moral responsibility, of police to keep a person in there custody with necessary care and concern for his safety<sup>1</sup>.

As per directions of the National Human Rights Commission, New Delhi and as per circular by govt. of Maharashtra it is necessary that postmortem examination in case of custody/prison deaths should be done at government medical college and hospital of the region by the forensic pathologist and video shooting of postmortem examination should be conducted. Section 3 of the act provides for the setting up of the national human rights commission (NHRC) and section 21 provides for the setting up of various state human rights commissions<sup>1</sup>.

As per the Oxford's dictionary custody means "protective care or guardianship of someone or something". In the legal parlance custody is defined as any point in time when a person's freedom of movement has been denied by law enforcement agencies, such as during transport prior to booking, or during arrest, prosecution, sentencing, and

correctional confinement<sup>2</sup>.

**Aims & objectives-**

1. To know the cause of death
2. To know the manner of death
3. To know whether the injuries which may not have caused death but suspected to be of torture in custody
4. To know whether there is consumption of intoxicating substance prior to death
5. To know whether custodial torture has lead to death/commission of suicide
6. In case of female inmates to rule out sexual torture/offence
7. To know the weapon of offence
8. Homosexuality

**MATERIAL & METHOD**

This retrospective study is based on postmortem examinations conducted at Shri. Bhausaheb Hire Government Medical College and General Hospital, Dhule Maharashtra. In north Maharashtra region, there are 4 districts viz. Dhule, Nandurbar, Jalgaon and Nashik. As per directions of the National Human Rights Commission, New Delhi and as per circular by govt. of Maharashtra it is necessary that postmortem examination in case of custody/prison deaths should be done at government medical college and hospital of the region by the forensic pathologist and video shooting of postmortem examination should be conducted<sup>1</sup>.

We examined all available files of inquest papers, postmortem reports, toxicological analysis reports, histopathology reports and case papers of death of persons in custody from the period of 15 years from 01/01/2000 to 31/12/2014. A standard proforma was designed to collect the information to ensure consistency for the whole sample. Information collected included age, sex, type of custody, place of death, presence of any associated disease, history of any psychiatric illness, substance abuse, injuries present, weapon of offence, manner of death, sexual offence and cause of death.

Only deaths due to unnatural causes were included in the study. Deaths during police action are excluded from this study. Postmortem examination

was conducted by a panel of doctors and video shooting of postmortem examination was carried out. Viscera was preserved for chemical analysis and histopathological examination in all cases.

**Observations-**

**Table 1: Sex-wise distribution of cases**

Sex	No. of cases (%)	%
Male	18	94.74
Female	01	05.26
Combined	19	100

**Table 2: Age-wise distribution of cases**

Age group (in yrs)	Male	Female	Total cases	%
20-30	08	00	08	42.11
31-40	06	01	07	36.84
41-50	03	00	03	15.79
51-60	00	00	00	00
61-70	01	00	01	05.26

**Table 3: Manner of death**

Manner of death	Number of cases	%
Suicide	12	63.15
Homicide	02	10.53
Accident	05	26.32

**Table 4: Cause of death**

Cause of death	Number of cases	%
Head injury	09	47.37
Hanging	07	36.84
Poisoning	01	05.26
Alcoholic intoxication	02	10.53

**Table 5: Presence of associated illness**

Presence of associated illness	Number of cases
Fatty liver	01
Old healed infarct with changes of early acute myocardial infarction	01
Pulmonary edema and pneumonitis	01
Alcoholic liver cirrhosis	01
Pulmonary edema	01

**Table 6: Year-wise distribution of number of cases of unnatural deaths in police lockup/prison**

Year	Number of cases of unnatural deaths in police lockup/prison
2000	00
2001	00
2002	00
2003	00
2004	01
2005	02
2006	04
2007	01
2008	01
2009	04
2010	01
2011	02
2012	01
2013	00
2014	02

**Table 7: showing type of custody**

Type of custody	Number of cases	%
Jail	09	47.37
Police lock-up	10	52.63

## DISCUSSION

Our study was restricted to unnatural deaths in police lockup/prison of north Maharashtra region. There was male predominance (18 versus 1 death) in our study (Table 1). Rarity of crimes by females may be in part explained the lack of female deaths<sup>2</sup>. In our study 36.84% of deaths occurred in the age group of 20-30 years and 42.11% of deaths occurred in age group of 31-40 years (Table 2). Our findings are consistent with Bardale R et al<sup>3,4</sup>.

We studied 12 cases of suicide (Table 3). In our study, majority of the unnatural deaths (63.15%) were due to suicide<sup>1,2,3</sup>. The mean age of suicides is 31.25 years at death. Prisoners between ages 15 and 34 years are at the greater risk for suicide as compared to older inmates<sup>5</sup>. Of 12 cases of suicide 7 were due to hanging (58.33%), 4 were due to head injury (33.34%) and 1 was due to KCN poison (8.33%) (Table 4). Bardale et al mentioned hanging as the most common method of suicide in prison inmates accounting for

42.85% of suicides<sup>4</sup>.

Of the 7 cases of hanging, 6 were male and 1 was female. Out of those 7 cases 4 cases of hanging occurred at police lockup whereas 3 cases occurred at prison. Items of clothing were the most commonly used objects for committing suicide by hanging like plastic strip used for packing the cartons, jute rope, own full sleeves shirt, scarf, bed sheet, towel.

Out of the 4 cases of suicidal head injury 3 occurred in police lockup while 1 occurred in prison. There were various ways of committing suicide by head injury in our study like (i) forceful self-impact of the head with the wall, (ii) jumping on the road from police vehicle, while police were taking the arrested person to the court, (iii) jumping in the well of a farm land when police had taken the arrested person to the scene of crime to gather the evidence, (iv) ran away from police station lock-up, climbed up the nearby building, and committed suicide by jumping on the ground from height. Bansal et al<sup>2</sup> has reported 3 cases of suicides due to fall. Bardale et al<sup>3</sup> reported 1 case of suicide due to jump from third floor resulting in intracranial hemorrhage.

In our study, we encountered an unusual case of suicide due to potassium cyanide poisoning by a male person who was in police custody<sup>6</sup>. Viscera was preserved for chemical analysis. The report of chemical analysis revealed presence of potassium cyanide in the organs- as stomach and loop of small intestine with their contents 6.50 milligrammes per 100 grams, liver along with gall bladder, spleen and kidneys 2.60 milligrammes per 100 grams and in blood 0.91 milligrammes per 100 millilitres.

The suicide in custody is worrisome and can be prevented by keeping proper vigil on the inmates. According to Cavanaugh, the shock of being incarcerated is a major determinant of suicide attempt<sup>7</sup>. In addition, the authoritarian environment perceived, dehumanization, isolation, helplessness and despair often experienced. The body search, finger printing, photographs and delousing, part of regular jail admission protocol add to humiliation. Prison suicides are often preceded by signs of suicidal intent and these signs should, at minimum, prompt the provision of further psychiatric care. Research into suicide in prison must be directed towards the exploration of protective factors (i.e. factors that reduce probability of suicide) and environmental

factors that may influence suicidal behavior (e.g. prison regimes and prisoner's social networks)<sup>8</sup>. As per Lawrence Gurzardi<sup>7</sup>, when a person first booked in jail a screening form should be completed that would become a part of the inmates record and should obtain history of past illness, present health problems and note of medications being taken, mental condition and any abnormal behavior, injuries or infections or allergies<sup>2</sup>. None of the persons who committed suicide were suffering from HIV infection/AIDS. Ten suicidal deaths occurred in police custody while 2 occurred in prison. Our findings are consistent with Bardale R et al<sup>3</sup> suggestive of suicidal deaths are more common in police lockup than in prison.

Of the 2 cases of homicide 1 occurred in prison (assault with hard and blunt object) while 1 death has occurred in police custody (assault by the public to the thief during train journey, afterwards arrested by police and died in police lockup). In both these cases the persons died due to intracranial hemorrhage due to head injury.

In our study 5 persons all male died due to accident. Of these 3 died due to accidental fall due to head injury, while 2 died due to alcoholic intoxication. The cause of accidental fall in 1 case was that the inmate was on antiepileptic drugs, fell on the ground at prison barrack and died after 3 days of hospitalization. In other 2 cases the inmates fell in the bathroom and sustained head injury. Interestingly both cases of alcoholic intoxication were from prison. Ingestion of intoxicants before arrest or while out on a pass do occur. Police forces need to be alerted to the danger of putting intoxicated people in cells<sup>3</sup>. Our findings are consistent with Agnihotri et al<sup>1</sup> who reported 2 cases of death due to poisoning (alcohol/drugs) in police custody. Bansal et al<sup>2</sup> reported 2 cases of poisoning in prison in which aluminium phosphide with ethyl alcohol was noted in both cases. Bardale et al<sup>3</sup> reported 2 cases of poisoning in custody, 1 due to OPP while another due to alcoholic intoxication. In the same study they reported 1 case of accidental death due to alcoholic intoxication. The depressant effect of alcohol and narcotics and their withdrawal are well recognized<sup>9</sup>. For this reason, intoxicated prisoners should be recognized as greater suicide risks. Some of these deaths could possibly be prevented by timely application of drug rehabilitation, counseling, pharmacotherapy and de-addiction programs.

Whenever unnatural death in police lockup/prison occurs allegations of custodial torture are always leveled up against the authorities. In our study we specifically looked for injuries to palms soles of feet, genitals, over back, inside the natural orifices but we did not find any injury suggestive of custodial torture. So abetment of suicide due to physical torture in custody was ruled out. Similarly we did not find evidence of sexual torture/offence/homosexuality in our study.

Of the 19 cases of unnatural deaths which we studied, we had preserved viscera for histopathological examination and in 14 cases (73.68%) we did not find any abnormal pathology and in 5 cases (26.32%) we found various diseases like fatty liver, myocardial infarction, pneumonitis, pulmonary edema, liver cirrhosis (Table 5).

Of the 19 cases of unnatural deaths which we studied, we had preserved viscera for chemical analysis and in 3 cases (15.78%) report of chemical analysis revealed poison in the viscera samples. Out of these 3 cases, ethyl alcohol was detected in 2 cases and KCN was detected in 1 case.

Our retrospective study of 15 years revealed that not a single case unnatural death was reported from police lockup/prison in the year 2000,2001,2002,2003 and 2013 (Table 6).



**Photo 1- a case of head injury due to homicidal assault in a 32 year old prison inmate**



**Photo 2- Linear fracture of skull and underscalp hematoma in a case of head injury due to homicidal assault in a 32 year old prison inmate**



Photo 3- suicide by hanging by a 36 years old female prison inmate- ligature material in-situ with fixed knot



Photo 6- showing head injury, a 36 years old male jumped in the well of a farm land when police had taken the arrested person to the scene of crime to gather the evidence



Photo 4- showing ligature mark and ligature material (scarf) in a case of suicide by hanging by a 36 years old female prison inmate



Photo 7- showing head injury- fracture of skull and brain matter exposed to exterior



Photo 5- showing ligature mark in a case of suicide by hanging by a 22 years old male prison inmate

### CONCLUSION AND SUGGESTIONS

Though it is true that not every case of unnatural death in custody will be avoidable, but it is possible to reduce the number of such deaths by preventive measures like regular physical and mental check-up of the inmates, psychological counseling and psychiatric treatment for those suffering from mental illness. There should be screening of people likely to have suicidal tendencies. De-addiction centers, Yoga, pranayam and recreational facilities should be provided in the prisons. Courses of "Art of Living" and "Vipassana Meditation" should be held in prisons. CCTV cameras be installed at most of the places in the prison and persons of different criminal gangs should be segregated. Round the clock vigil by the security guards is must.

As said in custodial jurisprudence, the prison is a

place of great symbolism and ritual. This ritual begins the moment a prisoner comes through the gate of the prison. His clothes were taken from him. He is given a set of uniform. He is given number, which will become important than his name. This symbolism will continue until the moment of his release. And before it is done, the symbolism is taken away so that the stigma of prisoner does not hang over him<sup>10</sup>.

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**Conflict of Interest** – Nil.

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# Fracture of Upper Cervical Vertebrae Need Not Cause Death: A Case Report

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## ABSTRACT

As quoted by many standard textbooks of Forensic Medicine, in cases of Judicial hanging, the cause of death is fracture of C2 – C3 vertebra. Here, in our institute, PESIMSR, Kuppam, we have received a case of fall from height with fracture of C2 vertebra. The patient is alive with quadriplegia. There are also other articles in literature which state that cause of death in judicial hanging being other than fracture of cervical vertebra. In cases where the death in judicial hanging fracture of cervical vertebra is reported, the cause of death is complete or partial transection of the spinal cord. Usually either in suicidal or judicial hanging there is no fracture of cervical vertebra, even if present is not usually the cause of death. It is asphyxia or cerebral anoxia which is the cause of death. Since Asphyxia is more painful than death by transection of spinal cord, it is our suggestion to the State authorities to consider other painless forms of execution.

**Keywords:** Fracture of cervical vertebra, Cause of death, Judicial Hanging.

## INTRODUCTION

A male aged about 28 years from Vellore district, Tamil Nadu was brought to the casualty of the PES IMS&R with the history of fallen from the top of the bus, while he was sleeping on the bus at its night halt station. He was the driver of the bus. He went to the local hospital, took injection and went home.

Next day he was taken to a local hospital in a nearby town with the complaints of quadriplegia. Later he was brought to the PESIMS&R Hospital, Kuppam for better treatment. His general condition was good, conscious and well oriented talks in whisper and was unable to lift any limb.

On examination the four limbs were flaccid, reflexes were brisk, and Babinsky is positive on both sides. Bowel and bladder control was good and was

eating well. Antero-posterior and lateral X-rays of the cervical spine were taken, which revealed the fracture dislocation of the odontoid process of the C2 vertebra. He was referred to higher institute for further management.



**Radiograph No.1 : Lateral X ray of cervical spine (Neck flexion)**

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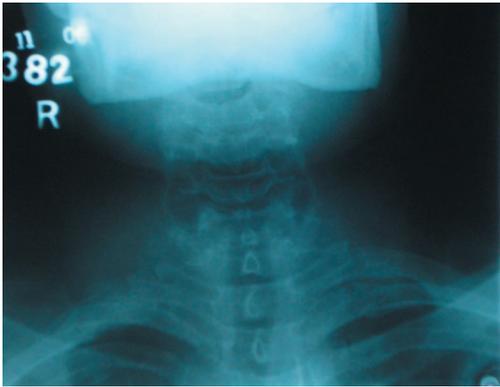
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**Radiograph No. 2: Lateral X-ray of cervical spine (Neck Extension)**



**Radiograph No. 3: Anteroposterior view of the cervical spine**

### REVIEW OF LITERATURE

The atlas and the axis are atypical cervical vertebrae. The atlas lacks a centrum and is modified in its vertebral arch to form a thick lateral mass on each side. The upper surface has articular facets for occipital condyles.

The axis is formed by the dens (odontoid process) and a large spinous process. The dens has an articular facet in the front to articulate with the anterior arch of the atlas. The weight of the skull is transmitted through lateral mass of the atlas to the superior articular process of axis lateral to the dens<sup>1</sup>.

Odontoid fractures may be type I, II or III. They may occur in violent flexion or extension of the neck. Type I fracture require only symptomatic treatment as they are stable while type II or III may be symptomatic or cause damage to the spinal cord. Not only the axis, the atlas is also susceptible for fractures by severe downward pressure of the occipital condyles. This can happen in weight falling on head, head striking roof of ear, fall from height on heels<sup>2</sup>.

Stability of the spinal cord of the cervical and

lumbar spine is best studied by lateral views in flexion and extension and plain X-rays remain the first line of investigation in spinal trauma. Spinal cord descends from the medulla oblongata commencing at the level of the foramen magnum and terminates at conus medullaris which lies between T12 and L3 vertebra<sup>3</sup>.

Among fractures of the spine fractures of the dens are most common, mainly due to hyperflexion injury. Hyperflexion injuries cause fractures of the posterior arch of the atlas without cord compression. Hyperextension injuries, though less frequent, also cause disruption of the posterior arch<sup>3</sup>.

### DISCUSSION

Among prominent textbooks of Forensic Medicine, there is confusion as to the fatality of the fractures of cervical vertebrae, C1 and C2. They say that fractures of C1 and C2 may cause partial or complete transection of the spinal cord, leading to death of the person in Judicial hanging<sup>4,5,6,7</sup>.

As discussed above, spinal cord compression in fracture of cervical vertebra C1 and C2 is rare. The same is substantiated by the case elaborated above; where there is fracture involving cervical vertebrae C1 & C2 and the person is suffering from quadriplegia.

There have been several methods of execution through the ages. They are torture, burning at the stake, breaking on the wheel, slow strangulation, crushing under elephant's feet, throwing from a cliff, boiling in the oil, stoning to death. Punishments involving torture disappeared with the idea that punishment by way of death sentence should be quick and humane, whether by guillotine, hanging, the garotte, or the headman's axe.

"Prior to the execution the prisoner must be weighed. The "drop" must be based on the prisoner's weight, to deliver 1260 foot-pounds of force to the neck. The prisoner's weight in pounds is divided into 1260 to arrive at the drop in feet. The noose is then placed around the convict's neck, behind his or her left ear, which will cause the neck to snap. The trap door then opens, and the convict drops. If properly done, death is caused by dislocation of the third and fourth cervical vertebrae, or by asphyxiation. This lengthy measuring process is to assure almost instant death and a minimum of bruising. If careful

measuring and planning is not done, strangulation, obstructed blood flow, or beheading often result. The death by hanging however according to most of the medico-jurisprudential writers is result of asphyxia or strangulation and fracture of the neck is an exception (both in judicial as well as suicidal hanging)" as given in a report by Law commission of India<sup>8</sup>.

However there is scarcity of post-mortem reports of judicial hanging cases executed by the Honourable Courts of Law.

In one case report by Wallace SK et al<sup>9</sup> showed one case with cervical spinal

ligamentous injury without injury to vertebral arteries or cervical cord. Whereas in another case they reported subluxation at C2, C3 with complete cord transection. Cause of death in the first case where cervical cord was spared was subarachnoid hemorrhage of cerebral hypoxia whereas in the second case where there was transection of the cervical cord, the cause of death was major spinal cord injury with subarachnoid hemorrhage.

Similar opinion was expressed by Jha MK et al who opined that though popular textbooks quote fracture cervical vertebra is cause of death in judicial hanging, recent case reports show otherwise<sup>10</sup>.

An English Surgeon who examined cases of Judicial hanging opined that "Dislocation of the neck is the ideal aimed at, but, out of all my post-mortem findings, that has proved rather an exception, which in the majority of instances the cause of death was strangulation and asphyxia"<sup>8</sup>.

### CONCLUSION

It can be concluded from our discussion that cause of death in majority of cases of Judicial hanging is asphyxia rather than fracture dislocation of cervical vertebrae. Since asphyxia is more painful than death by transection of spinal cord, other forms of execution may be considered by the Judiciary and Executive of the countries practicing hanging as a mode of execution.

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# Occupational Health and Safety Measures in a Mortuary of a Private Tertiary Care Medical College Hospital, Bangalore

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## ABSTRACT

**Introduction:** Mortuary services are integral to the compendium of services provided by a tertiary health care centre. Mortuary or Post-Mortem rooms have potential hazards and risks for the health personnel as well as attendants of the deceased. **Objectives of the study:** To identify existing practices and Occupational Health and Safety (OSH) measures in a Mortuary and to assess the use of Personal Protective Equipment (PPEs) among Health Care Workers. **Material and Method:** This is a cross-sectional study set in a private tertiary care teaching hospital. An Observation Checklist was developed for the purpose of assessing hazards which was partially based on Occupational Hazard Checklist of OSHA for a Mortuary. **Results:** The personnel involved in transporting the body to the mortuary are exposed to the biological hazards namely the body fluids of the deceased and exposure to aerosols spills and splashes incidental to activities in the Post Mortem Room. The potential physical hazards are injuries due to slips and falls. The potential chemical hazards are contact dermatitis and allergic asthma due to exposure to formalin vapours in cases of embalming and drugs/chemicals ingested by the deceased. The workers are at risk for Pulmonary Tuberculosis, Hepatitis B and HIV. The potential ergonomic hazards are musculoskeletal diseases and Repetitive Stress Injuries at the shoulder, elbow and small joints of the hands. The PPEs use was not consistent in most areas of the mortuary.

**Keywords:** Occupational Hazards, Mortuary, Forensic Medicine Department, Tertiary care Hospital, PPEs.

## INTRODUCTION

Any person involved in an occupational activity is at risk of Occupational Hazard, whether working on a lathe machine or with computer, travelling to meet clients or studying for an impending examination has an occupational hazard. These hazards, if ignored, may lead to occupational disease(s). Awareness of hazards and appropriate preventive measures mitigate or prevent most occupational diseases. In short, no occupation is without an occupational hazard and all occupational hazards can be prevented.<sup>1</sup>

The joint International Labour Organisation/ World Health Organisation (WHO) Committee on Occupational Health, in the course of its first session held in 1950 summarised that the Occupational health should aim the adaptation of work to man and of each man to his job.<sup>2</sup>

Occupational Health and Safety (OSH) is as important in the health care setting as it is in any industrial or agricultural setting.<sup>3</sup> Exposure to hazardous agents depends upon the job category and the work environment of the HCW.<sup>4</sup>

WHO estimates that there are 59.8 million Health Care Workers (HCWs) worldwide. About two-thirds (39.5 million) provide health services and other one-third (19.8 million) are management and support workers which includes those working in ancillary departments like Laundry, Dietary,

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Centralised Sterilization and Supply Department (CSSD), Laboratory, Mortuary, Ambulance Services and Administrative Departments.<sup>5</sup>

Many studies documenting the incidence of needle stick injuries and occupational hazards are among HCWs are available;<sup>6,7</sup> however there are only few studies with respect to Mortuary Department's personnel.<sup>8,9</sup> The Mortuary or Post-Mortem room is a source of potential hazards and risks for the staff and attendants of the deceased visiting mortuary.

### OBJECTIVES OF THE STUDY

1) To identify existing practices and occupational safety measures in Mortuary of Department of Forensic Medicine of a private medical college hospital and

2) To assess the use of PPEs by the staff of Mortuary.

### MATERIAL & METHOD

**Study design:** Cross-sectional study.

**Study area / location:** The study setting was a private tertiary care medical college hospital located in Bangalore City with bed strength of 1200 beds and bed occupancy of approximately 85%. The Hospital provides speciality and super speciality services. Mortuary is attached to Department of Forensic Medicine. On an average about 20 post-mortems are conducted.

#### Selection of the study population

**Inclusion criteria:** Currently working individuals who consented to participate in the study.

**Study period:** The survey was undertaken between September 2009 and August 2010.

#### Instruments used for the study

An observation checklist was developed by the research team. This observation checklist was partly based on

- Occupational Hazard Checklist by the Occupational Safety and Health Administration (OSHA)<sup>(10)</sup>
- And partly self-developed (based on interactions with domain experts and observation of activities at the department).

The questions were based on the literature review on hazards for the workers involved in these activities. *Validation of the Observation Checklist:* The checklists were face validated by three experts in the field of Occupational Health working in large tertiary care hospitals in Bangalore City and their comments and suggestions were incorporated. This was field tested and validated for applicability for this study.

### METHOD OF DATA COLLECTION

#### 1. Non-participatory Observation

The researchers made multiple visits to the mortuary and the activities during and after the post-mortem were observed to document the work processes and occupational safety measures in place therein.

**2. Interviews with workers:** Informed consent was obtained from the workers. A pretested interview schedule was administered to identify the factors determining the appropriate use of PPEs. An unannounced visit was also made to observe the practice of use of PPE.

#### 3. Qualitative Data

The qualitative data was documented by the following methods

1. On site interaction with the workers during the visits were undertaken to determine the reasons for not utilising the PPEs.
2. Key informant interviews were conducted using a semi-structured questionnaire. The key informants for the study were:
  - a. The Head of the Department of Forensic Medicine.
  - b. Other teaching staff of the Forensic Medicine Department.
  - c. Selected workers in the Mortuary.

### ANALYSIS OF DATA

The data collected was entered into Excel spreadsheets and analyzed using Microsoft Excel. Frequency tables were used to describe the distribution of study variables in the population.

## FINDINGS

### I. Description of the physical structure of the Mortuary

The Mortuary has been divided into various sections based on activities that happen in a specific area (figure 1). It included,

1. **Receiving Area:** An area where the deceased (body) are received due to death at the hospital or death outside the hospital.

2. **Cold Storage Area:** An area where the deceased body received is stored at the mortuary. The body is stored till its final disposal. For all natural deaths the body is handed over to the relatives and those of unnatural deaths are stored till the post-mortem procedure is conducted by the forensic experts.

3. **Post-mortem Procedure Room:** This room has a hall and a bathroom. The hall contains the mortuary table and equipment required for conducting the post-mortem and a bathroom for the workers for washing and bathing after the procedure.

4. **Common Area:** This region is common to the Cold Storage Area and Post-mortem Rooms. At this area the bodies of the deceased are temporarily placed before transferring to Storage Area or Post-mortem Room and before handing the body to the attendants.

5. **Prayer Area:** Here body is placed temporarily to facilitate the relatives to perform rituals.

6. **Doctor's Room:** This facility is where the forensic experts interact with police, and attendants or relatives of the deceased.

7. Room for the mortuary technicians and attenders.

### II. Biological hazards at the Mortuary Department

- The personnel involved in transporting the deceased (body) to the mortuary are exposed to biological hazards via the body fluids while transferring the deceased body on to the trolley in the ward and to the mortuary.

- While transporting (loading) body in the vehicle, the personnel are at risk of exposure to the

body fluids. In situations where the vehicle is small the nursing staff and attendants of the deceased are obliged to manoeuvre the body into the vehicle. This close contact with the body and/or body fluids thereof exposes them to risk of infections.

- The mortuary attenders, the forensic expert and the mortuary technician are at risk of infection due to exposure to the body fluids (spills and splashes) during the post-mortem procedure. There is generation of aerosols as well, that could potentially be inhaled by the attending staff.

- The attenders are at risk of sharp injuries especially while assisting for dissecting the body for examination using the scalpel, cutting the costochondral junctions to open the chest, while cutting the skull with a bone-saw and during suturing the skin to close the chest, skull and abdominal cavities. The attender's exposed body parts (part of the forearm) come in contact with the body fluids while shifting the body from one site to another and while taking anthropometric measurements and while preparing the body to be handed over.

### III. Physical and environmental hazards at the Mortuary

- The workers are at risk of slips and falls in the Post-mortem Room during the process if the floor is wet.

- The workers are exposed to the odours in the Cold Storage Room and gases formed due to decomposition of the bodies.

### IV. Ergonomic hazards at the Mortuary

- Due to paucity of the space in the vehicle, it was observed that the personnel involved are forced to twist their trunk and maintain awkward/bad postures and positions that may cause injury to the muscles of the back.

- The workers are at risk for MSDs while shifting the body from one site to another and during the post-mortem procedure and preparing the body for handing over the body to the relatives of the body.

- There are at risk of RSIs while cutting the skull using a bone saw.

- They are at risk of RSIs during the activity of

cutting the skulls by ordinary saw apart from being at risk of injuries due to cuts whilst using sharp equipment for procedure.

#### V. Chemical hazard at the Mortuary

- The worker reported that they sometimes have severe bouts of cough and breathing difficulty and eye irritation while preparing the formalin solution and also while embalming the body.

- Rarely the workers may get exposed to the toxic drugs that the patients were treated with while in hospital or at home, chemicals (poisons) consumed by the patient. However the experts opine that it is very rare.

#### VI. Personal Protective Equipments

- Personnel involved in transportation of the deceased (body) did not use appropriate PPEs during the activity.

- Nursing staff accompanying the deceased (body) used aprons, gloves, shoes and masks. However the use of mask and gloves were not consistent. The reasons stated were that during the change of shifts due to urgency they usually forget and while transferring the body of a child, as most of its handling is by the attendants of the deceased.

- The security personnel posted to Mortuary, did not use masks, gloves and aprons as they were not made available to them, as the assumption is they do not handle bodies. However, in practice they do assist in transfer of bodies as and when required.

- The worker used a pair of disposable gloves and shoes. They are also exposed to malodour of the bodies stored in this area.

- It was observed that during the post-mortem procedure, the mortuary assistant and the technician changed their clothes, and used the masks, disposable plastic apron covering only front of the body. They did not use the boots and goggles. The area has an exhaust fan.

#### VII. Characteristics of the workers in the Mortuary

There are seven personnel in Mortuary section of which 5 were males and 2 were females (Table 1). Among males, 60% were aged above 56 years (Table 3 and 4) and had experience of more than 30 years.

Six employees were permanent. Among the forensic experts there were equal number of male and females.

## DISCUSSION

#### Occupational Hazards

- The personnel involved in transporting the body within the mortuary are at risk of infections due to exposure to body fluids either by direct contact or through inhalation of aerosols. A study by the Collins et al<sup>9,11</sup> have mentioned that staff of necropsy rooms are estimated to be between 100 to 200 times more likely than the general public to develop tuberculosis and are also at high risk of contracting Hepatitis B and HIV infections. The forensic medical experts, mortuary technicians are higher risk of exposure to variety of hazards like biological, chemical and physical hazards and these risks are higher among the professionals and technicians in India due to lack of cleanliness. This risk was alluded to by the Head of the Department during the KII. In the KII with the workers it was noted that none of them had availed of the Hepatitis B vaccine.

- The attender was also exposed to the formaldehyde solution used for embalming which sometimes leads to bouts of cough and redness of eyes (irritation).

- The personnel involved in transportation and loading the body into the storage area have to lift the body above their shoulders to load into the cold storage room. This can lead to MSDs.

- Forensic team consulted for conducting post-mortem of all unnatural deaths.

- During the KII with the Head of the Department it was noted that unnatural deaths form only 5% to 10% of bodies received at the Mortuary.

#### Personal Protective Equipment

- It was observed that the personnel involved in transportation of the body did not use appropriate PPEs during the activity. The reasons were as follows:

- The nurses reported that they sometimes forget to use gloves and mask.

- During change of shifts and also perceived belief that they are not at risk as they do not come in

contact with body of the deceased often.

- The security personnel and the attenders did not use gloves and masks as they were not aware as to how to access these.

**Table 1: Age and Gender distribution of the workers in Mortuary Department**

Age group in years	Gender		Total(%)
	Male	Female	
26-35(%)	0(0)	1(100)	1(14.3)
36-45(%)	1(100)	0(0)	1(14.3)
46-55(%)	1(50)	1(50)	2(28.6)
956(%)	3(100)	0(0)	3(42.8)
<b>Total(%)</b>	<b>5(71.4)</b>	<b>2(28.6)</b>	<b>7(100)</b>

**Table 2: Distribution of the workers based on employment status**

Employment status	Gender		Total(%)
	Male	Female	
Permanent(%)	5(83)	1(17.0)	6(85.7)
Casual/Contractual/Temporary(%)	0(0)	1(100)	1(14.3)
<b>Total(%)</b>	<b>5(71.42)</b>	<b>2(28.58)</b>	<b>7(100)</b>

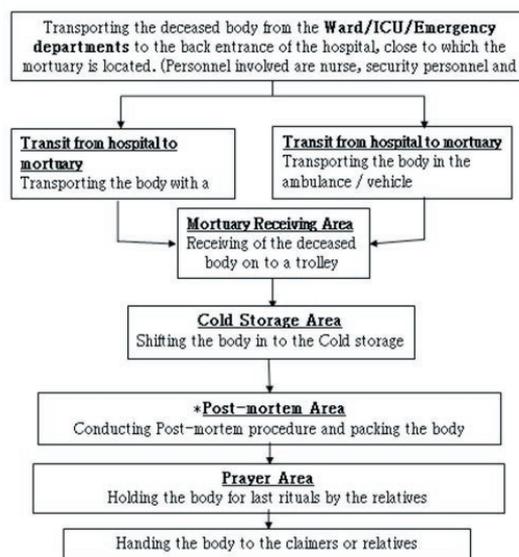
**Table 3: Distribution of the workers based on the working category**

Work Designation	Gender		Total(%)
	Male	Female	
Forensic experts(%)	2(50)	2(50)	4(57.14)
Mortuary technician(%)	1(100)	0(0)	1(14.28)
Mortuary attenders(%)	2(100)	0(0)	2(28.58)
<b>Total(%)</b>	<b>5(71.42)</b>	<b>2(28.58)</b>	<b>7(100)</b>

**Table 4: Categorization of the workers based on the years of experience**

Years of experience	Gender		Total(%)
	Males	Females	
1-5(%)	0 (0)	1 (50)	1 (14.28)

6-10(%)	0 (0)	0 (0)	0 (0)
11-15 (%)	1 (20)	0 (0)	1 (14.28)
16- 30(%)	1 (20)	0 (0)	1 (14.28)
930 years(%)	3 (60)	1 (50)	4 (57.14)
<b>Total(%)</b>	<b>5 (71.42)</b>	<b>2 (28.58)</b>	<b>7 (100)</b>



\* Post-mortem procedure is done only for unnatural deaths, hence for natural deaths this step is skipped.

**Figure 1: The schematic representation of various areas of Mortuary Department and the activities in each area**

### CONCLUSIONS

1. The study revealed the various Occupational Health and Safety Hazards inherent to a Mortuary section.
2. The health care workers were exposed to the physical, chemical, biological and ergonomic hazards.
3. The physical and environmental hazards were found to be very common in Post mortem Room. Standard and regular housekeeping activities can potentially reduce the hazards.
4. The consistent and correct use of PPEs is not universally followed.
5. Regular education sessions, motivation and monitoring will help improve compliance vis-a-vis PPEs use.
6. The study institution has policies for the welfare of the health care workers.

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**Ethical Clearance:** Approved by Institutional Ethics Committee of St.Johns Medical College.

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**Conflict of Interest:** Nil

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# Gender Identification Study of a Dry Human Mandible by Assessing its Measurable Dimensions

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## ABSTRACT

It's never an easy task for the forensic experts when it comes to opining on sex determination from dry bones. Some mandibles, rare though, do puzzle us while opining on sex in identifying an individual. Thus, more research was felt needed, and therefore, measurable parameters of mandible like maximum chin width (MCW), angular width (AW), angular length (AL) and maximum mandibular length (MML) were identified and studied by the author of the present study. Dry mandibles, preliminarily assessed for gender, and greater than 17 years of age, were included. Dry mandibles exhibiting sexual dimorphism and/or of lesser age were excluded from the study. The data thus obtained was tabulated, statistically analyzed and discussed. Mean, standard deviation and standard error of mean were calculated using the data obtained, and statistical significance with  $p < 0.05$  was assessed. Significant statistical results were attained by the present study, and thus, can be reliably used in sex differentiation of adult dry mandibles.

*Keywords* – Forensic; study; gender; identification; mandible; dimensions.

## INTRODUCTION

It's never an easy task for the forensic experts when it comes to opining on sex determination from dry bones. No doubt, hip bone has been the most informative bone when it comes to sex determination. But mandible isn't far behind. When it comes to identification of an individual, mandible lives up to the quote, 'small things come with big packages'. Mandible, being a comparatively smaller bone to that of skull, or a hip bone, has a package of data necessary for identification of an individual.

'Mandible' is a latin word which means lower jaw. 'Mandere' means 'to chew'. It is the strongest bone of facial skeleton and is best preserved after

death. Mandible, maxilla and teeth are known to be the best preserved parts of the body after death. In mass disasters like air crashes, wars, railway accidents, floods etc., it has been immensely useful in identifying the dead. However, an accurate determination of sex can be done in over 90 percent of cases using only pelvis and skull. <sup>[1]</sup>

While determining sex from a dry mandible, we routinely analyze features like chin size, its shape & height at symphysis menti, mandibular angle, breadth of ascending ramus, mylohyoid groove, and teeth morphology. But, have we solved the issue of dimorphism in relation to the mandible? The answer is still 'NO'. Some mandibles, rare though, do puzzle us while opining on sex in identifying an individual from skeletal remains. Thus, more research was felt needed by the author of the present study, in relation to sex determination with dry human mandible. And therefore, measurable parameters of mandible like maximum chin width (MCW), angular width (AW), angular length (AL) and maximum mandibular length (MML) were identified and studied by the author of the present study. The data thus obtained was tabulated, statistically analyzed and discussed.

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## MATERIAL & METHOD

Material for this cross-sectional study consisted of 40 unidentified dry human mandibles. Gender was preliminarily assessed by examining important parameters like general size & shape, chin width, shape and its height at symphysis menti, prominence of the mental tubercle, eversion/inversion at mandibular angle, breadth of ascending ramus, mylohyoid groove depth, teeth size and first permanent mandibular molar cusps. With the preliminary assessment, mandibles with male features were found to be 22 in number, and those of females were 18. The study was conducted on dry mandibles from teaching collection of the Anatomy department (after having taken consent from the head of that department) at Karpaga Vinayaga Institute of Medical Sciences and Research Centre, India. Dry mandibles, preliminarily assessed for gender, and greater than 17 years of age, were included. All the bones were assessed to be greater than 17 years based on presence of 3<sup>rd</sup> permanent molar tooth/ its empty socket/ presence of spacing for the same. Dry mandibles exhibiting sexual dimorphism and/or of lesser age were excluded from the study. With 41 dry mandibles available, 1 was excluded by implementing exclusion criteria. With confidence level at 95% and confidence interval at 3, sample size was determined as 40 (Fig1).



**Fig1: Sample size**

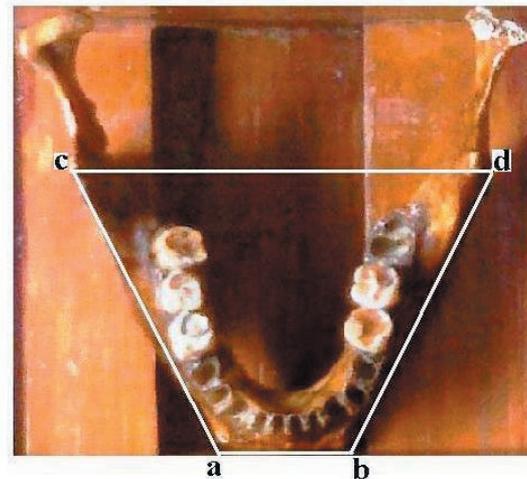
Measurements taken were maximum chin width, angular length, angular width, and maximum mandibular length. Maximum mandibular length (MML) was measured using Hepburn's osteometric board with the two wooden planks approximated at the outer chin margin on one end, and the mandibular condyles on the other (Fig2).

The other three parameters, maximum chin width (MCW), angular length (AL) and angular width (AW) were assessed by marking points (a,b,c & d) with a ballpoint pen (Fig3) on a neat blank

sheet of paper. Points 'a' & 'b' denoted the lateral most prominent points on the outer chin margin. Points 'c' & 'd' denoted the angles of that mandible (lower margin) at the point of maximum eversion/prominence. The four points were joined by straight lines as shown in the figure. Line ab corresponded to maximum chin width (MCW). Line cd corresponded to angular width (maximum width of the mandible at the level of its angle made between the horizontal and the ascending ramus). Angular length (AL) corresponded to the perpendicular distance between lines ab & cd. The respective parameters were then measured with a measuring scale.



**Fig 2: Maximum mandibular length (MML) measured using Hepburn's osteometric board**



**Fig3: Measurement method for assessing MCW, AL and AW**

Using the measurements mentioned above, two indices were calculated, mandibular length index (MLI) and mandibular width index (MWI). Mandibular length index (MLI) was angular length (AL)/ maximum mandibular length (MML) x 100. Mandibular width index (MWI) was maximum chin width (MCW)/ angular width (AW) x 100.

The observations were tabulated and statistically analyzed with unpaired t test. Significance level was assessed with p value < 0.05. Correlation study, linear regression type, between angular length (AL) and maximum mandibular length (MML) for all the 40 mandibles was also done.

**FINDINGS**

Observations for all the mandibles [male mandibles (n) = 22, female mandibles (n) = 18]

were tabulated into a master-chart. Mean, standard deviation and standard error of mean were calculated using the data obtained, and statistical significance with p<0.05 was assessed using unpaired t-test. Tables 1-5, highlight on the unpaired t test significant results for the parameters MML, AL, AW, MCW, and MWI respectively. However, the results, mean values for male and female mandibles being 63.47% and 63.33% respectively, were not significant with reference to mandibular length index (MLI).

**Table 1: Unpaired t test results with maximum mandibular length (MML) as parameter**

MML	Mean (cms)	Standard Deviation (SD)	Standard Error of Mean (SEM)	n	Results (R)	Statistical Significance (SS)
Male features	10.39	0.225	0.048	22	P value<0.0001 >10.3cms=Male <10.2cms=Female 10.2-10.3=Dimorphic	Extremely Significant
Female features	10.11	0.151	0.036	18		

**Table 2: Unpaired t test results of mandible with angular length (AL) as parameter**

Angular Length (AL)	Mean (cms)	Standard Deviation (SD)	Standard Error of Mean (SEM)	n	Results (R)	Statistical Significance (SS)
Male features	6.6	0.166	0.035	22	P value=0.0004 >6.5cms=Male <6.4cms=Female 6.4-6.5cms=Dimorphic	Extremely Significant
Female features	6.4	0.137	0.032	18		

**Table 3: Unpaired t test results of mandible with angular width (AW) as parameter**

Angular width (AW)	Mean (cms)	Standard Deviation (SD)	Standard Error of Mean (SEM)	n	Results (R)	Statistical Significance (SS)
Male features	9.43	0.170	0.036	22	P value< 0.0001 >9.3cms=Male <8.6cms=Female 8.6-9.3cms=Dimorphic	Extremely Significant
Female features	8.49	0.123	0.029	18		

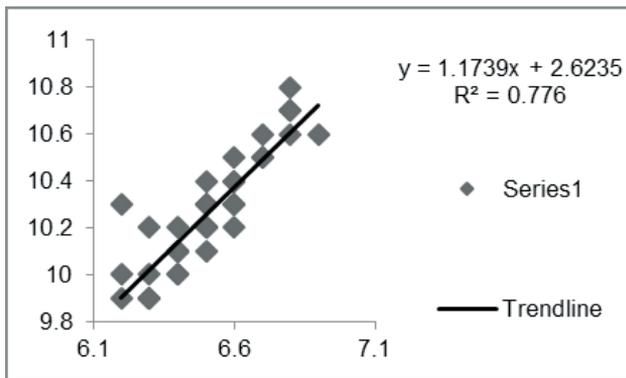
**Table 4: Unpaired t test results of mandible with maximum chin width (MCW) as parameter.**

MCW	Mean (cms)	Standard Deviation (SD)	Standard Error of Mean (SEM)	n	Results (R)	Statistical Significance (SS)
Male features	3.08	0.165	0.035	22	P value< 0.0001 >2.9cms=Male <1.2cms=Female 1.2-2.9cms=Dimorphic	Extremely Significant
Female features	1.09	0.137	0.032	18		

**Table 5: Unpaired t test results with Mandibular width index (MWI) as parameter**

MWI (MCW/AW x 100)	Mean %	Standard Deviation (SD)	Standard Error of Mean (SEM)	n	Results (R)	Statistical Significance (SS)
Male features	32.67	1.357	0.289	22	P value< 0.0001 >31.30%=Male <14.30%=Female 14.3-31.3=Dimorphic	Extremely Significant
Female features	12.80	1.480	0.349	18		

**Fig 4: highlights on the correlation study (linear regression type) between angular length and maximum mandibular length for all the 40 mandibles. The result was low positive correlation.**



**Fig 4: Correlation (linear regression type) between AL & MML displaying low positive correlation**

**DISCUSSION**

Parameters of the dry mandible considered by the author of the present study were found to be unique in a way that references with similar study parameters were hardly available. Martin (1936) [2], Morant (1936) [3], Clever (1937) [4], Hrdlicka (1940) [5], Stewart (1954) [6], Hanihara (1959) [7], and Giles (1964) [8] worked on biometrics, mathematical methods and parameters like symphyseal height, gonial angle, bigonial breadth and discriminant function analysis etc. In India, Heereshchandra and Malaviya (1972) [9] studied subjective signs of mandible taking into account that chin is squarer in male and round in female. Mallik, (1969) [10], Brothwell (1981) [11] and Surendranath (1989) [12] studied on minimum & maximum breadth of the ascending ramus of the mandible, while Lockhart (1965) [13], Whittaker (1989) [14], and Prakash and Abdi (1987) [15] studied on mandibular angle (angle made by the ascending ramus with the horizontal one).

Statistical results with relation to the length parameters, maximum mandibular length (MML) and angular length (AL), were extremely significant

in the present study. A typical male mandible (sexual dimorphism absent) tends to be longer (in relation to MML & AL) than a typical female mandible. This could be due to larger size, forward projecting wider chin, and a broader ascending ramus of male mandibles. The author of the present study also observed that female mandible has one factor that contributes uniquely to its length, which is, a more obtuse mandibular angle. Lockhart (1965) [13], Whittaker (1989) [14], and Prakash and Abdi (1987) [15] had confirmed this in their respective studies. However, in the present study, this unique factor in a female mandible wasn't found significant enough to make it longer than a male mandible. Width parameters, angular width (AW) and maximum chin width (MCW), also gave extremely significant statistical results. In a male mandible, angular width is contributed by more prominent, outward angulation and eversion at the mandibular angle. Female mandibles lack these features. With relation to maximum chin width, it's the shape that is the deciding factor for the significant difference between a male mandible and a female one. Male mandibles have a broad 'U' shaped chin, whereas a female one is more of a narrow and 'parabola' shape.

The only result that was not statistically significant was the mandibular length index (MLI). This could be due to wide variations in the mandibular angle between male and female mandibles. Female mandibles tend to have greater and more obtuse mandibular angle compared to that of a male leading to disproportionate increase in its maximum mandibular length (MML) to that of angular length (AL).

**CONCLUSION**

Significant results were attained by the present study, which, the author of the present study feels, can be reliably used in sex differentiation of adult dry mandibles. Maximum mandibular length (MML),

greater than 10.3cms, is a significant indicator for mandibles to be opined as belonging to 'male' gender. Those lesser than 10.2cms length were females. Mandibles with angular length (AL) greater than 6.5cms were males. Those lesser than 6.4cms length were females. Mandibles with angular width (AW) greater than 9.3cms were males. Those lesser than 8.6cms width were females. Mandibles with maximum chin width (MCW) greater than 2.9cms were males. Those lesser than 1.2cms width were females. Mandibles with mandibular length index (MLI) greater than 64.40% were males. Those lesser than 62.80% value were females. Mandibles with mandibular width index (MWI) greater than 31.30% were males, and those lesser than 14.30% value were females.

There is no doubt over the fact that 'larger the sample size, more reliable is the result'. The present study had an average sample size, which, the author of the present study believes is the only limitation of the study. However, author also believes to have given the best of efforts to overcome this limitation while recording observations to the best of accuracy during the study with the available material, and thus, results are equally reliable.

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# Study of Pattern of Thoraco-abdominal Injuries in Fatal Traumatic Cases

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## ABSTRACT

The objective of this study was to find out pattern of thoracoabdominal injuries in medicolegal cases of fatal trauma with regards to age and sex, survival period, causes and complications leading to death of the victims. Materials for the present study were collected from the 179 cases of fatal medicolegal cases of thoraco-abdominal injuries which were brought for autopsy at the mortuary of MGIMS Sevagram and District Civil Hospital, Wardha during the period from 1<sup>st</sup> July 2008 to 30<sup>th</sup> June 2010 and this cases were comprehensively studied. It was found that most commonly involved age group was 21 to 40 years with males outnumbering the females in a ratio of 6.7:1. Vehicular accident was the leading cause for fatalities in 66.48%, followed by railway accidents in 19.55%, domestic accidents in 3.91% while the homicidal assaults accounted for 7.82% cases. 45.81% of the victims died on the spot while 19.55% died before reaching to hospital during transportation. Most of the patient (44.13%) sustained combined thoraco-abdominal injuries in common followed by 36.31% sustaining thoracic injuries only. Fracture of ribs was the commonest thoracic injury found in 64.80% victims followed by injury to the lungs in 45.81% and heart in 5.58% cases. Liver was the most commonly affected abdominal organ in 43.01% followed by spleen in 25.13% and kidneys in 11.17% cases. In majority i.e. 87.15% cases the cause of death was haemorrhagic shock indicating that timely intervention could have saved the lives of unfortunate hapless victims.

**Keywords:-** thoraco--abdominal injuries, thoracic injury, Vehicular accident, domestic accidents, homicidal assaults.

## INTRODUCTION

Thoraco-abdominal region due to its anatomical position and dimensions is the major site of impact in any form of blunt trauma.<sup>[1]</sup> Since prehistoric times, thoraco-abdominal cavity has been looked upon as one of the most vulnerable regions of the body, and injuries involving it, have always been considered very serious.<sup>[2]</sup>

Thoraco-abdominal injuries are caused by wide variety of reasons like road traffic accidents, railway accidents, industrial mishap, penetrating

trauma, blunt trauma and growing menace of terrorism globally involving bomb explosion injuries and iatrogenic or therapeutic injuries <sup>[2]</sup>The bony thoracic cage contains vital organs of circulation and respiration and trauma to these organs challenges the integrity and viability of entire organisms, similarly abdomen is the third commonest region of body that is injured in civilian trauma, as human abdomen is largely unprotected by bony structure. Injuries to abdomen are important as it contains numerous vital organs like liver, spleen, kidney, pancreas and hollow viscous like stomach, intestines and urinary bladder and injuries to these organs are significant as isolated injuries to liver, spleen and intestine can be saved if timely surgical aid is provided to them.

In present study the thoraco-abdominal injuries were evaluated according to age, sex, manner of

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injury, pattern of injury and period of survival after sustaining injury. Attempt was made to assess what kind of injury is incompatible with life and what are fatal frequent complications. This will play a significant role in future planning to reduce morbidity and mortality, and to develop preventive strategies against such injuries.

## MATERIAL & METHOD

Present study was carried out at mortuary of MGIMS Sevagram and District Civil Hospital, Wardha. Present study consist of 179 cases of fatal thoraco-abdominal injuries which includes the deceased which are died on spot, dead on arrival and died after hospitalisation during the period 1<sup>st</sup> July 2008-30<sup>th</sup> June 2010. Routine information like age, sex, brief facts/history about the cases etc was collected from the inquest report and accompanying relatives of the deceased in case of spot dead cases, brought dead cases and from the hospital records and death summaries in admitted cases.

## OBSERVATIONS

**Table No.1** shows age and gender wise distribution of fatal medicolegal cases of thoraco-abdominal injuries. Males (87.15%) are the major victims as compared to females (12.84%). Altogether more than half of the victims (50.83%) are of younger (21-30 & 31-40) age group as compared to elder ones.

**Table No.2** shows distribution of fatal medicolegal cases of thoraco-abdominal injuries as per casualties involved. Road traffic accidents (66.48%) are the major cause of fatalities followed by railway accidents (19.55%) while homicidal assaults had led to the effect for few (7.82%) of them.

**Table No.3** shows distribution of fatal medicolegal cases of thoraco-abdominal injuries as per period of survival with respect to body region involved. Major victims are spot dead (45.81%) which mostly sustained both thoracic and abdominal injuries (22.34%) while some had only thoracic injuries (17.31%). They are followed by brought dead victims (19.55%) who also suffered mostly from both thoracic and abdominal injuries (10.05%).

**Table No. 4** shows distribution of cases as per pattern of fatal medicolegal thoracic injuries. Ribs (68.15%) are more frequently injured in these victims followed by lungs (45.81%), while heart (5.58%),

sternum (3.35%) and diaphragm (2.23%) injured in few cases only.

**Table No. 5** shows distribution of cases as per pattern of fatal medicolegal abdominal injuries. Liver is more frequently injured organ (43.01%) as compared to spleen (25.13%) and kidneys (11.17%) among these victims while few sustained injury to hollow organs like intestine (6.7%), bladder (3.35%), and stomach (2.79%). Injury to prostate and uterus is not observed in our study.

**Table No.6** shows profile of cause of death among fatal medicolegal cases of thoraco-abdominal injuries. Haemorrhagic shock (87.15%) is the profound cause of death among these victims followed by crush injury (8.93%), peritonitis (3.35%) and cardiac temponade (0.55%).

## DISCUSSION

In the present study maximum numbers of victims i.e. 26.81% are of young age group of 21-30 years followed by 24.02% in 31-40 years. Meera & Nebhachandra and Singh & Dhatarwal reported almost same findings<sup>[1,3]</sup>. Young age group individuals are more active, fearless, negligent, frequently going outdoor for work making them vulnerable to danger of accidents and injuries.

In the present study males were found to be more prone for accidents, involved in 87.15% of fatalities as compared to females in 12.84% fatalities. Meera & Nebhachandra and Ghangle et al had same observations<sup>[1,4]</sup>. This obviously is due to fact that our society is paternalistic in nature where males play a lead role and are involved in more outdoor activities as compared to female counterparts.

Present study revealed major cause of fatal thoraco-abdominal injuries to be accidents amounting for 92.17% as compared to 7.82% cases of homicidal assault. Not a single case of suicide was observed in the present study. Road traffic accident was the chief cause in 66.48% cases followed by railway accidents in 19.55% cases.. Meera & Nebhachandra also almost similarly observed 86.40% cases of accidents and 8% cases of homicidal assaults responsible for thoraco-abdominal injuries. Ganveer & Tiwari also reported similar findings in their study. <sup>[1,5]</sup> Injuries to chest and abdomen are mostly accidental, occasionally homicidal and rarely suicidal<sup>[5]</sup> due to accessible and unprotected nature.

Present study also revealed that majority of the victims died on the spot i.e. (45.81%) of which most of them (22.34%) had sustained combined thoraco-abdominal injuries. These was followed by brought dead victims (19.55%) in which only (10.05%) had sustained combined thoraco-abdominal injuries., Husaini et al and Ghangle AL. et al had also observed similar pattern.<sup>[2,4]</sup> It is very easy to understand that most of major vital organs of the body are located in these two cavities and injuries to these organs cause severe blood loss leading to death emphasizing to design and plan strategy to protect these vital areas of the body.

In the present study it was noted that injury to the ribs was commonest thoracic injury (68.1%) followed by injuries to the lungs (45.81%), heart (5.58%), sternum (3.35%), and diaphragm (2.23%). Galen et al, Bansal et al, Lalwani et al<sup>[7,8,9]</sup> also had similar observations . In thoracic injuries it was found that fracture of ribs occurred in most of the cases. This can be explained as fracture of ribs occurs even with slightest violence due to diminished elasticity and brittleness of bones in old age, rickets, osteomalacia and general wasting diseases. Lungs are most commonly affected as they occupy most of the space of the thoracic-cage making them more vulnerable to injury by trauma as compared to the other organs.

In the present study liver was most commonly injured among abdominal organs (43.01%) as compared to spleen (25.13%), kidneys (11.17%), intestine (6.7%), bladder (3.35%), pancreas (2.79%) and stomach (2.79%). Haruff et al., Banerjee et al also observed quite similar findings.<sup>[10,11]</sup> Involvement of liver is also supported by Reddy in which it is stated that liver is commonly injured, intraperitoneal organ, because of its large size extending from

fourth intra-costal space sometimes down up to the iliac crest. Structures most likely to be damaged in blunt abdominal trauma in order of frequency are: liver, spleen, kidney, intestines, abdominal wall, mesentery, pancreas and diaphragm.<sup>[12]</sup>

Importantly this study also shows that hemorrhagic shock is predominant cause of death (87.15%) followed by crush injury (8.93%), peritonitis (3.35%) and cardiac tamponade (0.55%) in fatal medicolegal thoraco-abdominal injury cases, which mostly die on the spot or are brought dead victims. Meera & Nabachandra (2005) and Ponifasio et al also had similar observation <sup>[1,13]</sup> The obvious reason is that that most of the vital organs are located in these two cavities and injuries to these organs causes severe blood loss leading to haemorrhagic shock.<sup>[2]</sup> Saukko & Knight have also reported that - any injury to chest wall or lung surface that breaches blood vessels and the plural cavities can lead to haemorrhage in thoracic region.<sup>[14]</sup>

## SUMMARY

Most commonly involved age group was 21 to 40 years and this group accounts for 50.83% of victims. Present study shows Male predominance in ratio of 6.7:1. Accidents are the major cause of fatalities accounting for 92.17% among which road traffic accidents are responsible for 66.48% of fatalities while homicides for 7.82% of fatalities. Major victims are spot dead (45.81%) which mostly sustained both thoracic and abdominal injuries (22.34%) while some had only thoracic injuries (17.31%). Ribs (64.80%) are more frequently injured in these victims. Haemorrhagic shock (87.15%) is the profound cause of death among these victims followed by crush injury (8.93%).

**Table No.1:-Age and gender wise distribution of cases**

Age Group	1-10	11-20	21-30	31-40	41-50	51-60	61-70	More than 70	Total
Male	2 1.11%	7 (3.91%)	42 (23.46%)	37 (20.67%)	29 (16.20%)	22 (12.29%)	10 (5.58%)	7 (3.91%)	156 (87.15%)
Female	0	3 (1.67%)	6 (3.35%)	6 (3.35%)	6 (3.35%)	1 (0.55%)	1 (0.55%)	0 (0%)	23 (12.84%)
Total	2 (1.11%)	10 (5.58%)	48 (26.81%)	43 (24.02%)	35 (19.55%)	23 (12.84%)	11 (6.14%)	7 (3.91%)	179 (100%)

**Table No.2:-Distribution of thoraco-abdominal cases as per fatality**

Manner of Fatality	Road traffic accident	Railway accident	Domestic accident	Agricultural accident	Fall from height	Industrial accident	Homicide	Suicide	Total
No. of cases	119	35	7	2	1	1	14	0	179
%	66.48	19.55	3.91	1.11	0.55	0.55	7.82	0.00	100

**Table No.3 Period of survival and body region wise distribution of fatal thoraco-abdominal injuries**

Survival Period	Thorax Only	Abdomen Only	Thorax + Abdomen	Thorax + Fracture of Pelvis	Abdomen +Fracture of Pelvis	Thorax+ Abdomen +fracture of pelvis	Total No.
Spot Dead	31(17.31%)	06(3.35%)	40(22.34%)	01(0.55%)	03(1.67%)	01(0.55%)	82(45.81%)
Dead on arrival	12(6.7%)	03(1.67%)	18(10.05%)	0	01(0.55%)	01(0.55%)	35(19.55%)
Died in 0-1 Hr	05(2.79%)	05(2.79%)	07(3.91%)	01(0.55%)	01(0.55%)	0	19(10.61%)
1-2 Hr	04(2.23%)	03(1.67%)	02(1.11%)	0	01(0.55%)	0	10(5.5%)
2-6 Hr	08(4.46%)	06(3.35%)	07(3.91%)	0	0	0	21(11.73%)
6-12 Hr	01(0.55%)	01(0.55%)	02(1.11%)	0	0	0	04(2.23%)
12-24 Hr	01(0.55%)	0	01(0.55%)	0	0	0	02(1.11%)
1-7 Days	01(0.55%)	01(0.55%)	01(0.55%)	0	0	0	03(1.67%)
1 wk-2 wk	01(0.55%)	0	01(0.55%)	0	0	0	02(1.11%)
>2wk	01(0.55%)	0	0	0	0	0	01(0.55%)
<b>Total</b>	<b>65(36.31%)</b>	<b>25(13.96%)</b>	<b>79(44.13%)</b>	<b>02(1.11%)</b>	<b>06(3.35%)</b>	<b>02(1.11%)</b>	<b>179(100%)</b>

**Table No.4 Distribution of cases as per pattern of fatal thoracic injuries (n=179)**

Sr. No.	Organ/ Structure	Pattern of Injury			No. of cases
		Contusion	Laceration / Perforation	Crush	
1	Liver	09(5.02%)	58(32.40%)	10(11.1%)	77(43.01%)
2	Spleen	04(2.23%)	33(18.43%)	08(4.46%)	45(25.13%)
3	Kidneys	04(2.23%)	10(11.1%)	06(3.35%)	20(11.17%)
4	Pancreas	02(1.11%)	02(1.11%)	01(0.55%)	05(2.79%)
5	Stomach	02(1.11%)	02(1.11%)	01(0.55%)	05(2.79%)
6	Intestines	04(2.23%)	04(2.23%)	04(2.23%)	12(6.7%)
7	Bladder	04(2.23%)	-	02(1.11%)	06(3.35%)

**Table No.5 Distribution of cases as per pattern of fatal abdominal injuries (n=179)**

Sr. No.	Organ/ Structure	Pattern Of Injury			No. of Cases
		Contusion	Laceration/ Fracture	Crush	
1	Ribs	-	116(64.80%)	06(3.35%)	122(68.15%)
2	Lungs	07(3.91%)	69(38.54%)	06(3.35%)	82(45.81%)
3	Heart	01(0.55%)	03(1.67%)	06(3.35%)	10(2.23%)
4	Sternum	-	-	06(3.35%)	06(3.35%)
5	Diaphragm	01(0.55%)	01(0.55%)	02(1.11%)	04(2.23%)

**Table No.06: Profile of cause of death among cases of thoraco-abdominal injuries**

Cause of Death	Haemorrhagic Shock	Crush Injury	Peritonitis	Cardiac Temponade	Total
No. of Cases	156	16	06	01	179
Percentage	87.15	8.93	3.35	0.55	100.00

## CONCLUSIONS

From the above study, it was concluded that, thoraco-abdominal injuries constitutes potential factor in increasing the amount of mortality. A timely diagnosis and surgical intervention can be of great help to reduce the mortality rates in these cases. Preventive measures of all the epidemic disease is based on the cause. Similarly for reducing fatalities among these victims of road traffic accidents, it is essential to study the cause, which revolves around the epidemiological triad, i.e. host(driver),agent(vehicle) and environment(roads).So Strict enforcement of traffic rules and regulations , making it compulsory regarding use of device which controls the over speeding (governors) in all motor vehicles including designing of vehicles, widening of the roads with better road lightening and traffic signal lighting , and better indicators on the road are some of the preventive strategies. This study will not only help us to broaden the horizon of the knowledge of clinicians for treatment of trauma victims and medicolegalists to deposit evidence in the court of law but also help us to device strategies and policies to reduce mortality and morbidity from thoraco-abdominal injuries.

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# A Study of Injuries to Carotid Arteries in Vehicular Accidents

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## ABSTRACT

The study was conducted in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur. Total 100 cases were examined to study various patterns, anatomical location of the cervical carotid artery injuries. Traumatic vascular injury to the extra cranial circulation appears relatively underdiagnosed in part because of frequent co-existence of traumatic brain injury. The blunt injuries to the carotid arteries usually present late with devastating stroke. As per this study, the maximum number of cases belonged to the age group 21-30 years (27%) and 82% of the victims were male. In only 42.3% of the cases with carotid artery injuries, there were surface injuries to the neck. The most common vessel involved was left common carotid artery (45.9%) followed by right common carotid artery (35.1%). In maximum number of cases, the cause of death was head injury (65%) which usually masks the presentation of the carotid artery injury. The multiple i.e. dual vessel involvement was found in the 42.31% of the positive cases suggesting possible mechanism of hyperextension of the neck rather than direct trauma.

**Keywords:** Road traffic accidents, Carotid artery injuries.

## INTRODUCTION

Traumatic vascular injury to the extracranial circulation appears relatively underdiagnosed in part because of frequent co-existence of traumatic brain injury. The blunt injuries to the carotid arteries usually present late with devastating stroke. The diagnosis is often delayed, usually occurs only after the stroke resulting in neurological morbidity rate of 40%-80% and mortality rate of 5%-40%. Several life threatening complications arise from injury to carotid arteries.

In case of vehicular accidents, the most common mechanism involved is hyperextension and contralateral rotation of the head and neck. This mechanism accounts for over 90% of blunt injuries to the internal carotid arteries and tends to affect young patients more frequently. About 50% of the patients

had no external signs of neck trauma, assessing the need for high index of suspicion and aggressive diagnostic approach to identify this reason in asymptomatic patients. There is very little attention has been given to carotid artery injury in forensic settings and less work has been done regarding anatomical distribution of cervical artery injury and extent of damage on histological examination. In an attempt to find out true incidence of carotid artery injury and determine these parameters, 100 victims of vehicular accidents were studied.

## MATERIAL & METHOD

The study is conducted in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur during the time span of 12 months from March 2004 to February 2005 as a thesis for M.D. (Forensic Medicine) course. Total 100 cases were examined to study various patterns, anatomical location and histopathological extent of the cervical carotid artery injuries. The cases were selected from those brought to the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur for post-

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mortem examination where the history of vehicular accident was present.

Identification data( age, sex) and data about the circumstances of the motor vehicle accident, nature of vehicular accident was obtained from police requisition and inquest, death certificate, and history asked to the relatives.

The autopsy data includes external injuries with special mention to the injuries to the head and neck, and other associated injuries on the other parts of the body and recorded them. Autopsy technique followed is the technique that is more or less routine technique in most hospital mortuaries but special attention was given to the neck region involving carotid arteries. Careful external examination was carried out before starting to open the body, with special emphasis on the head and neck region and noted down the findings in anatomical descriptions such as abrasions, contusions, contused abrasions, lacerations. For the dissection of the carotid arteries, "Y" or modified raquet incision was given. The adventitial surface of cervical portion of each common carotid artery and its respective internal and external branches up to 2cm beyond the bifurcation was examined for evidence of contusion or rupture. The arteries opened from below and its intimal surface examined. In those cases where a contusion or disruption was noted, were considered as positive cases.

**OBSERVATIONS**

The cases fall between the age groups from 4 to 75 years. Out of these 82 were males and 18 were females.

**Table 1. Distribution of the cases regarding age and sex**

Age group Years	Males	Females	Total
	No.	No.	No.
1-10	1	2	3
11-20	7	5	12
21-30	23	4	27
31-40	20	2	22
41-50	15	2	17
51-60	6	2	8
61-70	9	1	10
71-80	1	0	1
<b>Total</b>	<b>82</b>	<b>18</b>	<b>100</b>

**Table 2: Distribution of the cases regarding the Status of the accident victims.**

Status of the victim		No.
Pedestrian		30
Two wheeler(45)	Driver	35(77.78%)
	Pillion rider	10(22.22%)
Three wheeler(4)	Driver	1(25%)
	Occupant	3(75%)
Four wheeler(21)	Driver	9(42.86%)
	Occupant	12(47.14%)
<b>Total</b>		<b>100</b>

Above table shows those maximum numbers of the victims i.e. 45 were with two- wheeler.

**Table 3: Distribution of cases regarding presence of surface injuries over neck**

Surface injuries over neck	No.
Total No. of cases ( out of 100)	17
Cases with positive findings ( out of 26)	11(42.3%)

As per above table, surface injuries were present in 17 of the total 100 subjects and in 11(42.3%) of the 26 subjects with positive findings.

**Table 4: Distribution of the cases regarding the cause of Death**

Cause of death	No. of cases
Head injury	65
Injury to vital organs	32
Shock and haemorrhage	1
Head injury associated with injury to liver	1
Head injury associated with injury to arm	1
<b>Total</b>	<b>100</b>

As per the above table, it is obvious that maximum number of cases i.e. 65 died due to head injury.

**Table 5: No. of subjects and arteries with positive findings and anatomical and numerical distribution of the arteries involved:**

	No.	Percentage
No. of subjects with positive findings	26	26
No. of arteries with positive findings (out of total 600* arteries)	37	6.16
Artery involved (out of 37 arteries involved)		
LCC	17	45.9
LEC	1	2.7
LIC	3	8.1
RCC	13	35.1
REC	1	2.7
RIC	2	5.4
Total	37	100

- {\* 6 arteries in each subject-
1. Left Common Carotid (LCC)
  2. Left External Carotid artery (LEC)
  3. Left Internal Carotid (LIC)
  4. Right Common Carotid (RCC)
  5. Right External Carotid (REC)
  6. Right Internal Carotid (RIC) }

As per above table, 26 subjects out of total 100 and 37(6.16%) arteries out of total 600 arteries had positive findings. The left common carotid artery, 17(45.9%) was commonest followed by right common carotid artery, 13(35.1%).

**Table 6: Anatomical Distribution of Injury: Single Vessel Involvement and Multiple Vessel Involvement:**

Vessel Involvement	Artery involved	No. of subjects	Percentage (out of total 26 subjects with positive findings)
<b>Single</b>	LCC	7	26.92
	RCC	6	23.07
	RIC	1	3.84
	LIC	1	3.84
	<b>Total</b>	15	57.69
<b>Multiple</b>	LCC+RCC	6	23.07
	LCC+LIC	2	7.69
	LCC+LEC	1	3.84
	RCC+RIC	1	3.84
	LCC+REC	1	3.84
	<b>Total</b>	11	42.31

As per above table, single vessel involvement was noted in 15(57.69%) while dual vessel involvement was noted in 11 subjects (42.31%) in both an ipsilateral and contralateral distribution.

**DISCUSSION**

Out of total 100 cases we studied, 82(82%) were males and 18(18%) were females (Table 1). The maximum number of cases (27) falls between age ranges of 21 to 30 years followed by 22 cases in the age range of 31 to 40 years. These observations are similar with the observations of the other workers like Houck W.S. et al (1964)<sup>1</sup>, Cohen A. et al (1970)<sup>2</sup>, Zenelok R.B. et al (1982)<sup>3</sup>, Moar J.J. (1987)<sup>4</sup>, Cogbill

T.H. (1994)<sup>5</sup> and Mckevit E.C. et al (2002)<sup>6</sup>.

Considering the status of the motor vehicle accident victim, maximum number of victims i.e. 45 were with two-wheeler (Table-2). It has been established fact that in case of automobile collisions i.e. involving 2/3/4 wheelers, whenever there is impact hyperextension and stretching of the cervical structures beyond their functional capacity causes injury. This mechanism is also mentioned by Moar J.J. (1987)<sup>4</sup>.

In the present study, surface injuries over neck were present in 11 (42.3%) of the 26 subjects with positive findings (Table 3). Towne J. B. et al (1972)<sup>7</sup>

found minimal injury over neck in their study while An T. L. (1989)<sup>8</sup> did not found any surface injury in their subjects with carotid artery injuries. Martin R. F. et al (1999)<sup>9</sup> observed that in more than 50% of the cases with carotid artery injury there was no visible evidence of any cervical trauma.

Among total 100 cases, maximum number of cases i.e. 65 died due to head injury (Table 4). This again stresses the association of the head injury with injuries to carotid arteries. This association is also observed by Towne J. B. et al (1972)<sup>7</sup>, Solheim K. (1979)<sup>10</sup>, Dragon R. et al (1981)<sup>11</sup>, Perry M. O. et al (1990)<sup>12</sup>, and Larsen D. W. (2002)<sup>13</sup>.

In the present study, 26 subjects out of total 100 and 37(6.16%) arteries out of total 600 arteries had positive findings (Table 5). This incidence is lower than the incidence found in the study carried out by Moar J. J. (1987)<sup>4</sup> but it is much higher than the incidence reported by Dragon R. et al (1981)<sup>11</sup>, Cogbill T. H. (1994)<sup>5</sup>, Carr S. et al (1996)<sup>14</sup>, Opeskin K. (1997)<sup>15</sup>, Mulloy John P. et al (1998)<sup>16</sup> and Chomel et al (2002)<sup>17</sup>.

Among the arteries involved i.e. 30(81.08%) of the total 37 arteries involved, most common were common carotid arteries (Table 6). This finding is consistent with the findings observed in the studies by Mulloy John P. et al (1998)<sup>16</sup> and Moar J.J. (1987)<sup>4</sup>. As mentioned by Mulloy John P. et al (1998)<sup>16</sup>, common carotid artery is relatively superficially located and is not protected by bone and thus is the most common location of the penetrating and blunt injuries.

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# Wearing White Aprons at Work Place- a Metacognition from Medico-legal Point of View

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## ABSTRACT

Wearing a white apron during duty hours is a debatable issue. Whether white apron is considered uniform like uniform code of armed forces and Constitution demands its mandatory use or is it a violation of fundamental right of a physician? The effects of white aprons on patients' feelings and on their perceptions about the doctor has been studied extensively by different scholars but few articles point towards the conflicts of opinions and lack of clarity in this subject. The question regarding use of white aprons in commercials is also a subject of debate. Thus this article is an attempt on the part of the authors to review the literature and search for a rational view.

**Keywords:** *White aprons, doctors, perception.*

## INTRODUCTION

The recent news of a lady doctor being rebuked for not wearing a white apron during a function created a lot of chaos and resident doctors extending support by deciding not to wear aprons and threatening to resign en masse<sup>1</sup> may point towards a mere political vendetta but deeper in our heart, it leads us to ask ourselves the importance of white aprons and medical profession and questions the rationality and legality behind our decision making. Government Medical College and Hospital authorities have made it compulsory for all the doctors of the hospital to wear a white apron when on duty in Maharashtra.<sup>2</sup> This issue leads to a number of questions.

Whether a white apron is an uniform and who has the authority to issue this dress code is still a debatable issue. Whether the patient's perceptions towards white apron clad doctor is affected in rational decision making? Thus this article is an attempt on the part of the authors to review the literature and search for an answer to this conflict.

## HISTORICAL BACKGROUND

Even in Ateryas's Anushasana, it is mentioned clearly that a medical man shall be clean and modest in his attire and appearance.<sup>3</sup> The strife between the scientists and members of the medical profession

of owing allegiance to white aprons began in late 19<sup>th</sup> century, as an endeavor to project medicine is science in itself and the professionals are no less than scientists. The modern white coat was introduced to medicine in Canada by Dr. George Armstrong. The white color signifies that medical science is eternal and pure. The change came in the 1930s and accelerated after the Second World War.<sup>4</sup>

## DISCUSSION

### Medico-legal point of view:

Now the question is whether the white aprons are uniforms or trade dress of the doctors? The dictionary meaning of 'Uniform' as a noun refers to a mode of dress such as a soldier's uniform. As an adjective, it means standard or unvarying. Trade dress refers to characteristics of the visual or sensual appearance of a product that may also include its packaging which may be registered and protected from being used by competitors in relation to their business and services. The concept of trade dress was first brought in under the Trademarks Act, 1999.<sup>5</sup> The use of white aprons in commercials of every health products even by traditional system of medicine and even advertisement of soaps and detergents is noteworthy of discussion. Whether there is a legal sanction of its use or lack of community awareness which allows the producers to exploit the sentiments

is also questionable. The legality of white aprons as uniforms is still not clear and doctors are not materials or products to suit the definition of trade dress. The medical man is also a rational man with professional training and enjoys the same rights as any ordinary citizen. The dress he wears during his duty hours must not be vulgar and lewd or incite violence. Today, Courts review the facts of a particular dress code punishment and determine whether violation rises to the level of material and substantial.<sup>6</sup> But this judgment is given with respect to uniform in schools. There has been no such guidelines or rules for the medical man.

#### **Doctor's view:**

According to a study nearly seventy-two per cent of all hospital doctors and medical students wear white coats. White coats are worn chiefly for easy recognition by colleagues and patients, to put items in the pockets and to keep clothes clean. Psychiatrists and paediatricians try to maximize rapport with patients by deliberately not wearing white aprons.<sup>4</sup>

In a study done in Germany shows work clothing and protective clothing are two different things. Work clothing is not changed between patient visits and hence is no measure of infection control. Its function is to protect private clothing and to identify medical personnel. Protective clothing on the other hand should protect staff and patients from nosocomial infections. It has to be changed between patient visits and is especially recommended with invasive procedures and immune-compromised patients.<sup>7</sup> A study carried out to assess the public's perception showed that although attitude towards doctors is not altered but style of dress is important. The author is of the opinion that wearing white aprons or ordinary clothes could become contaminated and can be changed easily for a clean uniform.<sup>8</sup> White aprons has a capacity to harbor and spread infectious agents. Evidence shows that coat sleeves and pockets can act as a reservoir for bacteria as studied by different researchers.<sup>9</sup> White coats make a tangible contribution to a patient's sense of confidence and comfort with a physician. While patient's knowledge about coat-carried infection risk was low, information about this theoretic risk had only a minimal influence on their opinions. The current available evidence has not conclusively linked white coats with increased infection rates.<sup>10</sup>

#### **Patient's view:**

The preference about doctors' attire symbolizes the perception of patients regarding their doctor's image. Taking the historical and symbolic meaning of the doctor's white coat together, this clear preference of patients for the white coat might imply that patients require a more scientific and professional image.<sup>11</sup> Only about one-third of patients reported that they would be comfortable or confident in a physician who wore the professional attire with the sleeves rolled up and no white coat. According to Ridd et al, the consultation experience is one of the pillars of the doctor-patient relationship. The success of this experience depends on knowledge, loyalty, trust, and regard. A patient's first impression of a physician can instill trust by inspiring confidence and can build regard by engendering comfort.<sup>12</sup>

A study shows that white-coat-wearing improved all aspects of the patient-doctor interaction and patients perceived that doctors who wore white coats seemed more hygienic, professional, authoritative and scientific. The more important that patients considered an aspect, the greater the positive effect associated with wearing a white coat. From a list of doctors' reasons for wearing white coats, patients thought that doctors wore white coats because it made them seem more professional, hygienic, authoritative, scientific, competent, knowledgeable and approachable. 36% of the patients preferred doctors to wear white coats.<sup>13</sup>

White coats have largely disappeared from Australian teaching hospitals. The chief reason was a common perception that 'No one else wears a white coat'. Medical officers who did prefer white coats indicated reasons of convenience for carrying items, identification and/or professionalism, and hygiene and/or cleanliness.<sup>14</sup>

### **CONCLUSION**

The patient's impression of the doctor plays an important role in clinical practice and the attire is a must in promoting trust and confidence in the patients. A doctor in a white coat appears more professional and trustworthy but more important is the ethical behavior and adherence to good clinical practices which actually creates the patient's trust. Truly a scientific person does not require a uniform too glamorous but strict implementation of white

aprons as uniform must carry some scientific basis and not merely based on disciplinarian views.

### SUGGESTION

The use of white aprons and doctors need a debate on the medico-legal rationality of the use. Use of white aprons by paramedics is also to be intercepted. Due clarity can be brought by further expert opinions and studies and consequently, the contribution white coats make to medical practice should be taken into consideration before making uniform policy recommendations. The main limitation is a more extensive and expert views are required to put forth a view with solemn affirmation.

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# Simultaneous Determination of Morphine, Codeine, Pentazocine and Propoxyphene in Urine Using HPTLC

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## ABSTRACT

Opiate abuse is a major problem worldwide. Simple and cost-effective method with quantification capabilities is need of time especially for developing countries. A procedure for simultaneous determination of morphine, codeine, pentazocine and propoxyphenene in urine by High performance thin layer chromatography (HPTLC) is described. Following enzymatic hydrolysis, urine samples were extracted. Liquid-liquid extraction was carried out with dichloromethane and isopropanol (9:3) at pH 9. Extracts reconstituted in methanol were analyzed by HPTLC in quantification mode. Limit of quantification (LOQ) was 120 µg/ml for morphine and codeine with 20 ml of urine sample. For propoxyphene LOQ was 60 µg/ml and pentazocine 800 µg/ml with 20 ml of urine sample. This study is an attempt to utilize HPTLC for semi-quantification of biological sample. Unavailability of HPTLC inserts forced to take larger urine volume. Software (wincats) inability to save calibration curve resulted in preparation of calibration curve on regular basis.

**Keywords:** High performance thin layer chromatography, Liquid-liquid extraction, Opiate abuse.

## INTRODUCTION

Substance abuse is a major health problem worldwide and India is no exception. Abuse of psychotropic and narcotic substance has increased substantially in recent years. Many studies have demonstrated that psychosis, violence, aggression and crime are closely associated with drug abuse thereby making substance abuse a complicated psychosocial condition<sup>1</sup>. It has significant impact not only on the individual sufferer, but also on the family and society. Substance abuse is associated with significant morbidity and mortality and contributes to global burden of all disease<sup>2,3</sup>.

Information provided by patients are not always reliable in declaring their choice of drug use<sup>3,4</sup>. There is always a need of cost and time effective standardized procedures for monitoring these substances in the user's biological samples. Development of methods for identification and quantification of drugs in biological matrices is a major goal in analytical toxicology. This provides specialists (health care and law authorities) an objective tool for confirmation of use. Detection of abused drugs in biological samples has been an important tool in clinical and forensic toxicology<sup>5</sup>. Techniques for detecting abused drugs in biological samples have improved with the advancement in analytical instrumentation which is extremely beneficial in patient care<sup>6</sup>. Urine analysis is a favored method of validating self reported drug use in clinical practice<sup>7</sup>. Many techniques including immunoassay (radio-immunoassay and enzyme multiplied immunoassay) liquid, gas and planar layer chromatography<sup>8,9</sup> are available. For screening immunoassays are effective, and all positives subjected to confirmation by mass spectrometry High-performance liquid chromatography (HPLC) mass spectrometry (MS)<sup>10</sup>,

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gas chromatography (GC)/mass spectrometry (MS)<sup>11</sup>. Immunoassay often encounter problem of variable cross reactivity with other drugs<sup>12</sup> chromatography technique with mass spectrometry (LC-MS, and GC-MS) are very expensive and trained technical staff are essential to operate these instruments effectively. Thin Layer Chromatography which is widely use for drug screening procedures specially in developing countries can be attributed to the low cost of instrument, high output<sup>13</sup>. There have been several recent advances made on TLC which have revolutionized and transformed it into a modern instrumental technique viz High performance Thin Layer Chromatography is one of the most widely applied methods in phyto-chemical. Its numerous advantages; include simplicity, low costs, parallel analysis of samples, high sample capacity, rapidly obtained results, and possibility of multiple detection and cost efficacy<sup>14</sup>. HPTLC provides identification as well as quantitative results.

The current study describes extraction and detection of multiple opiates in urine samples. Biological samples are very complex and multi-component mixtures. Abused substances are usually present in low concentration in biological sample. It is therefore necessary to separate and concentrate them from the matrix prior to their analysis. This study is aimed to develop a HPTLC method for semi quantitative determination of Morphine, Codeine, Pentazocine and Propoxyphene in clinical samples.

## MATERIALS & METHOD

All chemicals used were of analytical grade. Bulk solvents and routine chemicals were procured from SISCO research laboratory (Mumbai, India). Morphine was procured from Verve health care New Delhi, India. Codeine Phosphate, from Cheminnova Remedies Pvt. Ltd. Medak Hyderabad, India. Pentazocine standard was procured from Indian pharmacopeia Ghaziabad U.P, India. Nor-propoxyphene melate was procured from Sigma Aldrich, USA. Standard stock solutions of 1mg/ml in methanol were made and stored in a dark cold throughout the study.

## RECEIPT OF BLOOD AND URINE SAMPLES

The Centre for Addiction Medicine at National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore ([www.nimhans.kar.nic.in/deaddiction](http://www.nimhans.kar.nic.in/deaddiction)) was started in 1994 as a nodal centre

for South India. This centre conducts diagnosis and treatment of drug abuse and carries out a comprehensive rehabilitation program. For accurate diagnosis and thorough monitoring of the drug-induced behavioral changes in patients, the centre is developing validating screening and confirmatory methods of drug detection. Permission from institutional ethics committee was obtained for method standardization procedures that would prove useful for patient care. Laboratory tests including blood sugar, urea and liver function test and test for abused substances are offered as part of the clinical evaluation. Each sample was accompanied with a requisition form containing details of patient including name, ward number, clinical profile. A detailed case history of individual patients was recorded during the OPD sessions. The samples (20-30 ml of urine /evaluation) were collected in labeled leak-proof sterile plastic containers. In most cases, the samples obtained were processed for drug test on the same day. If not, the samples were stored at 0-4°C until extraction and analysis.

## SAMPLE PREPARATION

### Liquid-Liquid Extraction

To 20 ml of urine sample 3.0 ml of conc. Hydrochloric acid was added for acid hydrolysis sample vortexed for 5 minutes. Sample was heated for 30 minutes at 80°C in a closed container in a water bath. Acid hydrolysis is necessary to free the basic drug from the glucuronide, the majority of alkaloids (synthetic analgesics) are excreted in this form. Sample was kept at room temperature for half an hour and pH 9.0±0.5 was adjusted with carbonate-bicarbonate solid buffer. Liquid-liquid extraction (LLQ) was performed with chloroform; isopropanol (3:1v/v) solution thrice. The aqueous layer was discarded and the organic layer was evaporated to dryness at 70°C in nitrogen evaporator. Residue was reconstituted in one ml of methanol and subjected to HPTLC analysis.

### HPTLC detection of opiates:

The standard and extracted samples were processed on the automated HPTLC system (CAMAG, Muttenz, Switzerland) according to the instructions of the manufacturer. HPTLC was performed on 20 cm ×10 cm TLC Silica gel coated 60 F254 plates from Merck Germany. Standard and samples were spotted on the TLC plate as bands

(width of each band: 8 mm) by Camag Automatic TLC sampler (ATS) using Camag 25  $\mu$ l dosing syringe (Hamilton, Switzerland). To develop the TLC plate, various mobile phases with different ratios were experimented in a twin trough compartment of the automatic developing chamber (ADC) and the optimum mobile phase ethyl acetate: Methanol: Ammonia (8.5:1.0:0.5) was selected. Accordingly, linear ascending development was done with appropriate mobile phase. This gave good resolution with dense, compact and well separated bands and distinct peaks. The chamber was saturated with the mobile phase for 5 min at 25°C. After development (distance 80 mm), the plate was air dried for 5 min in the ADC and scanned using Camag TLC scanner-3 at 254 nm wavelength in absorbance mode using a dedicated software (Win-Cats software, version 1.4.1). The scanning was carried out with slit dimensions 5 mm  $\times$  0.45 mm and scanning speed of 100 mm/s. The area data of the peaks obtained with the corresponding amounts of the standard was subjected to linear least square regression analysis. The HPTLC methods developed for quantization of opiates were validated and parameters like precision, accuracy (recovery), and robustness, limit of detection (LOD) and limit of quantitation (LOQ) were checked as per ICH guidelines.

## RESULTS

This study was planned to generate a standardized protocol for screening and semi quantification of opiates in urine samples of opiate users. The advantage was its capability to detect and semi-quantification of morphine, codeine, pentazocine and propoxyphene in single extraction as well as HPTLC procedure. The liquid-liquid extraction along with HPTLC will prove helpful in detection of opiate abuse in clinical and forensic areas.

Primary screening (rapid screening assay) of patient samples was done using Instant- view® Morphine/Opiates urine Cassette Test rapid screening from Alpha Scientific USA. These cassettes can identify opiates above cut-off in urine using monoclonal anti-opiate antibody. All positive and negative samples with suspected abuse history were cross-checked by HPTLC (Table1). For this purpose calibration curves were prepared for morphine, codeine, pentazocine and propoxyphene by plotting the peak areas (figure1a, 1b, 1c, 1d).

Morphine and codeine band emerged at Rf 0.20 $\pm$ 0.5 and Rf 0.30 $\pm$ 0.5 and linearity of the curve was 0.99987 and 1.00 respectively. Calibration range was 120-375 $\mu$ g/ml for morphine as well as codeine. Standard stock solution of 15 $\mu$ g/ml (morphine and codeine) was spotted as 8, 16 and 25 $\mu$ l. Limit of Detection (LOD) was - 90  $\mu$ g/ml (Fig 1a, 1b).

Propoxyphene appeared at Rf 0.82  $\pm$ 0.5 and a four point calibration curve in range of 60  $\mu$ g/ml-375  $\mu$ g/ml was prepared with 15  $\mu$ g/ml stock solution spotted as 4,8,16 and 25 $\mu$ l linearity of the curve was 0.99932 and LOD was -50 $\mu$ g/ml (Fig:1c).

Pentazocine emerged at Rf 0.72 $\pm$ 0.5 a four point calibration curve was prepared in calibration range 800-5000  $\mu$ g/ml with 200  $\mu$ g/ml stock solution spotted as 4,8,16,25  $\mu$ g/ml linearity and LOD was 0.99946 and 700  $\mu$ g/ml (Fig-1d ) respectively. Since 20 ml urine sample after LLQ is converted into 1ml (20 time concentration) of which 25  $\mu$ l was spotted. Sample was concentrated around (20 $\times$ 25) 500 times so that drugs above cut-off levels can be quantitated.

## DISCUSSION

Several methods in past have been proposed to identify and semi quantification of opiate in biological matrices, primarily for clinical, legal and forensic toxicology purposes. A few methods are adequate because fair degree of linearity and high sensitivity is required. Radioimmunoassay (RIA) is quite simple and sensitive but has serious limitation because of cross reaction of main metabolites with polyclonal antibody<sup>15</sup>. High performance liquid chromatography using electrochemical, chemo luminescence or fluorescence detection had low sensitivity compared to RIA, also require extensive sample preparation<sup>8,16</sup>. Gas chromatography with flame ionization detector, nitrogen-phosphorous detector has problem related to selectivity for opiate at lower concentrations<sup>17</sup>. Gas chromatography mass spectrometry (GC-MS) techniques are highly sensitive and selective for clinical and forensic purpose. But cost of instrument and running cost/test is more and requirement of skilled staffs are essential. GC-MS, LC-MS techniques are more time consuming where the instrument is kept on line round the clock because at a time only one sample can be processed<sup>16-18</sup>. This makes these techniques expensive and more time consuming.

For sample clean up, enzyme hydrolysis with  $\beta$ -glucuronidase is known for good recovery<sup>19</sup> but hydrolysis with hydrochloric acid which is swift and effective for handling larger volumes. LLQ at pH 9.0 $\pm$ 0.5 with chloroform; isopropanol (3:1v/v) resulted in good recovery (70-75%). Extracted samples were quantified using HPTLC. HPTLC is simple, cost & time effective, user friendly and easy to operate technique.

Sample application was done using auto sampler for accurate loading. Out of various mobile phases {Methanol; Strong ammonia solution and toluene; acetone: ethanol: ammonia} ethyl acetate; methanol and ammonia gave good resolution and well separated bands. For simultaneous detection and quantification, calibration standards can be spotted on 20 $\times$ 10mm silica gel plate previous to samples, Wincats software of HPTLC in quantitative mode will quantitate samples against standard simultaneously. This makes this technique very useful, time and cost effective. We observed increase in the number of samples received for opiate screening (table1). From April 2009 till July 2012 total 990 patients were tested by immunoassay and 319 sample were subjected for quantification (table 1) using HPTLC. Sample positive by immunoassays along with suspected abuse samples were quantified using HPTLC and result obtained was in collaboration with patient history.

Unavailability of HPTLC inserts (for 100-200  $\mu$ l) was our main limitation, to overcome this large samples volume (20ml/test) was taken for LLQ extraction. Another limitation was software (winCATS) inability to save calibration curve for this daily new calibration was prepared.

**Table 1: Sample screened by immunoassay and confirmed by HPTLC.**

Year	No. of patients tested by rapid kits	No of patient tested by HPTLC	Positive
2009	125	55	Mor=49, codeine=0, penta=3, proxy=3
2010	272	92	Mor=75, codeine=2, penta=5, proxy=10
2011	441	81	Mor=76, codeine=1, penta=2, proxy=2
till 05-2012)	152	91	Mor=28 codeine=0/chloro=43 penta=4, proxy=16

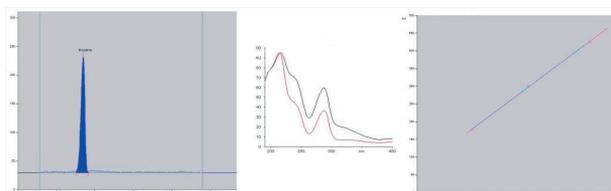


Fig 1a. Peak (RD) Spectra and Calibration curve for Morphine

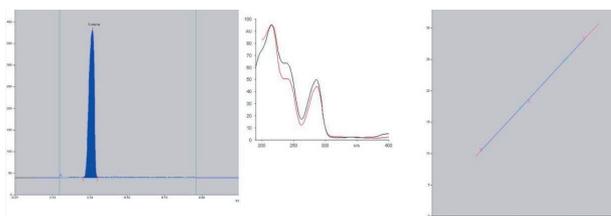


Fig 1b. Peak (RD) Spectra and Calibration Curve for Codeine

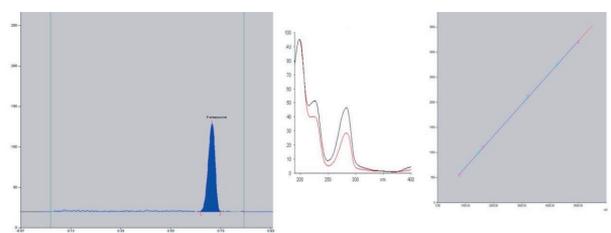


Fig 1c. Peak (RD) and Calibration Curve for Pentazocine

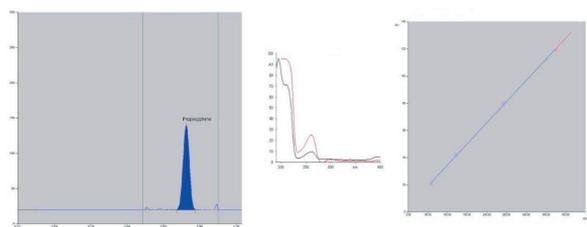


Fig 1d. Peak (RD) Spectra and Calibration Curve for Propoxyphene

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# The Spectrum of Unnatural Deaths in Solapur District of Western Maharashtra: An Autopsy based Study

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## ABSTRACT

The main aim of this study was to analyse different causes of unnatural deaths and its epidemiological aspects. Identifying the risks of unnatural deaths will help to improve overall planning & enable to prevent avoidable deaths. The study was conducted in the Department of Forensic Medicine and Toxicology, Dr. V.M. Government Medical College, Solapur in an attempt to explore pattern of unnatural deaths in Solapur. Total 1794 cases of medico-legal autopsies were studied during the period of one year. As per this study, trauma (51.92%) was the most common cause of death followed by thermal injuries (21.16%), violent asphyxia deaths (13.46%) and poisoning (12.02%). While in case of males, trauma (64.39%) was the most common cause of the death in case of males, it was thermal injuries (46.78%) in case of females. Deaths due to trauma (25.13%) and thermal injuries (34.42%) were most common among age group 21-30 years.

**Keywords:** Unnatural deaths, medico-legal autopsy, epidemiological study.

## INTRODUCTION

With increasing urbanisation and modernisation, the number of un-natural deaths is increasing rapidly in India. Accident as a cause of unnatural death is undoubtedly leader all over the world. Among accidents, road traffic accidents eclipse all other causes of accidental deaths by huge margin. As such unnatural deaths are the indicators of social and mental health of the society. Periodic publication of the statistical data is very much useful as it will give though not holistic but important information regarding social well-being. Authorities can use this data to devise a strategy to prevent further losses. Medico-legal autopsy is very much important tool for analysing trends of unnatural deaths, as most of the cases of unnatural deaths are submitted for medico-legal autopsies. Medico-legal autopsy along with police inquest will give us data regarding cause of death, age, sex as well as supposed manner of death.

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## MATERIAL & METHOD

This is one year retrospective study which was carried out at Department of Forensic Medicine, Dr. V.M. Government Medical College, Solapur during a period extending from 01/01/2007 to 31/12/2007. The material of this study consists of 1794 cases. The autopsy report as well as police requisition and inquest was used for collecting data regarding age, sex, cause of death and supposed manner of death. The causes of death were divided in five broad categories namely trauma, thermal injuries, violent asphyxia deaths, poisoning and other causes. The last category i.e. other causes consists of death due to electrocution, lightning, therapeutic misadventure etc. Undetermined deaths are those which are not yet confirmed whether natural or unnatural due to several reasons such as non-receipt of chemical analysis, histopathology or other investigation reports. The data thus collected was compiled and analysed statistically.

## OBSERVATIONS

Over the period of one year, there were total 1794 cases sent to Dept. of Forensic Medicine, Dr. V.M.G.M.C., Solapur.

**Table 1: Distribution of the cases regarding natural and unnatural deaths.**

Trait	No. of cases	Percentage
Natural death	312	17.39%
Unnatural Death	1456	81.16%
Undetermined	26	1.45%
<b>Total</b>	<b>1794</b>	<b>100%</b>

Out of total 1794 cases, overwhelmingly 81.16% were those of unnatural deaths while 17.39% were natural deaths (Table No. 1).

**Table 2: Distribution of the unnatural deaths regarding the manner of death**

Manner of Death	No. of cases	Percentage
<b>Accidental</b>	1183	81.25%
<b>Suicidal</b>	231	15.87%
<b>Homicidal</b>	42	2.88%
Total	1456	100%

After dividing unnatural deaths according to manner of death, it was found that accidental deaths had lions share with 81.25% cases followed by suicidal deaths i.e.15.87% (Table No. 2).

**Table 3: Distribution of unnatural deaths according to sex**

Sex	No.	Percentage
<b>Male</b>	1022	70.19%
<b>Female</b>	434	29.8%

From Table No. 3, it is clear that most of the cases were male (70.19%), male to female ratio being

2.35:1.

**Table 4: Distribution of the unnatural deaths according to age groups**

Age Group (years)	No.	Percentage
0-10	42	2.88%
11-20	154	10.58%
21-30	392	26.92%
31-40	371	25.48%
41-50	252	17.31%
51-60	147	10.10%
61-70	77	5.29%
> 70	21	1.44%
<b>Total</b>	<b>1456</b>	<b>100%</b>

If we apply criterion of age, then most common age group was 21-30 years (26.92%), closely followed by age group 31-40 years (25.48%). As such more than half of the total unnatural deaths were in these two age groups (Table No.4)

**Table 5: Distribution of unnatural deaths according to cause of death**

Cause of Death	No.	Percentage
Trauma	756	51.92%
Thermal Injuries	308	21.16%
Violent Asphyxia	196	13.46%
Poisoning	175	12.02%
Other Causes	21	1.44%
<b>Total</b>	<b>1456</b>	<b>100%</b>

After classifying according to cause of death, it was found that trauma was responsible for 51.92% followed by thermal injuries (Table No. 5)

**Table 6: Distribution of causes of deaths according to sex**

Cause of Death	Sex						Total
	Male			Female			
	No.	% A*	% B#	No.	% A*	% B#	
Trauma	658	64.39%	87.03%	98	22.58%	12.97%	756
Thermal Injuries	105	10.27%	34.09%	203	46.78%	65.91%	308
Violent Asphyxia	147	14.38%	75%	49	11.29%	25%	196
Poisoning	98	9.59%	56%	77	17.74%	44%	175
Other Causes	14	1.37%	66.67%	7	1.61%	33.33%	21
<b>Total</b>	<b>1022</b>	<b>100%</b>		<b>434</b>	<b>100%</b>		<b>1456</b>

\* % A = Percentage in particular Sex-group (Male/Female)

# % B = Percentage in particular Cause of Death group

The sex-wise distribution of causes of deaths revealed that trauma (64.39%) was the leading cause of death among males while thermal injuries (46.8%) were most common cause among females (Table No. 6). The victims of the traumatic death

were predominantly males (87%) while nearly 2/3<sup>rd</sup> victims of thermal injuries were females (65.91%). Similarly 75% of the deaths due to violent asphyxia were males.

**Table 7: Distribution of cause of death according to age groups**

Age Group		Cause of Death					Total
		Trauma	Thermal Injuries	Violent Asphyxia	Poisoning	Other Causes	
0-10	No.	23	1	9	6	3	42
	% A*	54.76%	2.38%	21.43%	14.29%	7.14%	
	% B <sup>#</sup>	3.04%	0.33%	4.59%	3.43%	14.29%	
11-20	No.	66	45	13	29	1	154
	% A*	42.86%	29.22%	8.44%	18.83%	0.65%	
	% B <sup>#</sup>	8.73%	14.61%	6.64%	16.57%	4.76%	
21-30	No.	190	106	56	36	4	392
	% A*	48.47%	27.04%	14.29%	9.18%	1.02%	
	% B <sup>#</sup>	25.13%	34.42%	28.57%	20.57%	19.05%	
31-40	No.	161	85	56	64	5	371
	% A*	43.40%	22.91%	15.09%	17.25%	1.35%	
	% B <sup>#</sup>	21.30%	27.60%	28.57%	36.57%	23.81%	
41-50	No.	149	37	35	29	2	252
	% A*	59.13%	14.68%	13.89%	11.51%	0.79%	
	% B <sup>#</sup>	19.71%	12.01%	17.86%	16.57%	9.52%	
51-60	No.	103	19	12	10	3	147
	% A*	70.07%	12.93%	8.16%	6.8%	2.04%	
	% B <sup>#</sup>	13.63%	6.17%	6.12%	5.72%	14.29%	
61-70	No.	50	14	10	1	2	77
	% A*	64.94%	18.18%	12.99%	1.30%	2.60%	
	% B <sup>#</sup>	6.61%	4.55%	5.10%	0.57%	9.52%	
>70	No.	14	1	5	0	1	21
	% A*	66.67%	4.76%	23.81%	0%	4.76%	
	% B <sup>#</sup>	1.85%	0.32%	2.55%	0%	4.76%	
<b>Total</b>		<b>756</b>	<b>308</b>	<b>196</b>	<b>175</b>	<b>21</b>	<b>1456</b>

\* % A = Percentage in particular Age-group

# % B = Percentage in particular Cause of Death group

After analyzing causes of death according to age groups, it was found that trauma was the most common cause of death in most of the age groups while all the causes of death were most common among age group 21-30 years closely followed by age group 31-40 years (Table 7).

## DISCUSSION

As per present study, the percentage of unnatural deaths was 81.16%, which is relatively lower but comparable with similar studies by Bansude M.E.<sup>1</sup>, Kaulaskar S.V.<sup>2</sup>, Vaghela P.<sup>3</sup>. Solapur being tertiary care center for adjoining 3-4 districts, so the several critical cases are referred to hospitals in the city. If

patient is brought dead in hospital or dies within 24 hours of admission, then such cases are usually send for medico-legal autopsy. This explains high number of natural deaths.

The sex-wise distribution observed in the study is similar to that found by Bansude M.E. et al<sup>1</sup>, Youufani G.M. et al<sup>4</sup>, Sharma B.R. et al<sup>5</sup>. But the incidence of female unnatural deaths is much lower to Kaulaskar S.V.<sup>2</sup>, Vaghela P.<sup>3</sup>. This fact underlines the importance of statistical studies in different regions.

As per this study, the age group 21-30 years was the predominant age group followed by age group 31-40 years. This finding is similar with those of Khan Md. B.H. et al<sup>6</sup>, Bansude M.E. et al<sup>1</sup>, Santhosh. C. S et al<sup>7</sup>. The active life style in these age groups makes them prone for unnatural deaths.

Labelling the manner of death is quiet difficult as investigations are not yet completed. Just medico-legal autopsy is not sufficient tool to decide manner of death. The supposed manner of death deduced from police requisition and inquest might change afterwards.

Trauma was responsible for more than half of the cases of unnatural deaths. This finding is comparable with but slightly higher than Kaulaskar S.V. et al<sup>2</sup> & Vaghela<sup>3</sup>. The Solapur city is well connected with major cities as four national highways pass through it. This explains high preponderance of traumatic deaths as a result of road traffic accidents. Thermal injuries with 21.16% ranked second as a cause of unnatural deaths. Sharma B.R. et al<sup>5</sup> in their study observed that poisoning not thermal injuries is second commonest cause of unnatural death. This can be explained by difference in study region as in North India, is ruled by agrarian economy.

The traumatic deaths were common among males while deaths due to thermal injuries were common among females. These findings are similar with those observed by Vaghela P<sup>3</sup>, Kaulaskar S.V. et al<sup>1</sup>. Aggarwal and Chandra<sup>8</sup> observed that 67% of the cases of burns deaths belong to females. But the number of deaths due to thermal injuries is quiet higher as compared to studies conducted in other countries by Meng H et al<sup>9</sup> and Youufani G.M. et al<sup>4</sup>. It gives insight regarding social structure in India, where males are supposed to earn bread while females are relegated to household work making them prone for thermal injuries irrespective of manner. The high incidence of thermal deaths among females may be attributable to the infamous "Bride Burning" or "Dowry Deaths" which are prevalent in India.

Similarly age group 21-50 years account for most of the traumatic deaths, age group 21-30 years being most common. Govekar et al<sup>10</sup> found that highest incidence of road traffic accidents is in age group 31-40. Thermal injuries also account for significant deaths in age groups 21-30 & 31-40 years. Haralkar S.J<sup>11</sup> found that 69.68% of deaths due to burn injuries belong to females & maximum number of cases (45.48%) belonged to age group between 15-25 years.

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**Conflict of Interest:** None

**Source of Funding:** Self

**Ethical Clearance:** Not required as it was a retrospective study which included only collection of data.

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# Changing Trends (Patterns) of Human Poisoning in Tirupati Region – a Five Years Study

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## ABSTRACT

“Caution is advised while decontaminating a victim of poisoning. Over enthusiasm may result in eliminating the patient, not the poison!” -John Morrisson

Poisoning has been known to mankind since time immemorial and the study of various poisons and their effects has always fascinated mankind. References to poisons and various instances of poisoning are available in Indian Shastras, Egyptian Papyri and Sumerian writings.<sup>7</sup>

Since then many substances considered advantages and disadvantages in the form of food or poisons have been discovered. Those substances which are used unfortunately to take away the man's life or cause ill health have been changing.

Some of the great persons who were poisoned to death are Chatrapati Shivaji Maharaj,<sup>2-3</sup> whose bed was poisoned, Socrates, who was made to drink Hemlock (*Conium maculatum*) and Rasputin who was poisoned with cyanide and then shot. Aluminum phosphide poisoning, a rodenticide is also posing a formidable challenge and is on the way for taking the number one position. As poisoning trends go on changing, it is necessary to know the poisoning trends from time to time.

**Keywords** -Poison, Dose, Incidence.

## INTRODUCTION

The term “Toxicology” is derived from the Greek word “Toxicos”, the adjective of ‘toxon = bow’. The historian Herodotus used the word toxicon for describing poisoned arrows.<sup>10</sup>

Poison can be defined as a substance which may be solid, liquid or gas, which on gaining entrance into or comes in contact with body parts of a living subject, causes ill health, disease or death. It is difficult to draw a boundary line between medicine and poison because medicine in large doses acts as poison and a poison in a small dose used as a medicine. The only real difference is the intent with which they are purposely and not accidentally given .

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Toxicology or study of poisons is considered by many to be a very recently developed scientific discipline. On the contrary, observation of harmful effects of chemical substances on living organisms is rooted in prehistory. Even the ancient people sought antidotes for poisons. Since many chemical compounds, which are used as drugs can act as poisons in their larger doses carry certain degree of risk to human health and to environment. The incidence of poisoning is constantly increasing in all civilized countries. The type of poison used for various modalities may depend upon certain factors. However, there is a progressive shift towards suicidal poisoning and accidental poisoning in the household and in agriculture. Accidental poisoning, which is common among children is ascribe increased use of numerous chemical articles in the household. Poisoning in children occurs most frequently in kitchen (34%), bedroom (27%), bathroom and laundry (15%). Industrial poisoning is gradually receding owing to advances in industrial hygiene

and medical service and to the increasing automation of industrial processes.

Incidence of accidental poisoning is increasing because of increased use of chemicals both for industrial and domestic purposes. Insecticides and weed killers are also in extensive use in agricultural sector

Incidence of suicidal poisoning is also increasing because of the easy availability of these agents and also due to non-adjustments to the situations of stress and strain of modern life as they have become highly mechanical and competitive in so many ways.

The incidence of poisoning has increased considerably in the recent past as evidenced by hospital records. This high incidence of poisoning and mortality rates has promoted us to undertake a study of human poisoning.

In Tirupati the age old tradition of suicides by drowning in wells or by hanging have been replaced by poisoning oneself by the use of "organosphorus" compounds, barbiturates, etc. In Andhra Pradesh the poisoning due to the insecticides is on the increase year after year. In the districts of Andhra Pradesh state, incidence of death due to endrin (a chlorinated hydrocarbon) and organosphorus compounds is showing steady increase.. In view of the increase in the number of poisoning cases all over, it is desirable to study the pattern of poisoning cases in each hospital. In the present study, the pattern of poison encountered, incidence of poisoning among different age groups, male and female ratios and the manner of poisoning were studied.

## MATERIALS & METHOD

This is a retrospective, simple study conducted from 2005 to 2010 at SVIMS TIRUPATI. 1000 poisoning cases was admitted to medical wards in Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati. The total number of 72737 Inpatients admitted during the 5 years in the medical wards. This period formed the material for this present study. Even though some cases have come from Tirupati city proper, majority of the patients are from the near by rural areas. The patients were studied at the time of admission to the wards and followed up in the hospital until recovery or death.

Broadly the patients are divided into two groups<sup>10</sup>

- Poisoning cases due to ingested poisons.
- Poisoning cases due to snake and insect bites.

## POISONING CASES DUE TO INGESTED POISONS

The criteria observed is:

- All patients with history of consumption of poison having positive and significant signs and symptoms:
- Patients with doubtful history of consumption of poison but with definite signs and symptoms of acute poisoning.

Patients with history of consumption of poison but having no positive signs and symptoms of poisoning. Even though the present study is not a clinical oriented study of poisoning cases, due importance is given for the diagnosis and the clinical manifestations in all cases. At the time of admission, inquiry was made about the type and quantity of poison consumed, duration between consumption and onset of symptoms, any such attempts previously. All patients were asked to describe the symptoms like abdominal pain, loose motions, vomiting, dizziness, vertigo and any other general symptoms. In most of the cases history regarding the manner of poisoning was elicited either from the patient himself / herself of the close relative.

### Clinical examination was done under the following heading:

General physical examination:

The vital signs like pulse rate, blood pressure, respiratory rate and level of consciousness were noted in all cases of poisons. The state of the eyes, pupils, tongue and skin were checked. A thorough search was made for the presence of any suicidal or homicidal injuries over the body in all cases.

**Systemic examination:**<sup>10</sup> A detailed examination of central nervous system, cardiovascular system, respiratory system and abdomen was carried out giving due merit to individual cases. When once the diagnosis of poisoning is made treatment is instituted on general lines followed by specific therapy

according to the individual cases. The treatment of the patient carried out under the following guidelines:

- Removal of unabsorbed poison from the body.
- Administration of antidotes.
- Elimination of poison by excretion.
- Symptomatic treatment.

In case of death of the patient the body was subjected for postmortem examination.

### **POISONING CASES DUE TO SNAKE AND INSECT BITE**

#### **The inclusion criteria<sup>10</sup>**

1. All patients with history of bites having positive and significant signs and symptoms due to poisonous creatures like snakes, scorpions, bees and insects. But for the purpose of discussion only the snake bite cases are included.

2. Patients with doubtful history of bites due to poisonous creatures but with definite acute onset of signs and symptoms locally or systemically

#### **Exclusion criteria:**

Patients with history of bite but having no signs and symptoms either locally or systemically.

At the time of admission inquiry is made about the type of snake, site of bite, time of bite, interval between bite and medical aid and the manner of snake bite.

The presence of two definite puncture wounds with progressive swelling and tenderness with persistent bleeding was taken as poisonous bite, whereas inverted 'U' shaped or multiple teeth marks with mild non-progressive swelling confined to the site of bite with minimum bleeding which stopped on its own were considered to be due to non-poisonous snake bite.

The presence of pain, numbness, tenderness, neuroparalytic, haematotoxic signs and symptoms were also considered for differentiation poisonous and non-poisonous snake bites.

Once the diagnosis of poisonous snake bite is made, first aid treatment followed by specific therapy

was instituted for all the cases.

During the study, the viscera and the vomited matter was sent to the chemical examination, F.S.L. Tirupati. In most of the cases, the poison was not detected as per the chemical examiner's report. Hence, not much importance was given to the report and the only consideration is given to the history, inquest report, circumstantial evidence, signs and symptoms as noted in the patient's hospital case sheet and above all postmortem findings.

### **FINDINGS**

**Incidence of poison:** In the analysis 1000 poisoning cases admitted to medical wards in Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati during 2005 to 2010, which includes both ingested poisons and poisons due to snake and insect bites, the incidence of poisoning was observed to be (1.37%). The total number of hospital admissions during this period was 72737.

#### **Classification of cases:**

For the purpose of better study, the cases were divided in to two groups:

I. Poisoning cases due to ingested poisons.

II. Poisoning cases due to snake and insect bites.

The present study shows that 856 (86%) of ingested poisons and 144 (14%) of Snake bites and other insect bites.

### **POISONING CASES DUE TO INGESTED POISONS**

**a) Commonest type of poison used (Table No. 1&2):**

The present study shows that 50.10% of the total poisoning were due to Organophosphorus compounds which include insecticides. The second commonest poison was Tablet poisoning 13.3%. The third commonest poison was unknown 8.6%. The fourth commonest poison was Supervasol 6.6%.

### **POISONING DUE TO SNAKE AND INSECT BITES**

**Total incidence (Table No.3)** Out of 1000 cases of poisoning admitted in medical wards of SVIMS, Tirupati, 2005 to 2010, the total number of poisoning cases due to snakebite and insect bites were 144.

This constituted 14.4% of the total cases studied.

## DISCUSSION/CONCLUSION

### Poisoning cases due to ingested poisons:

#### a) Commonest type of poisons used:

In our study it was observed that 50.1% of the total poisoning cases were due to insecticides which include organophosphorus compounds. The second commonest poisoning was Tablets (13.3%). The third commonest poison was unknown (8.6%) the fourth commonest poison was super vasmol (6.6%). The use of OPC poisons was found to be comparatively more in our study. An observation made by De-Alwls L.B et al<sup>4</sup> 1988 in Srilanka showed that (78.08%) of the poisonings were due to insecticides and OPC. However, the study conducted by Chirasirisap K et al<sup>1</sup> showed the major types of poisoning to be insecticides 27.2%, misused therapeutic drugs 19.0% and household chemicals 10.1%.

Tunwashe O.L et al<sup>9</sup> (1985) have observed that among 146 cases of acute poisoning-cases 82.6% were suicidal, 15.8% were accidental and 1.4% were homicidal in nature. Observations made by Petersen-H et al<sup>8</sup>(1977) found that suicidal poisoning were frequent among females 70% and in males 43%. Dalal et al<sup>6</sup> observed the manner of death due to poisoning was unclear in most of the cases, but where the manner is known, suicide accounted for 58% of death, commenting that the poison of choice for suicide is organophosphorus compound.

## SNAKE AND INSECT BITES

Total incidence of snakebites (Table No -3&4 ):

During the present study conducted from 2005 to 2010 the total number of poison cases admitted to medical wards in SVIMS, Tirupati was 1000. During this period 105 cases of snake bite were studied among the medical admissions. This constituted 10.5% of all poison cases admitted during this period, The total number of hospital admissions during this period was 72,737. Based on this, the incidence of snake bite was observed to be 144 Per 1,00,000 patients.

A similar study during 1970-1974 was conducted by Banerjee and Siddiqui<sup>5</sup> (1976) in Safdarjang Hospital, New Delhi. Their hospital incidence was observed to be 133 per 100,000 patients. A higher incidence in our study may be due to vast agricultural lands in and around the city of Tirupati

where farming is the main occupation.

In our study it was found that 82.9% of the total bites were poisonous, while the remaining 17.1% were non poisonous. Observations were made by Banerjee. R.N. et al<sup>5</sup>(1974) in Safdarjang Hospital, New Delhi was poisonous snake bites 24.28% were non poisonous snake bites 75.72%. Sawai et al<sup>11</sup> (1974) also has made similar observations. The incidence of type of snake bite may vary in different regions of the country according to the prevalent species of snake.

1000 poisoning cases admitted in medical wards of SVIMS, Tirupati were studied for the various parameters like the commonest type of poison encountered, the incidence of poisoning, the common age group involved, the occupational incidence, the urban and rural incidence the manner of poisoning and the mortality rate.

The incidence of poisoning which include both ingested poisons and snake-bites was 1.37% among the total hospital admissions during the five years.

### I. Poisoning cases due to ingested poisons:

- The commonest poisons consumed were Organophosphorus compounds (50.1%) and tablet poisoning (13.3%). The third commonest poison was unknown (8.6%) the fourth commonest was Supervasmol (6.6%).

### II. Poisoning due to snake and insect bites :

The incidence of poisoning due to snake bites and insect bite (scorpion sting) was (14%) of the total Poisoning cases studied.

- Poisonous snake bites are seen in (82.9%) of the total snake bite cases as against (17.1%) of the nonpoisonous snake bites.

To prevent such high incidence exposure and death due to poisoning, the laws has to be made stringent and people must be educated in the prophylactic measures and facilities for prompt and adequate treatment in all the hospitals to prevent high morbidity and mortality

## RECOMMENDATIONS AND SUGGESTIONS

### PREVENTION AND SAFETY MEASURES

**Toxic vigilance:** This is an active process of

identification and evaluation of toxic risk in the community. All enquiries addressed to a poison information center are regularly analysed to determine the possible toxic agents and circumstances of poisoning. The regulatory or health authorities can be alerted to take appropriate preventive measures, if poisoning related to a new product, improper packing or wrong labeling is observed.

#### Emergency Information Service:

This is the most important activity of a poison information center. By accessing a number of

information sources and databases, the center can quickly identify the age involved in any kind of toxic exposures and provide information on its toxicity and risks. In instances of acute poisoning, the center provides immediate advice on first aid, management, antidotes and investigations needed for patient care. **Teaching and training of health professionals:** These centers being an important source of human toxicology data, can provide updated information on new treatment modalities to health professionals.

**Table No. 1: Type of poison used**

Sl. No.	Poison used	No of cases	Percentage	Sl. No.	Poison used	No of cases	Percentage
1	Acid	12	1.2	26	Multi Drugs	4	0.4
2	Acu, Alco. Intox	1	0.1	27	Mosquito repelliant	1	0.1
3	All out	1	0.1	28	Nerium Odorum	6	0.6
4	Alluminum Phosphate	2	0.2	29	NPSB	18	1.8
5	Alprax Tablet	16	1.6	30	Oliander Seeds	1	0.1
6	Aluminium Sulfphate	1	0.1	31	OPC	501	50.1
7	Antidepressant	1	0.1	32	Paracetmal Tablet	4	0.4
8	Atenolal	2	0.2	33	Phenobarbital Tablets	2	0.2
9	Avil Tablets	22	2.2	34	Phenol	6	0.6
10	Baygon Spray	2	0.2	35	Phosphorus	1	0.1
11	Benadryl syrup	1	0.1	36	PSB	87	8.7
12	Benzodiazepens	2	0.2	37	Rat Poison	13	1.3
13	Brake oil	1	0.1	38	Restil Tablets	3	0.3
14	Carbamazapine tablets	7	0.7	39	Scorpion Sting	39	3.9
15	Compose Tablets	1	0.1	40	Sleeping Tablets	3	0.3
16	Daonial Tablets	1	0.1	41	Sorbitrate Tablets	1	0.1
17	Daturaseeds	1	0.1	42	Super Vasmol	66	6.6
18	Dettol	1	0.1	43	Tegretal Tablet	1	0.1
19	Diazepam Tablet	6	0.6	44	Trika Tablet	3	0.3
20	Eptoin Tablets	2	0.2	45	Unknown	87	8.7
21	Food Poison	2	0.2	46	Unknown Tablet	48	4.8
22	Gamaxine	2	0.2	47	Vadesaku	11	1.1
23	Gardinal 300 mg Tablets	2	0.2		<b>Total</b>	<b>1000</b>	<b>100.0</b>
24	Hair Dyie	4	0.4				
25	Lorazapam tablets	2	0.2				

**Table No. 2: Commonest type of poison used**

S. No.	Poison	No of cases	Percentage
1.	OPC	501	50.1%
2.	Tablet	133	13.3%
3.	Unknown	86	8.6%
4.	Supervasmol	66	6.6%
5.	Others	214	21.4%

**Table No.3: Total incidence**

Snakebites	No of patients	Percentage
PSB	87	60.4
NPSB	18	12.5
Other (Scorpion sting)	39	27.1
<b>Total</b>	<b>144</b>	<b>100.0</b>

**Table No.4: Incidence of type of snake bite**

Snakebites	No of patients	Percentage
PSB	87	82.9
NPSB	18	17.1
<b>Total</b>	<b>105</b>	<b>100.0</b>

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**Conflict of Interest** –Research work

**Sources of Support-** Self finance

**Ethical Clearance-** Obtain from institution ethical committee.

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# A Study of Lip Prints among Kerala Population

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## ABSTRACT

**Background and objectives:** Human identification is based on scientific principles, mainly involving estimation of age, sex, fingerprints, measurement of height, dental records. Just like these methods, lip prints can also be instrumental in identifying the sex which is vital for establishing the identity of an individual. The study of lip prints is known as cheiloscopy. The main objective of study was to find out accuracy of sex determination through lip prints.

**Method:** The study was conducted on 2nd, 3rd and 4th year students of Azeezia medical college, Kollam. Subjects were 100 males and 100 females of the state of Kerala, aged between 18 and 25years. Details of the study were explained to the subjects and lip prints taken and analysed as per the Classification given by Tsuchihashi.

**Results:** Type I was the most common lip print in total subjects and males. Type III predominated in females. Type I, I', II constituted majority of females. Type III, IV, V predominated in males.

**Conclusion:** The results obtained in our study do not prove it to be an infallible method. But it still seems to open a small window to a vast unventured field. The need of the hour is to develop a standardized method to assess and accurately record the cheiloscopic patterns.

**Keywords:** Lip Prints, Identification, Cheiloscopy, Sex Determination.

## INTRODUCTION

Human identification is one of the most challenging subjects that police have been confronted with. Human identification is based on scientific principles, mainly involving estimation of age, sex, fingerprints, measurement of height, dental records. Just like these methods, lip prints can also be instrumental in identifying the sex which is vital for establishing the identity of an individual. The study of lip prints is known as cheiloscopy. Cheiloscopy

is derived from Greek word, cheilos means lips and skopein means to see<sup>1</sup>. The wrinkles and grooves on the labial mucosa called as 'Sulci labiorum' forms a characteristic pattern called as lip prints. The wrinkles and grooves visible on the lips have been named as 'Sulci labiorum rubrorum'<sup>2</sup>. The lip prints are unique<sup>3</sup> and can be identified as early as the sixth week of intrauterine life<sup>4</sup>. There are no changes in lip prints during the life of a person<sup>3</sup>. After undergoing alterations due to minor trauma, inflammation, and diseases like herpes, lip prints have been found to recover in some time<sup>4</sup>. However, scarring of the lips secondary to major trauma, pathosis, and surgical treatment may affect the size and shape of lips, thereby altering the pattern and morphology of the grooves<sup>5</sup>.

Lip prints were first described by Fisher in 1902<sup>1,3</sup>. In 1932, French criminologist Edmond Locard

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recommended the use of lip prints for the first time, while Le Moyne Snyder mentioned the use of lip prints in the identification of individuals in his book "Homicide Investigation" written in 1950<sup>6</sup>. The main objective of this study was to ascertain whether lip prints behold the potential for determination of sex from their configuration.

**MATERIALS & METHOD**

Lipstick of a bright red colour and nonglossy, transparent cellophane tape and glued on one side, unglazed white bond paper, scissors, magnifying lens and tissue paper. Subjects were 100 males and 100 females of the state of Kerala, aged between 18 and 25years. All the subjects were 2nd, 3rd and 4th year students of Azeezia medical college, Kollam. The cases with gross deformities of lips like cleft lip, ulcers, traumatic injury on the lips and cases with known allergy to the lipstick used were not included in the study. Subjects were informed about the study and written consent was obtained prior to recording the lip prints.

The subjects were asked to clean his/her lips with water and dry them with tissue paper. The subject was asked to open his/her mouth and lipstick applied in a single stroke on both upper and lower lips evenly. The subject was asked to rub the lipstick evenly on all parts of the lips. The glued portion of cellophane tape was applied gently over the lips with even pressure for few seconds to allow the print to form on the tape. The tape was carefully lifted from the lip avoiding any smudging of the print. If the print was satisfactory then the strip of cellophane tape was pressed gently over the white bond paper with a finger in order to obtain a neat and optimal print. Then the subjects name and other details in the form of right and left sides were noted. A line was drawn at the centre of the two lines, ie, the centre of the lips vertically downwards to a point below the cellophane tape. 5mm on either side of the line, two parallel lines were drawn and all the three were joined at the lower end. These lines showed 10mm of the lower lip, which was the area to be studied. The piece of bond paper with lip prints was placed under the magnifying lens and middle 10mm of the lower lips were studied. The determination of pattern depends upon the numerical superiority of properties of the lines on this study area. The grooves in this area were classified according to Tsuchihashi's<sup>4</sup> classification of lip print types. These were:

1. Type I: Clear cut vertical grooves that run across the entire lips.
2. Type I': Similar to type I, but do not cover the entire lip.
3. Type II: Branched grooves (branching Y shaped pattern)
4. Type III: Intersected grooves.
5. Type IV: Reticular grooves.
6. Type V: Undetermined.

The sex of the individual was determined as given by Vahanwala et al<sup>7,8</sup>.

Type I and I' : Pattern dominant – Female.

Type II : Pattern dominant – Female.

Type III : Pattern dominant – Male.

Type IV : Pattern dominant – Male.

Type V : Pattern dominant – Male.

**RESULTS**

In our study type I lip prints were the commonest (28%) and type V were the rarest (9%) (Table 1). In males type III was the commonest (44%) followed by type IV, V, I, II and I' respectively. The frequency of Type I was maximum in females and type V was the least (Table 1). On estimation of the sex from lip prints as given by Vahanwala, it was found that Type I, I' and II constituted 92 out of 100 in females and Type III, IV and V accounted for 83 out of 100 males (Table 2). No two lip prints matched with each other, thus establishing the uniqueness of lip prints.

**Table 1: Lip print patterns in males and females**

Patterns	Female	Male	Total
I	48	8	56
I'	31	3	34
II	13	6	19
III	4	44	48
IV	3	22	25
V	1	17	18
<b>Total</b>	<b>100</b>	<b>100</b>	<b>200</b>

**Table 2: Prevalent lip patterns in males and females**

Type	Female	Male	Total
I, I', II	92	17	109
III, IV, V	8	83	91
<b>Total</b>	<b>100</b>	<b>100</b>	<b>200</b>

## DISCUSSION

The above findings are in accordance with study done by Vahanwalla<sup>8</sup> but in studies conducted by Ramandeep S Narang<sup>9</sup> and Sivapathasundharam<sup>3</sup> type III was most common. T.N.Uma Maheshwari<sup>10</sup> had done her study on lip prints in Chennai and found that type II was prominent. Verghese<sup>11</sup> et al studied lip prints in the population of Kerala and found that the most common pattern was type IV. These studies reveal that lip prints show racial differences which can be a useful adjunct to identification of the person. Type III and I were predominant in males and females respectively. Thus the most common lip pattern for females is Type I/ I' /II (92%) and the most common lip pattern for males is type III/IV/V (83%). Similar results were obtained by Preethi Sharma and Saxena et al<sup>12</sup>, similar results were obtained by studies conducted by Satyanarayana Naik et al<sup>13</sup> and Chaitnaya Babu et al<sup>14</sup> in karnataka

Lip prints can be a factor in many different kinds of crimes, such as rape when a person has been bound or gagged, prints on a glass that a person drank from, prints on cigarette butt and prints on a glass or a window if they were pressed up against it. All of these are potential places where lip prints may be found and used in the investigation of a crime.<sup>15</sup> In recent years, lipsticks have been developed that do not leave a visible trace when they come in contact with different items. These lip prints are characterized by their permanence and are referred to as persistent lip prints. The use of lipsticks is not indispensable for leaving lip prints. The vermilion border of the lips have minor salivary and sebaceous glands, which together with the moisturizing from the tongue, leads to the possibility of the existence of latent lip prints. The identification of latent print evidence is often considered the key in solving a crime<sup>1</sup>. Many reagents such as magnetic oxides, aluminium oxides, fluorescent dyes such as Nile blue and Nile red are used to develop latent lip prints similar to the finger prints<sup>15</sup>.

## CONCLUSION

Among the large number of tools available to a forensic expert, cheiloscopy is a relatively newer one. Though work on this subject has already elicited useful information, limitations still exist in the use of cheiloscopy. The results obtained in our study do not prove it to be an infallible method. But it still

seems to open a small window to a vast unventured field. According to many studies, cheiloscopy holds promise as a supplementary tool along with other modes to recognize the sex of an individual. The need of the hour is to develop a standardized method to assess and accurately record the cheiloscopic patterns. Further studies are required on the effect of age and seasonal changes on the cheiloscopic patterns.

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# Patterned Injury Due to Flash Suppressor: A Case Report

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## ABSTRACT

In cases of contact or near contact firearm injury due to a rifled weapon fitted with a flash suppressor, the emerging soot-laden gas in the barrel escapes from the slits of the flash suppressor. This produces a characteristic patterned injury; like petals of flower surrounding the firearm entry wound. This “flower-like” pattern of searing and blackening can be used to determine the type of weapon used. This case report presents one such case of patterned injury due to flash suppressor in a 45-year-old man who committed suicide with his service SLR rifle.

**Keywords:** Flash suppressor, suicide, patterned injury, contact shot.

## INTRODUCTION

Nowadays flash suppressor is attached to the muzzle of modern military rifles and some civilian rifles.<sup>1</sup> A flash suppressor, also known as a flash guard, flash eliminator, flash hider, or flash cone, is a device attached to the muzzle of a rifle that reduces its visible signature while firing by cooling or dispersing the burning gases that exit the muzzle. Its primary intent is to reduce the chances that the shooter will be blinded in lowlight shooting conditions.<sup>2</sup> According to some these devices are intended to break up a fireball that emerges from the muzzle of the rifle when fired at night. Hence it is useful in combat to decrease the possibility of counterfire.<sup>3</sup>

A flash suppressor is different from a muzzle brake, although they are typically mounted in the same position and sometimes confused with each other. While the former is intended to reduce visible flash, a muzzle brake is designed to reduce painful recoil inherent to large cartridges and typically has no effect on visible flash.<sup>4</sup>

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## CASE PRESENTATION

A 29-year-old man committed suicide by firing a service SLR rifle while he was on duty on 12/03/2015 at 06.00 am. He was found dead on the floor with the body lying in a pool of blood and SLR service rifle besides him. He was then brought to Sassoon general hospitals Casualty, where he was declared dead. After police inquisition his dead body was referred to department of forensic medicine for postmortem examination. His clothes were retained for the purpose of examination by forensic science laboratory.

## POSTMORTEM FINDINGS

### External examination:

1. Firearm wound of entry, present over under surface of chin, situated 10 cm above suprasternal notch and 0.5 cm left to midline, circular of diameter 01 cm, surrounded by circular muzzle impression of diameter 02 cm, reddish. Margin of wound of entry are inverted with abrasion collar of 01 mm all around, reddish. (figure 1)
2. Firearm wound of exit present over left fronto parietal region of head, of size 09 cm x 01 cm, with irregular, everted and reddish margins. (figure 2)
3. Oval shaped dermo-epidermal burn injury

surrounded by soot deposition present over neck, 05 mm left lateral to injury no. 1, of size 03 cm x 02 cm, reddish. (figure 1)

4. Oval shaped dermo-epidermal burn injury surrounded by soot deposition present over neck, 05 mm right lateral to injury no. 1, of size 03 cm x 02 cm, reddish. (figure 1)

5. Oval shaped dermo-epidermal burn injury surrounded by soot deposition present over neck, 06 mm superior to injury no. 1, of size 03 cm x 02 cm, reddish. (figure 1)

### INTERNAL EXAMINATION

1. On dissection of external injury no. 1, tract of bullet passed through underlying subcutaneous tissue, strap muscles of neck, in backward and upward fashion, glancing lateral margin of posterior third of tongue laterally, then perforating posterior half of hard palate on left side, left side of anterior cranial fossa, lacerating left frontal lobe of brain, and passing through and through left frontal lobe to exit out through external injury no. 2. The tract of bullet was contused, hemorrhagic, lacerated and reddish.

### OPINION

Opinion as to the cause of death was –“Traumatic and hemorrhagic shock due to contact range firearm injury.”

External injuries no. 3, 4 and 5 could have been due to expulsion of gases and flames through the slits of flash suppressor used in cases of rifled firearm due to contact range firing. This is to be confirmed after ballistic examination.

### DISCUSSION

Flash suppressors are generally cylindrical structure (figure 3). Its construction varies according to the manufacturers and the types of weapons. There are a certain number of longitudinal slits along its length.<sup>4</sup>

When a rifle fitted with a flash suppressor is fired, the emerging soot-laden gas in the barrel escapes from the slits. In contact or near contact shots, the flash suppressor will produce a characteristic “flower-like” pattern of seared and blackened zones around the entrance.<sup>5</sup>

The number of “petals” of the “flower” depends

on the number of weapon’s slits.<sup>6</sup> Thus if the flower pattern is fully formed, it may help to determine the type of the weapon, range and direction of firing.<sup>4</sup>

As the “flower” pattern had three “petals” in the present case and were fully formed, following opinions can be drawn as:

- The barrel must have been in perpendicular direction to the area of contact at the time of firing.
- The range of firing must have been contact or near contact one.
- The flash suppressor used must be having three symmetrical slits.

Grucan Altun has reported one such case of a firearm injury, in which six petal like seared contused lesions were present surrounding the firearm wound of entry. The said injury was due to contact shot by G3 automatic infantry rifle with flash suppressor having six rotationally symmetrical slits.<sup>1</sup>

In an another case reported by Naik SK et al, three symmetrical deep dermal burns were present surrounding firearm wound of entry. This resulted from escaping hot soot laden gases through the flash suppressor having three symmetrical slits and mimicked multiple entry wounds with characteristic flower like pattern.<sup>7</sup>

### FIGURES



Figure 1: Showing firearm wound of entry with muzzle impression and flower petal pattern.



Figure 2: Firearm wound of exit

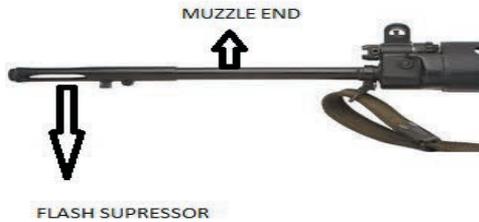


Figure 3: Muzzle end with muzzle suppressor.

### CONCLUSION

Number of slits in flash suppressor will decide the number of radially arranged seared, burned and blackened lesion surrounding the firearm wound of entry. Though at times it mimic multiple wounds of entry, careful look of such “flower-like” pattern of searing and blackening can be used to determine the type of weapon used. As such wounds are produced in contact and near contact shots, it also gives an idea about the range. Symmetrical or asymmetrical nature of flower petals gives impression about direction of firing. Hence in all such cases showing atypical firearm injuries, it should be a routine practice of autopsy surgeon to examine alleged firearm weapon.

**Acknowledgement:** Nil

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Taken from institutional ethics committee.

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# Hematological Manifestations of Ratol Poisoning : A Case Report

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## ABSTRACT

Ratol paste which contains 2%-5% of yellow phosphorus is being increasingly used nowadays following the decreasing effectiveness of warfarin containing rodenticides. The lethal dose is 1mg/kg. We are presenting a case of poisoning with yellow phosphorus which had clinical features of hepatotoxicity and hematological manifestations in the form of leucopenia and thrombocytopenia.

**Keywords:** Ratol, yellow phosphorus, leucopenia, thrombocytopenia, hepatotoxicity.

## CASE REPORT

A 30 year old lady presented after intake of around 20-25 grams (half of a tube) of Ratol –rodenticide paste containing yellow phosphorus. Around 6 hours after consuming the poison she developed nausea and vomiting. 2 days later she complained of abdominal pain, malena and giddiness. There were no other bleeding manifestations or alteration in the level of consciousness. She did not have any significant illness in the past, was not on any drugs and did not have any addictions. Examination showed icterus, pulse rate 72/minute, blood pressure 106/70mm of Hg, no orthostatic hypotension, right upper quadrant tenderness, tender and firm liver palpable 9 cm below the costal margin in the mid clavicular line, no stigmata of chronic liver disease or splenomegaly or ascites or features of hepatic encephalopathy. Other system examination was normal.

On day 1 evaluation showed Hemoglobin (Hb) 13.6g %. Total leukocyte count (TLC) 5800 /mm<sup>3</sup> with 86% neutrophils, 14% lymphocytes. Platelet count 1.9lakhs/mm<sup>3</sup>. Total bilirubin .8mg%, direct fraction .2mg%, serum oxaloacetate aminotransferase

(SGOT) 18IU/L, serum glutamate aminotransferase (SGPT) 13 IU/L, serum alkaline phosphatase (ALP) 46IU/L, Prothrombin time 15 seconds (control value 14 seconds) INR 1.1. Her blood sugar, renal function tests and serum electrolytes were normal.

Day 3 Hb 13.6g% TLC 4500/mm<sup>3</sup> neutrophils 66%, lymphocytes 30%, eosinophils 4% platelet count 1.5lakhs/mm<sup>3</sup>. Serum bilirubin 3mg%, direct fraction 1.8mg%, SGOT 360IU/L, SGPT 217IU/L, ALP 95 IU/L Prothrombin time 29 seconds more than control, INR 3.2

Day 5 Hb 11.5g% TLC 1900/mm<sup>3</sup> neutrophils 40%, lymphocytes 54%, eosinophils 6% platelet count 1.56,000lakhs/mm<sup>3</sup>. Serum bilirubin 7.6mg%, direct fraction 4.2mg%, SGOT 1376IU/L, SGPT 779IU/L, ALP 197 IU/L Prothrombin time 16 seconds more than control, INR 2.2 Peripheral smear showed normocytic normochromic blood picture, leucopenia with scattered reactive lymphocytes and thrombocytopenia. Ultrasound scan of abdomen showed hepatomegaly, no splenomegaly or ascites. Other causes of liver disease were ruled out by negative HBsAg, anti HCV, IGM anti HAV and HEV, normal ferritin and ceruloplasmin

Day 6 Hb 12.3g% TLC 4000/mm<sup>3</sup> neutrophils 10%, lymphocytes 77%, eosinophils 4% platelet count 60, 000/mm<sup>3</sup>. Serum bilirubin 7.9mg%, direct fraction 4.6mg%, SGOT 475IU/L, SGPT 534IU/L, ALP

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159 IU/L Prothrombin time 14 seconds more than control, INR 2.1 Bone marrow trephine biopsy was normal, without any evidence of hypocellularity or degeneration.

Day 7 Hb 11.9g% TLC 6000/mm<sup>3</sup> neutrophils 44%, lymphocytes 54%, eosinophils 2% platelet count 1.5 lakhs/mm<sup>3</sup>. Serum bilirubin 17.1mg%, direct fraction 13.2mg%, SGOT 200IU/L, SGPT 390IU/L, ALP 159 IU/L Prothrombin time and INR returned to normal.

Day 10 Hb 10.8g% TLC 8000/mm<sup>3</sup> neutrophils 70%, lymphocytes 15%, eosinophils 6% platelet count 1.9 lakhs/mm<sup>3</sup>. Serum bilirubin 3.6mg%, direct fraction 1.9mg%, SGOT 93IU/L, SGPT 171IU/L, ALP 23 IU/L

She was treated with supportive measures. She gradually improved and was discharged after about two weeks and is on follow up.

## DISCUSSION

Yellow phosphorus is an ingredient in fireworks and rodenticide paste (Ratol). Because of its rapid absorption after oral administration and high concentration in the liver, hepatotoxicity is a common manifestation of poisoning with Ratol. Other manifestations include gastrointestinal symptoms, renal failure, seizures, coma, arrhythmias and cardiovascular collapse.<sup>1</sup> The clinical features occur in three stages. The first stage is within the first 24 hours of consumption of the poison. In this stage the patient experiences symptoms like nausea, vomiting and abdominal pain. During this period there need not be any biochemical abnormalities suggestive of liver damage. This is followed by an asymptomatic stage in which there may be evidence of liver dysfunction. Liver failure occurs in the third stage of the illness. This patient also exhibited all these classic stages of poisoning. It is important for the physician to be aware of this temporal evolution of this poisoning in order to avoid the complacency which may develop in the initial phase of the presentation. Missing out on the early phase takes away precious time during which awareness of the complications can go a long way in improving the outcome.<sup>2</sup> Mortality rate in yellow phosphorus poisoning is to the tune of 23%-73%.

There are only two case reports<sup>3,4</sup> of hematological complications of yellow phosphorus poisoning. In the case report of Tafur A J et al the leukocyte count was normal at base line, but declined after 24 hours. In another report of Basheer A et al the leucopenia manifested very early. In this patient there was decrease in the leukocyte and platelet count with maintained hemoglobin level, similar to the report by Tafur A J et al. Bone marrow showed evidence of hypocellularity in the previous two case reports. The reason for the normal bone marrow findings in this case could be due to the slight delay in performing the procedure. The bone marrow suppression is reversible as evidenced by the spontaneous recovery within one week, in all these cases. The reason put forward for the mechanism of neutropenia is metaphase arrest of cells by yellow phosphorus.<sup>3</sup> Another point of interest is that in spite of the severe neutropenia there is no predisposition to infection. These cases highlight the importance of regular monitoring of blood counts in cases of yellow phosphorus poisoning.

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**Source of Funding:** Self

**Conflict of Interest:** Nil

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# Study of Fingerprint Patterns in Hypertensive Patients

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## ABSTRACT

100 patients diagnosed as suffering from Hypertension were included for the study. About 100 healthy volunteers were also included in the control group. The finger print patterns observed between Hypertensive individuals and controls. Hypertensive patients showed increase in frequency of number of loops as compared to control group. Hypertensive patients also showed decrease in frequency of whorls as compared to the control group. However these findings were not statistically significant.

**Keywords:** Fingerprint patterns, Diabetes Mellitus.

## INTRODUCTION

Fingerprint is unique to every individual and it is determined genetically. Hypertension is also determined genetically. The incidence and prevalence of hypertension has increased globally, especially in developing countries like India. Hypertension causes significant morbidity and mortality. It's also more prevalent in the population because of change in life style pattern. Since both fingerprints and hypertension are genetically determined there appears to be a correlation between the two. if such correlation exists between them that will serve as a screening aid as well as diagnostic tool in persons who carry a particular fingerprint pattern. This helps in taking preventive measures by the concerned individual genetically related to the hypertensive patient.

## MATERIALS & METHOD

The study of fingerprints in hypertensive patients

was conducted in Navodaya Medical College Raichur Karnataka India during the period January to June 2014. A predesigned proforma containing the details such as name age sex and disease conditions that is hypertension was given to the patients. Data was collected from the patients after obtaining the informed consent. The fingerprint was recorded using the stamp pad. Fingers of both hands were printed on a durable plain paper which consisted of 10 different blocks for 10 fingers of both right and left hands. Both rolled and plain prints of right and left hands were taken. After obtaining the fingerprints the details of diagnosed condition such as presence of hypertension was gathered the patterns observed within the help of powerful hand lens. Each finger in the fingerprint proforma was assigned a number example first number given to the left Thumb and 10th to the right thumb and the results thus obtained were systematically analysed.

## RESULTS

**Table1: Fingerprint patterns in Hypertensive patients and Control Groups**

PATTERN	LEFT HAND			RIGHT HAND		
	HYPERTENSIVES	CONTROLS	SIGNIFICANCE	HYPERTENSIVES	CONTROLS	SIGNIFICANCE
LOOP	66.7%	64.6%	Not Significant	68.7%	67.6%	Not Significant
WHORL	26%	29.6%	Not Significant	26%	29%	Not Significant
ARCH	7.3%	5.8%	Not Significant	5.3%	3.4%	Not Significant
COMPOSITE	0%	0%	Not Significant	0%	0%	Not Significant

## DISCUSSION

The present study shows increased frequency of loops and arches in hypertensives than controls in both hands. There is decrease in frequency of whorls and composite in hypertensives than controls. However, these findings were not statistically significant. However in a study<sup>1</sup> it was found that frequency of double loop, whorl patterns and arches were increased when compared to controls and this finding was statistically significant, the ridge count was grossly elevated in case of hypertensive population comparative to normotensive individuals. However, totals ridge study was not conducted in the present study. They also found that the percentage incidences of arches and double loop whorl patterns were clearly higher in hypertensive group. The radial loop pattern was significantly less in incidence in hypertensive group.

In yet another study<sup>2</sup> it was found that whorl pattern was predominant followed by loop and composite pattern in hypertensives compared to controls. However, in our study loop pattern was predominant followed by arch and composite respectively. Sampling fluctuation, inadequate sample size, sampling error might be responsible for such differences in findings from one study to the other.

In a study<sup>3</sup> loops were most common patterns in left hand in both sexes. On the right hand digits, loops were higher in number. There was no significant difference in the frequency of patterns between two hands. The above findings are similar to the present study.

In a study<sup>4</sup> it was found that hypertensive males and females had significantly high whorl and low ulnar loop pattern in right hand, left hand as well as both hands than control group. But these findings differ from the findings of the present study as in our study we found increase infrequency of loops and arch pattern and decrease in frequency of whorl pattern.

In a study<sup>5</sup> it was found that there was significant association between fingerprint pattern and hypertension in female subjects while for the male subjects there was no association between fingerprint pattern and hypertension. However, the present study does not indicate any statistically significant

association between fingerprints and hypertension.

In a study<sup>6</sup> had more number of arches than controls. Loops were also more in number in hypertensives than controls. But the whorl patterns were less in number in hypertensives compared to control group in males. In females the right hand study group showed more number of whorls than control group and the left hand study group showed less number of whorls as compared to control group. However, such findings were not seen in the present study and no significant statistical finding was evident in our study. Though the percentage of loops were maximum followed by arches, whorls and composite in both hands but these findings are not statistically significant.

## CONCLUSION

The study of fingerprint pattern in hypertensive patients explores the association of fingerprint pattern with the diseases known to carry the risk of hereditary and genetic determination as well as inheritance, such as hypertension. This study helps genetically related individuals of hypertensive patient to take preventive measures for reducing the risk of developing such disease conditions. This study also helps as a screening aid or diagnostic tool to individuals with particular fingerprint pattern, threatened with the risk of developing hypertension. Thus, such studies are beneficial for reducing mortality and morbidity, thereby contributing to community health and social accountability.

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**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** Has been obtained

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# Gastric Rupture- an Uncommon Finding at Autopsy

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## ABSTRACT

Gastric rupture, an uncommon finding following blunt abdominal trauma is usually associated with other intra-abdominal injuries. We report such a case of gastric rupture associated with splenic laceration following blunt abdominal trauma. Autopsy revealed an uncommon site of rupture in the posterior wall of the stomach. Possible mechanisms responsible for gastric rupture have been discussed.

**Keywords:** Non-penetrating, Abdominal Injuries, Rupture, Lacerations, Spleen.

## INTRODUCTION

Gastric rupture following blunt abdominal trauma is a very rare entity, with a reported incidence of 0.02-1.7%.<sup>1</sup> Concomitant intra-abdominal injuries contribute to a significant morbidity and mortality. The severity of injury, the time between the last meal and trauma, and associated injuries have been implicated as the prognostic factors. It is usually caused by traffic accidents accounting for 75% of cases.<sup>2</sup> Other causes include fall from height, seat-belt injuries, and even a vigorous cardio-pulmonary resuscitation. We present a case of gastric rupture with associated splenic laceration following blunt abdominal injury. Ethical clearance has been taken from

Institutional ethical committee

Autopsy Findings

A 61 year old male presented to the emergency department in a gasping condition following run

over by bullock cart. On examination, his pulse and blood pressure were not recordable, and pupils were dilated and non-reactive to light. Distension of abdomen along with tenderness and guarding of the upper abdominal region was noted. He succumbed three hours after the incident.

A medico-legal autopsy revealed no external injuries over the abdomen or lower back. Multiple linear abrasions over the right scapular region and lower limbs were noted.

On abdominal dissection, there was a gush of blood through the incision with collections of 2500 ml of blood mixed with blood clots and solid green colored vegetable material in the peritoneal cavity (Fig 1). On opening the stomach it was found to be empty and a rupture was seen in the posterior wall near the cardiac end (Fig 2). Splenic laceration was noted (Fig 3). Rest of the abdominal organs was intact and pale. Ribs were fractured in the posterior part on both sides.

Death was attributed to shock and haemorrhage as a result of ruptured spleen and stomach following blunt abdominal trauma.

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Fig 1. Vegetable matter in the peritoneal cavity

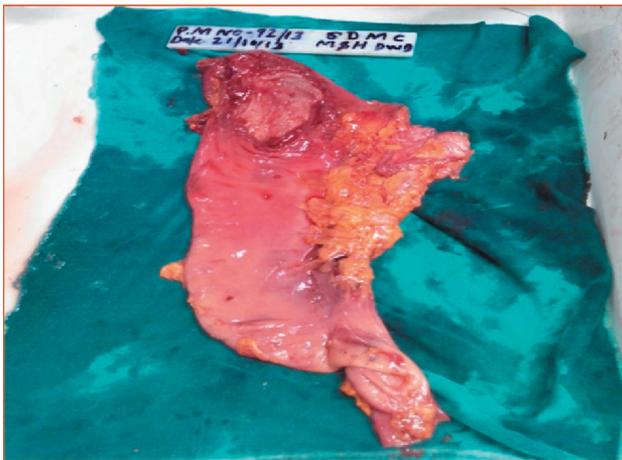


Fig 2. Tear in the posterior wall of stomach



Fig 3. Splenic laceration

## DISCUSSION

Gastric injuries are uncommon in isolation as the stomach is a highly muscular organ relatively mobile with thick strong walls, protected by rib cage. They usually occur in combination with either intra- or extra- abdominal injuries.<sup>1</sup> Most common associated solid organ injury is of the spleen.<sup>2,4</sup> The liver and pancreas are less commonly injured possibly because the full stomach stabilizes these organs by filling the abdominal empty space; absorbs the force of impact

over the epigastrium, and acts as an “air bag” for these organs.<sup>4</sup>

Three different mechanisms of gastric injury have been described. First, a full stomach is likely to be ruptured by blunt force, which can be explained by a balloon bursting type of phenomenon.<sup>5</sup> Stomach usually escapes injury in blunt abdominal trauma unless it is very severe or if the stomach is distended by food, liquid or gas.<sup>6</sup> In such cases, a blow over the abdomen causes a violent displacement of the contents of gastrointestinal tract. Hydrostatic forces are set up in the displaced contents and such forces may be sufficiently powerful to injure the stomach in a region anatomically distant from the site of application of force.<sup>7</sup> Secondly, the vertical transection of the empty stomach when it is compressed against the spine (seat-belt injury) can lead to gastric rupture.<sup>8,9</sup> Thirdly, gastric rupture may be caused by a rapid deceleration injury that causes a tear in the anterior wall of the stomach because of the rigidity of the short hepatogastric or hepatoduodenal ligament.<sup>2,10</sup>

Most case series report that the anterior wall of the stomach (40%) is the most common site of rupture followed by the greater curvature (23%), lesser curvature (15%) and the posterior wall (15%).<sup>2,3</sup> In our case, the rupture was found at the cardiac end in the posterior wall.

The distribution of rupture sites is determined by the Law of Laplace which states that wall tension of a cylindrical object is directly proportional to the product of intraluminal pressure and radius of the tube. Therefore at a given gastric pressure due to compression, the tension on the stomach wall is highest in that part of the stomach which is of greatest curvature, predisposing it to rupture.<sup>11</sup>

Stomach jolt due to rapid deceleration of full stomach with shearing force on spleen causing sudden rise in intra gastric pressure might be responsible for the lesser curvature tear.<sup>12</sup>

Immobilization of the lesser curvature may cause different and reverse effects on a full rather than an empty stomach. It may cause a tear in the anterior wall of the full stomach, whereas it can cause a laceration in the lesser curvature of an empty stomach.<sup>5</sup>

The mortality rate following gastric injuries is reported at 0.4-17% and is invariably due to associated

lesions. The stomach lies in close proximity to other vascular viscera that often have associated injuries resulting in death due to haemorrhage and shock.<sup>13</sup> Other complications like intra-abdominal sepsis are a result of the massive intraperitoneal contamination that ensues following rupture of a distended stomach and usually account for the late mortality.<sup>2</sup>

### CONCLUSION

We report a case of posterior gastric rupture with leakage of gastric contents and splenic injury following blunt abdominal trauma. Possibly, in our case gastric rupture resulted from bursting force of a full stomach following blunt abdominal trauma. Hollow viscus injuries after blunt trauma, although uncommon, can have serious consequences if the diagnosis is missed or delayed. Prompt diagnosis and early intervention reduces mortality and morbidity.

**Source of Funding-** Self

**Conflict of Interest-** Nil

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# Age Estimation by Depth of Pit at Sternal End of Fourth Ribs in Males - a Quantitative Approach

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## ABSTRACT

**Background & Objectives:** This study aims to find the relation of pit depth at sternal end of fourth ribs with the age of an individual on a quantitative basis, to find any bilateral variation in the progression of pit depth according to age and to derive regression formulas if applicable.

**Materials and Method:** The study includes 178 rib samples from 89 male bodies brought for post-mortem examination. After processing for removal of cartilaginous part, pit depth was measured at that point where the distance between the base of the pit and the adjacent anterior or posterior wall was greatest. The ribs were scored according to depth of pit and the data were statistically analyzed.

**Statistical analysis used:** Mean, Standard Deviations, Simple linear regression with R, R Square and Adjusted R Square, Coefficients.

**Results & Conclusions:** Prediction of age from the pit depth of sternal end of fourth rib is significant. There is no any bilateral variation in the progression of pit depth according to age. Regression formulas have been derived for age prediction from the pit depth which are,  $Y=8.684X+9.621$  for the left side and  $Y=8.900X+7.828$  for the right side of the rib ends, where Y= age in years and X= pit depth in mm.

**Keywords:** Sternal end of fourth rib; Pit depth; Age.

## INTRODUCTION

Aging skeletons have their own limitations due to multiple factors affecting ossification and growth patterns. Geographic variation is significant factor among them. Since the inception of "postmortem examination", age determination of an unknown individual has remained the core aspect for the purpose of identification. The accuracy and feasibility to determine age depends on availability of the material received for postmortem examination, which may consisted of a fresh intact dead body to few skeletal remains. Damaged or incomplete skeletal remains constitute a major portion of the

samples submitted for analysis.<sup>1</sup> Gradually the demands for accurate methods to determine age at death enhance. There are many accurate methods available to determine age within the first two decades, but after that the reliability of methods to estimate age decreases as the age increases. After 25 years, reliability is only within a decade.<sup>2</sup> In general, greater the personal age the less the confidence quotient.<sup>3</sup> Age estimation from the rib is an important forensic tool as the rib is more likely to be recovered in skeletonized remains when other bones are not available.<sup>4</sup> The method for age estimation using sternal end of fourth rib based on morphological changes was developed by M.Yasar Iscan et al. on white males.<sup>5</sup> Phase wise changes at sternal end of fourth rib is qualitative approach to determine age.<sup>6</sup> This study focused on quantitative assessment of depth of developing pit at sternal end of fourth ribs in relation to age in males.

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## MATERIALS & METHOD

The materials for the present study consisted of fourth ribs, bilaterally. Materials were obtained from the male dead bodies brought for the post-mortem examination after taking necessary consent from the relatives and concerned investigating officer. Age of the deceased were obtained from the nearest relatives and investigating officer and verified by necessary documents.

Fourth ribs from both sides were removed by bone cutters 6 to 8 centimeters away from costo-chondral junction. After removing excess fibromuscular tissues, ribs were put in containers filled with plain tap water with identity tags for several days. The collected specimens were periodically checked for removal of the cartilaginous part attached at sternal end of the ribs. The specimens, in which cartilaginous part still attached, were boiled for 30-35 minutes in plain water. The ribs were easily processed by this method of removal of cartilaginous part and caused no damage at all.

Ribs which were broken at the medial end or having the remains of cartilage at the pit were excluded from the study. Total 210 rib ends were collected from 105 cadavers. From 210 rib ends, 178 rib ends from 89 cadavers were finalized as study samples. Rest of the rib ends were excluded from the study. Measurements were taken by Baker's digital caliper with an accuracy of 0.01mm. Pit depth was measured at that point where the distance between the base of the pit and the adjacent anterior or posterior wall was greatest. The ribs were held perpendicular to the caliper end and pit depth was measured by inserting a depth measuring rod of digital caliper into the pit as shown in Figure-1.

Ribs were scored according to the depth found as mentioned in Table-1. Mean ages were derived for each score. The data were statistically analyzed in SPSS software with Simple linear regression method and interpreted accordingly.

## RESULTS

Table-2 shows the distribution of cases, according to age groups starting from 15-20 years group to the group of more than 70 years. It is evident from the table that the highest number of cases were found from age group 21-30 years, followed by age group 41-50 years and lowest number of cases from age

group of more than 70 years.

It is evident from the Table-3 and Table -4 that mean age increased as the score for pit depth increased. So it can be said that depth of pit at sternal end of fourth rib is age dependent. The standard deviations are less in extremes of mean age, but they are comparatively more in middle aged groups. 95% confidence interval also shows the narrow interval in extremes of age as compared to wider interval in middle aged groups.

Table-5 shows results of ONE WAY ANOVA test applied to bilateral data individually. It is evident from the significance values that progression of pit depth according to age is highly significant.

Table-6 shows R, R square, Adjusted R square and standard error of estimate derived from statistical analysis of bilateral data calculated separately. It is evident from the adjusted R square derived that 69.1% of all of the variability in age can be explained by pit depth on the left side while on the right side 74.2% of all of the variability in age can be explained by pit depth.

Table-7 shows regression coefficients and F ratios derived by ANOVAs test. It is evident from the table that the slope of the regression line is 8.684 for the left side and 8.9 for the right side, moreover the intercept for the left side is 9.621 and for the right side is 7.828. So regression formula for the pit depth to predict age of the individual is  $Y=8.684X+9.621$  for the left side and  $Y=8.900X+7.828$  for the right side as derived from the table, where Y= Age and X= Pit depth. Figure-2 shows regression lines in graphical format.

The Paired T test was applied to find bilateral variations of pit depth changes according to age, which shows correlation coefficient was 0.903 with p value <0.05 (0.000<sup>b</sup>). Correlation coefficient of more than 0.8 is suggestive of strong correlation. So it is concluded that pit depth changes at sternal end of fourth rib according to age has no any significant bilateral variation.

## DISCUSSION

R<sup>2</sup> derived in the Study done by Gupta et al.<sup>7</sup> are 52% on left side and 49% on right sided ribs in 17-30 years age group. For age group 31-44 years, 23% on left side and 21% on right sided ribs and for ages more than 45 years they are 40% on left side and

36% on right sided ribs. While in this study, adjusted R square derived are 69.1% for left sided ribs and 74.2% for right sided ribs involving all age groups combining.

Several studies are based on age estimation from sternal end of ribs, but more or less dependent on morphological features and qualitative assessment of the rib ends. Defining rib in accordance with the phase as described by iscan et al. needs utmost expertise. There may be a chance of observation bias when ribs are classified by different observers as the phases described by iscan et al are based on different morphological parameters within each phase. Hartnett study concluded that there are significant differences in the observed versus actual ages ( $r = 0.75329$ ,  $p < 0.001$ ) and that there are significant interobserver differences according to correlation results.<sup>8</sup> Study done by Kimmerle et al. concluded that even among experienced investigators in the assignment of phase or metric data, there appears to be a wide range of variation and this may be due to qualitative nature of descriptive phase categories, which contain multiple skeletal features, open to interpretation.<sup>9</sup> The major advantage of quantitative assessments of ribs is to minimise observation bias, as it requires only simple measurements and not dependent on multiple descriptive qualitative data to interpret.

However, there are also some limitations of this method. Removal of every remnant of cartilaginous part from the pit is very time consuming and tough exercise. Chances of total breakage of rib ends during this process may make the ribs useless. To identify fourth rib from the bunch of whole skeleton is also a major issue. Future studies should be based on comparison of qualitative and quantitative assessments statistically and also comparing age assessment based on various other available methods. For example, comparing ages estimated by pubic symphysis changes, auricular surface changes and cranial sutures closures. Moreover, future studies should also include others ribs to find inter-rib correlation with the age of an individual and the error that can occur if rib numbers are misidentified.

**Table-1: Divisions of the score according to pit depth (in mm)**

Score	Pit depth (in mm)
D1	0 to 0.99
D2	1 to 1.99
D3	2 to 2.99
D4	3 to 3.99
D5	4 to 4.99
D6	5 to 5.99
D7	6 to 6.99
D8	7 to 7.99

**Table -2 Age Wise Distribution of Cases**

Age group (years)	Number of cases
15-20	10
21-30	18
31-40	14
41-50	16
51-60	12
61-70	15
>70	04

**Table-3 Scoring of left ribs and their statistical analysis.**

Pit Depth Score	Number Of Cases	Mean Age	Std. Deviation	95% Confidence Interval	
				LOWER	UPPER
D1	5	17.40	0.54	16.72	18.08
D2	11	22.82	3.12	20.72	24.92
D3	6	28.00	10.60	16.87	39.12
D4	29	39.41	11.55	35.02	43.80
D5	18	52.05	10.91	46.63	57.48
D6	9	55.44	10.81	47.13	63.75
D7	8	64.75	6.56	59.26	70.23
D8	3	72.67	1.53	68.87	76.46

**Table-4: Scoring of right ribs and their statistical analysis.**

Pit Depth Score	Number Of Cases	Mean Age	Std. Deviation	95% Confidence Interval	
				LOWER	UPPER
D1	5	17.60	0.89	16.49	18.71
D2	10	22.40	3.24	20.08	24.72
D3	7	30.28	10.92	20.19	40.38
D4	26	36.57	10.24	32.44	40.71
D5	20	52.40	10.50	47.49	57.32
D6	9	54.11	8.62	47.49	60.74
D7	10	66.60	7.03	61.58	71.63
D8	2	72.50	0.71	66.15	78.85

**Table-5: Application of one way anova**

Side		Sum of Squares	Degree of Freedom	Mean Square	F-ratio	Significance value
Left	Regression	18354.821	1	18354.82	197.711	.000 <sup>b</sup>
	Residual	8076.775	87	92.836		
	Total	26431.596	88			
Right	Regression	19685.740	1	19685.74	253.883	.000 <sup>b</sup>
	Residual	6745.855	87	77.539		
	Total	26431.596	88			

**Table-6 Derivation of r, r square and adjusted r square**

Side	R	R Square	Adjusted R Square	Std. Error of the Estimate
Left	.833 <sup>a</sup>	.694	.691	9.63517
right	.863 <sup>a</sup>	.745	.742	8.80560

**Table-7 Derivation of Coefficients**

		Unstandardized Coefficients		Standardized Coefficients	T	Significance value
		B	Std. Error	Beta		
Left	(Constant)	9.621	2.580		3.729	.000
	Pit depth	8.684	.618	.833	14.061	.000
Right	(Constant)	7.828	2.393		3.272	.002
	Pit depth	8.900	.559	.863	15.934	.000



Figure-1 Method of pit depth measurement

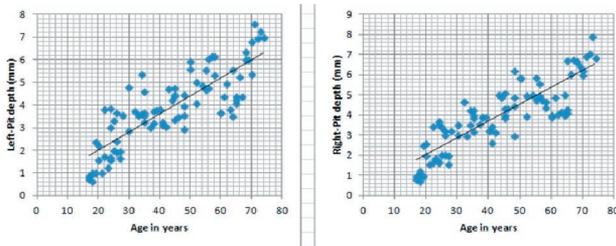


Figure-2 Graphs showing positive linear regression of pit depth with age

### CONCLUSIONS

Positive correlation found in between pit depth at sternal end of ribs and age of an individual suggests that pit depth increases as the age of an individual increases. There is no any statistically significant bilateral variation in terms of progressing pit depth in accordance with the age. Regression formulas have been derived for age prediction from the pit depth which are,  $Y=8.684X+9.621$  for the left side and  $Y=8.900X+7.828$  for the right side of the rib ends, where  $Y=$  age and  $X=$  pit depth in mm.

**Ethical Clearance:** The study was approved by the Institutional Ethics Committee

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# Mortality Profile of Thermal Burns : A Postmortem Study in Dr. B.R. Ambedkar Medical College, Bengaluru

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## ABSTRACT

The present study is an epidemiological profile of the unnatural death cases resulting from burns brought to the mortuary of Dr. B.R. Ambedkar medical college, Bengaluru over a four year period from January 2011 to December 2014. This study explores the age-gender distribution, socio-economic status, place of occurrence, survival period, smell of kerosene and status of clothes over the body, degree of burns, total body surface area involved, manner of death and cause of death. The results of this study provides the necessary information to develop proper burn prevention, thereby reducing the frequency of burns and burn related deaths.

**Keywords :** Thermal burns, Burn deaths, Epidemiology, Postmortem, Manner of death, Causes of death.

## INTRODUCTION

A burn is an injury which is caused by application of heat or chemical substances to the external or internal surfaces of the body, which causes destruction of tissues. The minimum temperature for producing a burn is about 44°C for an exposure of about 5 to 6 hours and full thickness destruction of skin occurs within seconds above 70°C.<sup>1</sup>

Burns have tremendous medicolegal importance as they may be considered to be commonest cause of unnatural death in India. Often, the circumstances of burns are enveloped in mystery, obscurity and unreliable statements. The reason behind this action may be personal, domestic, occupational or social tragedy, and more recently dowry death.<sup>2</sup> The World health organization estimates that each year over 300000 people die from flame or fire-related burn injuries.<sup>3</sup> In India, with a population of over 1 billion, there are 700000 to 800000 burn admissions annually.<sup>4</sup>

## MATERIAL & METHOD

The present study was carried out on the burn death cases brought to the mortuary of Dr.B.R.Ambedkar medical college, Bengaluru for medico-legal postmortem examination during January 2011 to December 2014. Relevant details of the cases were collected in a pre-designed format from the persons accompanying the deceased persons, police papers, inquest reports, hospital records and postmortem reports. All the observations were tabulated, analyzed, interpreted and conclusions were drawn.

## OBSERVATION AND RESULTS

During the study period, a total of 2,358 medico-legal postmortem examinations were conducted, out of which 56 (2.37%) cases were brought with the alleged cause of death as burns.

Regarding the gender distribution, female victims, 34 (60.71%) outnumbered the male victims, 22 (39.28%) with female to male ratio of 1.5:1. Of the females, 25 (73.52%) were married and 9 (26.47%) were unmarried. Of the males, 14 (63.63%) were married and 8 (36.36%) were unmarried. Most of the victims, 39 (69.64%) were married and 17 (30.35%) were unmarried, with married - unmarried ratio of

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2.29:1.

As per the age of the victims, most of the victims, 16 (28.57%) were between 21-30 years of age, followed by 15 (26.78%) cases in 31-40 years age group. Least were 2 (3.57%) cases from less than 10 years age group.

Occupation wise, most of the victims, 23 (41.07%) were house wives followed by labourers 10 (17.85%) and least, 6 (10.71%) were doing private jobs.

As noted in our study, accidental burning, 31 (55.35%) was commonest manner of death due to burns, followed by suicidal in 21 (37.5%) cases and homicidal in 4 (7.14%) cases. All suicide and homicide cases are common in females, while accidental, 20 burn cases were common in males.

In 12 (21.42%) cases, period of survival after sustaining burn injury was more than 15 days, followed by 10 (17.85%) where period of survival was between 7 - 15 days and in 22 (39.28%) cases, spot death occurred.

Septicemia was the most common cause of death in 30 (53.57%) cases followed by neurogenic shock in 26 (46.42%) cases.

Regarding variations in burn injury with time of day, 39 (69.64%) cases occurred in between 6pm - 6am, while 17 (30.35%) cases occurred in between 6am - 6pm.

According to the place of occurrence of burns, majority of burns, 44 (78.57%) took place at home followed by outdoor locations in 8 (14.28%) cases and a small percentage at workplace, 4 (7.14%).

With regards to the total body surface area (TBSA) burnt, it is evident that majority of victims, 25 (44.64%) had burns from 76 - 100% TBSA, followed by 15 (26.78%) cases involving 25 - 50% TBSA, 14 (25%) cases involving 51 - 75% TBSA and 2 (3.57%) cases involving upto 25% tbsa.

Extremities of the body was found to be the most commonly affected in 55 (98.2%) cases; followed by chest and abdomen in 50 (89.28%) cases; head, face and neck in 39 (69.64%) cases and genitalia in 19 (33.92%) cases.

In the present study, body was devoid of clothings in 31 (55.35%) cases and in 25 (44.64%) cases, burnt clothes were intact. Smell of kerosene

was present in 26 (46.42%) cases.

In the present study, 22 (39.28%) cases died at the burn site and the rest, 34 (60.71%) cases died in the hospital during the course of treatment.

In the present study, 32 (57.14%) cases showed dermo-epidermal burns and deep burns were noticed in 24 (42.85%) cases.

Majority of the cases, 33 (58.92%) were belonging to middle socio-economic class, followed by lower 13 (23.21%) and next were from high socio-economic class, 10 (17.85%).

## DISCUSSION

In our study, out of 56 burn cases, 34 (60.71%) were females and 22 ((39.28%) were males. These findings are consistent with other studies.<sup>5,6,7,16</sup> The preponderance of female victims is probably because of increasing familial stress, cooking on open fire, explosion of kerosene pressure stoves, wearing loose clothes which are more vulnerable to catch fire, hurrying through in an overcrowded room with minimal amenities inviting frequent accidents. Moreover in developing country like India, females are married earlier than males in the family and are more exposed to social and family stress much earlier than males.

In our study, most of the victims were between 21 - 30 years of age. These are consistent with other studies.<sup>3,5,6,7,8,9,12,16</sup> The high mortality in this group can be due to this young active group failing to cope with the stressful life situations, job failures, lack of adequate safety measures and awareness while working.

Married people 39 (69.64%) were usual victims of burns as compared to unmarried persons, 17 (30.35%). These findings are consistent with other authors.<sup>6,7,8,9,16</sup> Suicidal and homicidal burn victims were more common in married females, the reason being dowry harassment and marital disharmony which will compel the married females either to commit suicide or they may get burnt by their husband and in-laws.

Occupation wise, house wives 23 (41.07%) have topped among other occupations. These are consistent with findings of other authors.<sup>6,10</sup> Burns are more common among house wives because they are usually involved in cooking on open fire and

kerosene pressure stoves, dowry related problems and wearing of loose clothes which are more vulnerable to catch fire.

In the present study, body was devoid of clothings in 31 (55.35%) cases and in 25 (44.64%) cases, burnt clothes were intact. These findings were consistent with other authors.<sup>5,6</sup>

Smell of kerosene was present in 26 (46.42%) cases, probably because of its easy availability, easy access and its use as a fuel in kitchen. Similar findings were observed by other authors.<sup>5,6,10,11</sup> Non-detection of kerosene in 30 (53.57%) cases was because the cases were treated in the hospital and wounds were cleaned and in other cases, the causative agents were L.P.G (Liquid petroleum gas) or factory fire or firewood.

Maximum number of cases occurred during evening and night times, 39 (69.64%) cases. Similar findings were made by other authors.<sup>3,6</sup> This could be due to victims being busy in cooking activities during that time and will be in a hurry to finish other household works and a small mistake with fire during that time can lead to fatal burns.

Regarding the place of occurrence of burns, majority of burns 44 (78.57%) took place at home. Similar findings are made by other authors.<sup>6,11,12,13</sup> This may be due to use of inflammable materials in housings and furnishings and as a method of suicide.

In the present study, as per the degree of burns, most of the victims 32 (57.14%) cases showed dermo-epidermal burns. Similar findings are made by other authors.<sup>6,8,9</sup>

In our study, most of the burn injuries were accidental in nature, 31 (55.35%) followed by suicidal, 21 (37.5%) and homicidal burns in 4 (7.14%) cases. Similar findings were made by other authors.<sup>3,6,7,9,10,11,12</sup> Accidental burns are more common in males. Suicidal and homicidal burns are common in females. Accidental burns are common probably due to widespread use of portable kerosene stove, adverse housing conditions, poor standards of safety measures and use of loose clothings which are likely to catch fire.

As per the distribution of burns, extremities were involved in 98.21% cases; followed by chest and abdomen in 89.28% cases; face, head and neck

in 69.64% cases and genitalia in 33.92% cases. Similar observations were made by other authors.<sup>5,14</sup>

In the present study, maximum percentage of burns, 25 (44.64%) cases showed involvement of 76 - 100% TBSA. These findings are consistent with other authors.<sup>3,5,6,15</sup> It is also concluded that it is the percentage of body surface area involved which decides death due to burns.

Regarding cause of death, most of the victims died of septicemia (53.57%), followed by neurogenic shock (46.42%). Similar observations were made by other authors.<sup>3,10,16,17</sup> Maximum deaths were caused due to septicemia, which can be reduced to some extent by early excision of the burnt tissue and covering the area with split skin grafts after controlling infection with proper antibiotic coverage.

**Table no.1 : Age and gender distribution.**

Age (Years)	Male	%	Female	%	Total
1-10	2	3.57	0	0	2 (3.57%)
11-20	2	3.57	8	14.28	10 (17.85%)
21-30	7	12.5	9	16.07	16 (28.57%)
31-40	8	14.28	7	12.5	15 (26.78%)
41-50	1	1.78	3	5.35	4 (7.14%)
51-60	0	0	3	5.35	3 (5.35%)
>60	2	3.57	4	7.14	6(10.71%)
<b>Total</b>	<b>22</b>	<b>39.28</b>	<b>34</b>	<b>60.71</b>	<b>56 (100%)</b>

**Table no.2 : Incidence and distribution of burns on the body.**

Body regions	Involved	Spared
	No. (%)	No. (%)
Head, face and neck	39 (69.64)	17(30.35)
Chest and abdomen	50 (89.28)	6 (10.71)
Extremities	55 (98.21)	1 (1.78)
Genitalia	19 (33.92)	37 (66.07)

**Table no 3: Burn deaths according to manner of death.**

Manner of death	Male	Female	Total	%
Accidental	20	11	31	55.35
Suicidal	02	19	21	37.5
Homicidal	0	04	04	7.14
<b>Total</b>	<b>22</b>	<b>34</b>	<b>56</b>	<b>100%</b>

**Table no.4 : Percentage of total body surface area involved in burn injuries.**

Percentage of body surface area involved	Number of cases	%
Upto 25	02	3.57
25 - 50%	15	26.78
51 - 75%	14	25
76 - 100%	25	44.64
<b>Total</b>	<b>56</b>	<b>100%</b>

**Table no.5 : Condition of clothing in burn cases.**

Condition of clothes	Number of cases	%
Clothes present and burnt	25	44.64
Clothes not present	31	55.35
<b>Total</b>	<b>56</b>	<b>100%</b>

**Table no.6 : Incidence and distribution of occupation of burn cases.**

Occupation	Number of cases	%
House wife	23	41.07
Labourer	10	17.85
Business	08	14.28
Student	09	16.07
Private job	06	10.71
<b>Total</b>	<b>56</b>	<b>100%</b>

**Table no.7 : Survival period in case of burn deaths**

Period of survival	Number of cases	%
Spot death	22	39.28
Upto 24 hours	04	7.14
24 - 72 hours	02	3.57
3 - 7 days	06	10.71
7 - 15 days	10	17.85
> 15 days	12	21.42
<b>Total</b>	<b>56</b>	<b>100%</b>

**Table no.8 : Place of death**

Place of death	Number of cases	%
Hospital	34	60.71
Burn site	22	39.28
<b>Total</b>	<b>56</b>	<b>100%</b>

**Table no.9 : Cause of death.**

Cause of death	Number of cases	%
Septicemia	30	53.57
Neurogenic shock	26	46.42
<b>Total</b>	<b>56</b>	<b>100%</b>

### CONCLUSION

The observations indicate that patients with lesser percent of burns or with lesser risk of death are not able to survive even at the tertiary level of our health care system, with septicemia being the cause of death in majority of the cases. Hence the infection control programme for the burn centers requires strict compliance with a number of environmental control measures that include strictly enforced hand washing and universal use of personal protective equipment. Health care personnel must be gowned and gloved at each entry to the burn patient's isolation room. Monitoring and diagnostic equipment should be housed in each burn patient's room to prevent cross-contamination between patients and these equipments must be regularly cleaned with appropriate disinfectants.

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# Near Fatal Poisoning by Isoniazid and Rifampicin- a Case Report and Review of Literature

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## ABSTRACT

Isoniazid (INH) and Rifampicin(RIF) were first introduced as a chemotherapeutic agent for tuberculosis in 1952 and 1967 respectively. Since then they are the mainstay of the anti-tubercular treatment and are included in nearly all Anti Tubercular Treatment (ATT) regimes. The minimum acute lethal or toxic dose of Rifampicin is not well established. However, nonfatal acute overdoses in adults have been reported with doses ranging from 9 to 12 gm Rifampin and fatal acute overdoses with doses ranging from 14 to 60 gm. Isoniazid ,if acutely ingested ,even 1.5 to 2 gram may cause toxicity in adults. Acute INH toxicity usually manifests as altered mental status or seizures, including status epilepticus. Poisoning may occur with unintentional or accidental ingestion, suicidal intent, or in patients taking extra tablets to compensate for missed doses. Untreated or inadequately treated cases of gross isoniazid over dosage can be fatal, but good response has been reported in most patients treated within the first few hours after drug ingestion. We report a case of Potts spine on ATT, who took massive overdose of Rifampicin (>18 gm) and Isoniazid (>12 gm) and reported late (almost 36 hours) after ingestion. He was treated successfully with pyridoxine, Hemodialysis and supportive care.

**Keywords:** Rifampicin; Isoniazid; Pyridoxine; acute overdose; Hemodialysis.

## INTRODUCTION

Isoniazid and Rifampicin are one of the most effective and widely used anti-tubercular drugs. Long treatment duration and Easy access to these drugs increases the potential for deliberate self poisoning. Acute INH toxicity frequently presents as altered mental status, seizures, metabolic acidosis or coma; and chronic INH toxicity frequently manifests as peripheral neuropathy or hepatotoxicity. An acute ingestion of even 2 g may cause toxicity<sup>(1)</sup>. Higher doses ( $\geq 20$  mg/kg) are associated with increased likelihood of seizures<sup>(2)</sup>. In toxic doses, rifampicin produces hepatic, renal, hematological disorders, convulsions and sometimes red man syndrome. The prognosis and outcome depends on rapid diagnosis and timely management of complications.

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## CASE PRESENTATION

Mr. VS, 25 years, 62 kg body weight, had been taking Anti-tubercular treatment since last two and a half years for Potts Spine without follow-up consults. He was brought to triage on 13.05.2015 with alleged history of ingesting around 15 to 20 tablets of Rifampicin 450mg + Isoniazid 300 mg on the night of May 11, 2015. He was initially taken to a local hospital where he developed generalized tonic clonic seizure and became comatose. He was then referred to a higher centre and was later admitted to another hospital where he was managed with antiepileptics, vasopressors, N-Acetyl cysteine and supportive treatment. No Gastric lavage was done. He was then shifted to our Facility, almost 36 hours after ingestion. On admission, there was a history of nausea, vomiting, shortness of breath after ingesting alleged tablets followed by generalized tonic clonic seizures and altered sensorium. All this happened within 2 hours of ingestion of tablets. He was admitted to Medical intensive care unit for further management.

On examination he was restless, irritable, had tachycardia (Heart rate 115/mt), BP 150/90 mm Hg, afebrile, Tachypnea (Respiratory rate 22/mt), mild jaundice, GCS E2V2M4, bilateral plantar extensors, and basal coarse crackles. Rest of the clinical examination was normal. His serology, serum electrolytes, thyroid function tests, electrocardiogram and ultrasound abdomen were normal. His other investigations are mentioned in Table 1. Further evaluation revealed orange to red color urine (no other features of red man syndrome), high anion gap metabolic acidosis, rhabdomyolysis (very high CPK) and hepatic dysfunction. He was managed conservatively with high dose Pyridoxine slurry, single session of Hemodialysis, Torsemide, Anti

Epileptic Drugs (Levitiracetam and Lorazepam), fluids and other supportive treatment. He improved over next 48 hours and was discharged on 19.05.2015. In follow up patient revealed that he had in fact taken more than 40 tablets (more than 12 gm of Isoniazid and 18 gm of Rifampicin). A pre-discharge MRI LS spine showed chronic changes of spondylodiscitis. His Anti tubercular treatment was stopped. We did not measure blood levels of Isoniazid and rifampicin because of non-availability and the diagnosis of intoxication was based on history and photographs of the used labeled drug strips. Moreover, blood levels are not clinically helpful in managing an acute overdose and results may take days or weeks to perform.

**Table 1: Hematology and Biochemistry**

	Normal Values	13.05.2015	15.05.2015	17.05.2015	18.05.2015	27.05.2015
Hemoglobin(gm/dl)	13-0-17.0	13.8	15.5			
TLC( 1000 cells/cmm)	4.0-10.0	23.24	12.78			
Total Platelet count (1000 cells/cmm)	150-400	151	129			
ESR (mm 1 <sup>st</sup> Hour)	0-10		60			
CRP(mg/dl)	< 0.6	4.29			4.76	
S.Bilirubin Total (mg/dl)	0.0-1.3	3.5			2.5	0.7
S.Bilirubin Direct (mg/dl)	0.0-0.3	1.8			1.5	0.5
AST(IU/L)	15.0-37.0	1171		1398	526	46
ALT(IU/L)	30.0-65.0	206		528	406	89
ALP (U/L)	38-126	83		128	103	74
S.Total Proteins (mg/dl)	6.4-8.2	6.77			6.69	6.40
S.Albumin (gm/dl)	3.4-5.0	3.82			3.5	3.32
Creatine Kinase(U/L)	<171.0	>20,000.00				

TLC: Total Leucocyte Counts; ESR: Erythrocyte Sedimentation rate; CRP: C Reactive Proteins; AST: Aspartate aminotransferase; ALT: Alanine Aminotransferase; ALP: Alkaline Phosphatase.

## DISCUSSION

Most of us monitor liver function tests to detect hepatotoxicity in patients with tuberculosis who are being treated with isoniazid or Rifampicin. However, many of us may not be aware that the acute ingestion of as little as 1.5 to 2.0 g of INH can be toxic<sup>(1)</sup>. In higher doses (30 mg per kg

or more) INH often produces seizures and if large quantities (80 to 150 mg per kg or more) are taken intentionally or accidentally, recurrent seizures, profound metabolic acidosis, coma and even death can occur<sup>(3)</sup>. INH is a hydrazid derivative of isonicotinic acid and is rapidly absorbed from the gastrointestinal tract. Peak blood levels of isoniazid are reached within one to two hours after ingestion, although toxic effects can begin to appear much sooner<sup>(4)</sup>. Its volume of distribution is between 0.6 and 1.2 L/kg. It readily diffuses to all body fluids and tissues, with the largest concentration occurring

in the liver. It undergoes hepatic metabolism to hydrazones, as well as acetylating to hydrazine and hydrazides. The metabolite of isoniazid, isoniazid hydrazone is produced by dehydrazination that inhibits formation of pyridoxal-5 phosphate from pyridoxine by inhibiting pyridoxine phosphokinase competitively. The functional pyridoxine deficiency induced by INH and inhibition of Glutamate dehydrogenase leads to Gamma Amino Butyric Acid (GABA) deficiency. GABA deficiency may manifest as seizures, particularly in acute overdose. The major route of elimination is via the kidney. The first signs and symptoms of INH toxicity may appear within 30 minutes to two hours after ingestion and may include nausea, vomiting, rash, fever, ataxia, slurring of speech, peripheral neuritis, dizziness and stupor<sup>(5)</sup>. These symptoms are usually followed by grand mal seizures and coma. The functional pyridoxine deficiency induced by INH leads to a reduction in GABA production. In addition, INH inhibits glutamate dehydrogenase, the enzyme which catalyzes the conversion of glutamate to GABA. GABA deficiency may manifest as seizures, particularly in acute overdose. The seizures are often refractory to anticonvulsants, particularly phenytoin and barbiturates. Respiratory failure and death can follow.

Metabolic abnormalities such as metabolic acidosis (due to lactate production), an elevated creatine kinase and later renal insufficiency from rhabdomyolysis are directly related to seizure activity<sup>(6)</sup>. Isoniazid also inhibits conversion of lactate to pyruvate which in turn results in lactic acidosis. Acetyl hydrazine metabolite of isoniazid is hepatotoxic. INH may also cause hyperglycemia by blocking specific steps in Krebs cycle that requires nicotinamide adenine dinucleotide and also from stimulating glucagon secretion. Isoniazid toxicity therefore manifests with central nervous system dysfunction (CNS), hepatic dysfunction, metabolic abnormalities such as lactic acidosis, hyperglycemia, and hyperkalemia<sup>(6,7,8,9)</sup>. Despite the reported efficacy of Hemodialysis and peritoneal dialysis in isoniazid poisoning, closer scrutiny has revealed that only 9.2% of dose is dialyzable and the rest is handled through hepatic metabolism. However, metabolites of isoniazid are rapidly cleared through normal kidney, and hence forced diuresis is preferred to accelerate isoniazid clearance<sup>(9,10)</sup>. In the present case forced diuresis was done along with a single session

of Hemodialysis.

Rifampicin in toxic doses produces gastrointestinal, renal, hepatic, hematological, and central nervous system manifestation. It often presents with Nausea, vomiting, metabolic acidosis, convulsions, thrombocytopenia, cholestatic jaundice, Oliguric renal failure, and red man syndrome. The typical features of red man syndrome are glowing red discoloration of skin, facial, and periorbital edema. The toxicology findings are attributed to high concentration of rifampicin and two major metabolites 25-desacetyl rifampicin and 3-formylrifamycin. The toxic effects have been described with ingestion of 9-12 g and 14-15 g of rifampicin in various situation<sup>(9,11,12)</sup>. About 70-80% of rifampicin is bound to protein and is distributed throughout body. The diacetyl metabolite is less toxic and its aqueous solubility results in better elimination in bile. With rifampicin intoxication fatal outcomes are exceptional in otherwise normal man. Rifampicin is not significantly removed by Hemodialysis, in view of its large molecular weight, wider distribution in tissue, highly lipophilic and high (80%) protein binding. However, it has rapid hepatic clearance<sup>(13)</sup>.

Blood levels are not clinically helpful in managing an acute overdose and results may take days or weeks to perform. Our patient had taken massive overdose of INH and RIF and presented within few hours with CNS, hepatic and metabolic abnormalities. He reported late at our centre (after 36 hours of ingestion) and had all features of severe INH/RIF toxicity such as convulsions, altered sensorium, coma, metabolic acidosis, rhabdomyolysis, hepatotoxicity with very high creatinine Kinase values and some red man syndrome features like persistent orange discoloration of urine and stool for 3-5 days.

In terms of management, apart from general measures such as providing a secured airway (intubate if the patient is having seizures, is comatose or is unresponsive), gastric lavage with activated charcoal, correction of metabolic acidosis by soda bicarbonate if pH is < 7.1, and measures to correct hypotension and hyperkalemia should be done. Correction of GABA deficiency by pyridoxine replacement is the mainstay of treatment. Pyridoxine should be administered in a dose equivalent to the suspected maximum amount of isoniazid ingested (i.e., gram-per-gram replacement)<sup>(9,14)</sup>. If the amount of ingested isoniazid is unknown, 5 g of pyridoxine is given

intravenously over five to 10 minutes. There should be a low threshold for pyridoxine administration in acute isoniazid toxicity. If the intravenous form of pyridoxine is not available, the drug can be given as slurry, using crushed tablets<sup>(15)</sup>. Repeat dosing may be needed for persistent seizure activity and may also be used to reverse altered sensorium and deep coma. In our case we initially gave around 6 gm of Pyridoxine as slurry as Intravenous pyridoxine was not available. Further dosage were also given in view of persistent mental obtundation.

### CONCLUSION AND FINAL COMMENT

In conclusion, we have reported a case of near fatal poisoning from Isoniazid and rifampicin combination, with detailed literature review. In addition to hepatotoxicity, CNS toxicity is common with acute over dosage of INH and as little as 1.5-2 g can cause clinical symptoms. Caregivers should remember acute toxicity with INH as one of the causes for seizures and mental obtundation. Time is the essence of overall management and patient should be brought/referred as early as possible. Pyridoxine is the drug of choice in gram to gram replacement dosage and can be given as slurry through Ryle's tube. The late presentation or referral, shock, severe metabolic acidosis, and renal failure contribute to fatal outcome.

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# Estimation of Stature and Sex Determination from the Foot and/or Shoe Dimension in Youngsters of Ahmedabad City of India

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## ABSTRACT

Foot print/ shoe print is one of the valuable physical evidence encountered in the crime scene. The aim of the study was to develop a formula to estimate the stature and determine the sex of an individual using foot and/or shoe dimensions. Our study is based on the stature, shoe size, left and right shoe dimensions, left and right foot length and width measurement of a target group of 468 youngsters of age 17-30 years, randomly selected from the Ahmedabad city of India. Of which 433 were again selected for data analysis and the remaining 35 were used to verify the formula of determining their sex.

**Keywords:** Forensic Anthropology, correlation coefficient, t-test, logistic equation, linear regression equation.

## INTRODUCTION

A person's stature is an identifying characteristic that is often used in forensic investigation. Estimation of height, age, weight from different body parts has received great attention in anthropology and forensic and medical scientists from many years stature of an individual is proportionate to various body parts.

Researchers have tried to estimate stature (body height) using 'anatomical' and 'mathematical' techniques. (Lundy<sup>1</sup>). The anatomical method yields more accurate results than mathematical methods. However, the former cannot be applied unless almost all components of the Skelton are available (Tralter and Gleser<sup>2,3</sup>); Pelin and Duyar<sup>4</sup>).

In case of mass disasters and criminal mutilation, it likely to find peripheral parts of body such as hand or foot. Stature has been estimated from such parts of the body. Person identification using footprint or shoeprint or foot with shoe is an emerging

biometric technique. The characteristics features provide useful clues to establish identify whenever a footprint or shoeprint are recovers at the crime scenes (Krishan<sup>5</sup>, Oberoi et al<sup>6</sup>) stature can be estimated from imprints of the hand, foot or from a shoe left at the scene of a crime(Saxena<sup>7</sup>, Ozaslan et al<sup>8</sup>, Giles and Vallandhigham<sup>9</sup>, Jayadip and Shila<sup>10</sup>, Muktarani et al<sup>11</sup>, Naomi et al<sup>12</sup>, 2013; Ukoha et al<sup>13</sup>).

In forensic sciences to determine one's sex is quite important during the identity defining stage. The identity of the victim or the suspect that is tried to be defined will be searched in a 50% reduced population within the determination of one's sex. Besides the body appearance some parts of Skelton and bones, private/personal clothes and other things, and the other numerous data can be made use of to determine one's sex in fatal or harmless incidents.(Kanchan and Rastogi<sup>14</sup>, Ozden et al<sup>15</sup>). Ozden et al<sup>15</sup> have developed a formula to estimate the stature and sex of an individual using the collective effect of foot and shoe dimension.

This study was design to investigate the relationship between stature and dimensions of left foot, right foot, left shoe and right shoe collectively as well as individually with shoe size and/or without shoe size for male, female and pooled data. Also these

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variables are used to identify person's sex with the help of logistic regression. The significant variables in estimating stature and sex are identified.

### MATERIALS & METHOD

Harpender anthropometry sets, balance and apparatus are used to measure the stature, foot and shoe dimensions. The present study was conducted on youngsters residing in the Ahmedabad city of Ahmedabad district of Gujarat state, India. Stature and foot/shoe length width in 468 randomly selected individuals (238 males and 230 females) aged between 17 and 30 years were measured in centimeters using the anthropometer and anthropometric rod compass. Stature was measured as the vertical distance between the vertex and the floor when the head is held in Frankfurt Horizontal (FH) Mane.

The foot length is defined as the direct maximum distance from the rear of the heel to the tip of the longest (first or second) toe. Foot width is the distance between the surfaces of the first and fifth metatarsal bone heads. Shoe length and width are defined as the direct maximum distance. Both for male and female, the footwear was recorded as rubber sole shoes, heeled shoes, sandals, slippers, boots, sport shoes etc. Of 468 individuals, 433 (222 males and 211 females) were randomly selected and used for analysis. The remaining 35 (16 males and 19 females) were used for result verification. Analysis was performed using SPSS to develop linear regression equation and logistic equation for all the foot and shoe dimensions for male, female and pooled data.

Paired t-test was performed to test the significant difference between the left and right side measurement of foot and shoe based on the data of male, female and pooled. Independent sample t-test is also used to test the significant gender difference with respect to the different variables under study. The linear equations are derived for estimating stature in case of male, female and for the pooled data when sex was presumed as unknown. The significance of results was tested and p-value of less than 0.05 was considered as significant. The accuracy of the logistic regression models, which are developed to determine sex is checked by employing the models on the remaining data set of 35 individuals (16 males and 19 females).

### FINDINGS

Descriptive statistics of age, Stature, foot and Shoe measurements in male, female and pooled data are shown in Table 1. From the last column of Table 1, all length and width of foot and shoe measurements, stature and shoe size are found to be larger in males than females in left and right feet at 1% level of significance, but observed no significant difference in age of male and female.

The investigation reveals the significant bilateral asymmetry in foot width and foot length in male but not in female, while in female significance bilateral asymmetry is observed in shoe length and width. For pooled data except shoe width significant bilateral asymmetry is observed in all other cases (Table 2). Also significant correlations are found between stature and other variables regardless of the sex (Table 3).

The relationship between stature and foot width in males was found non-significant, whereas in case of female and pooled sample all the variables have significant relation with stature ( $p < 0.01$ ). Since all the above regression equations on estimation of stature in males, females and the pooled sample are statistically significant ( $p < 0.01$ ) hence the predictive accuracy is found to be statistically significant for stature estimation. To determine sex under the different kinds of situations, logistic regression equations are given in Table 7.

### DISCUSSION & CONCLUSION

All the derived regression equations (Table 4) for stature estimation using foot and/or shoe measurement have great significance ( $p$  values 0.000).

Considering real crime scenarios, where the sex of the perpetrator is unknown, it is suggested that a better regression equation that can be used for stature estimation is the one without sex indicator (i.e. based on pooled sample). The multiple correlation coefficients ( $R$ ) between stature and right foot measurements are more than that of left foot measurements. (i.e. Equ. 4 & 5, Tables: 4 - 6) in case of known or unknown sex. The similar conclusion is also drawn in case of shoe measurements without shoe size. (Equ. 9 & 10, Tables: 4 - 6).

Left shoe width and left shoe length without

knowledge of shoe size gives 100% correct determination of sex. When all the measurement of foot and shoe are available the formula gives 97.14% correct determination of sex. The measurement of left shoe with its size gives more correct (97.14%) prediction for sex rather than based on the measurements of right shoe with its size (91.43%) (Equ. 12, 13; Table 7)

When only foot prints are available the equation based on only left foot measurements predict 85.71% correct while based on only right foot measurement the equation predict sex 88.57% correctly (Equ. 3 and 6; Table 7 ). But if we utilize the measurement of both the feet simultaneously, the equation predicts sex 91.43% correctly.

The equation based on the measurement of left or right shoe gives more correct prediction about sex than the measurement of left or right foot (Equ. 3 - 4, 6 - 7; Table 7).

When only shoe measurements are available either of the left or right foot, the logistic equation predicts sex correctly more than that of including shoe size; but when measurement of shoe of both the feet are available with or without including shoe size the logistic equation predicts sex correctly equally in both the cases. (Equ. 4 and 12; 7 and 13; 11 and 15; Table 7).

It was supposed that if any kind of shoe found on the spot, this study would lead the determination of sex. 91.43 to 100% correctly.

**Table -1: Descriptive Statistics**

Variables	Male( N = 222 )				Female( N = 211)				Pooled sample( N = 433)				P-value
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	
Age	17	30	20.7	3	17	30	20.9	2.607	17	30	20.8	2.814	0.475 <sup>ns</sup>
Stature(cm)	150	193	171.33	8.798	135	174	157.22	6.711	135	193	164.45	10.552	0.020*
ss(cm)	5	11	8.53	1.136	4	12	6.06	1.18	4	12	7.33	1.691	0.020*
lfw(cm)	8	13	10.46	0.811	8	13	9.68	0.635	8	13	10.08	0.827	0.000*
lsw(cm)	9.5	15	12.028	0.873	8.1	13.6	10.663	0.821	8.1	15	11.363	1.0881	0.020*
lfl(cm)	20.9	29	25.181	1.3233	18.3	26.5	22.582	1.1771	18.3	29	23.914	1.8057	0.020*
lsl(cm)	21.2	32	28.277	1.5424	20	29.3	24.755	1.3575	20	32	26.561	2.2844	0.020*
rfw(cm)	8	14	10.63	0.811	7	11	9.63	0.669	7	14	10.14	0.897	0.020*
rsw(cm)	9.8	22.3	12.029	1.1204	8.5	12.7	10.517	0.7754	8.5	22.3	11.292	1.2277	0.020*
rfl(cm)	20.3	29.5	25.305	1.4207	19.9	29	22.738	1.1855	19.9	29.5	24.054	1.8348	0.020*
rsl(cm)	22	32	28.43	1.495	20	28	24.88	1.304	20	32	26.7	2.265	0.020*

\*-Significant(< 0.05), N-Sample Size,  
**Table: 2 P- values for Paired Sample t-test**

Pair	Male	Female	Pooled Sample
lfw - rfw	0.020*	0.153	0.037*
lfl - rfl	0.028*	0.057	0.007*
lsw - rsw	0.982	0.000*	0.056
lsl - rsl	0.061	0.047*	0.007*

**Table: 3 Correlation between Stature and other variables**

Variables	Male	Female	Pooled Sample
ss	0.485**	0.493**	0.734**
lfw	0.045	0.331**	0.412**
lsw	0.037	0.307**	0.479**
lfl	0.363**	0.500**	0.696**
lsl	0.238**	0.396**	0.658**
rfw	0.053	0.329**	0.469**
rsw	0.051	0.287**	0.488**
rfl	0.342**	0.447**	0.671**
rsl	0.303**	0.424**	0.686**

**Table 4: Stature estimation for Male**

No.	R	Estimating equation
3	0.535**	Stature = 127.098 + 3.368**(ss) - 0.309(lfw) - 1.252(lsw) + 0.389(lfl) - 0.241(lsl) - 0.679(rfw) + 0.657(rsw) + 0.515(rfl) + 0.602(rsl)
6	0.523**	Stature = 130.112 + 3.396**(ss) - 0.858(lfw) + 1.036*(lsw) + 0.075(lfl) - 0.539(lsl)
9	0.523**	Stature = 71.598 + 1.737**(ss) + 1.403*(rfw) + 0.745(rsw) + 1.254**(rfl) + 1.014**(rsl)
12	0.342**	Stature = 116.564 + 0.129(rfw) + 2.110**(rfl)
15	0.363**	Stature = 108.363 + 0.235(lfw) + 2.403(lfl)
18	0.372**	Stature = 105.818 + 0.119(lfw) + 1.667**(lfl) + 0.094(rfw) + 0.842(rfl)
21	0.519**	Stature = 135.999 + 3.533**(ss) - 1.898*(lsw) - 0.111(lsl) + 0.684(rsw) + 0.807(rsl)
24	0.324**	Stature = 124.559 - 1.331(lsw) + 0.303(lsl) + 0.724(rsw) + 1.6**(rsl)
27	0.245**	Stature = 139.224 - 0.582(lsw) + 1.386**(lsl)
30	0.303**	Stature = 119.572 + 0.114(rsw) + 1.772**(rsl)
33	0.505**	Stature = 144.159 + 3.737**(ss) - 1.317*(lsw) + 0.394(lsl)
36	0.497**	Stature = 124.404 + 3.383** (ss)- 0.192(rsw) + 0.717(rsl)

R= multiple correlation coefficient

**Table 5: Stature estimation for Female**

No.	R	Estimating equation
2	0.664**	Stature = 62.459 + 1.624**(ss) + 0.574(lfw) + 0.978(lsw) + 1.171**(lfl) + 0.325(lsl) - 0.534(rfw) + 0.296(rsw) + 0.899*(rfl) + 0.230(rsl)
5	0.648**	Stature = 73.787 + 1.829** + 1.312**(lfw) + 1.569**(lsw) + 0.482(lfl)+1.136(lsl)
8	0.635**	Stature = 71.598 + 1.737** + 1.403*(rfw) + 0.745(rsw) + 1.254**(rfl) + 1.014**(rsl)
11	0.506**	Stature = 82.945 + 2.443**(rfw) + 2.232**(rfl)
14	0.536**	Stature = 79.740 + 2.145**(lfw) + 2.511(lfl)
17	0.581**	Stature = 64.067 + 1.003 (lfw)+1.816**(lfl)+1.250ns(rfw)+1.337**(rfl)
20	0.598**	Stature=94.188+2.221**(ss) + 1.182(lsw) + 0.455(lsl) + 0.490(rsw) + 0.826(rsl)
23	0.472**	Stature = 89.720 + 0.958(lsw) + 0.668(lsl) + 0.763(rsw) + 1.315*(rsl)
26	0.440**	Stature = 98.985 + 1.649**(lsw) + 1.642**(lsl)
29	0.457**	Stature = 93.319 + 1.542**(rsw) + 1.917**(rsl)
32	0.589**	Stature = 100.087 + 2.332**(ss) + 1.622**(lsw) + 1.038**(lsl)
35	0.587**	Stature = 97.155 + 2.221**(ss) + 1.424**(rsw) + 1.271**(rsl)

**Table 6: Stature estimation for Pooled data**

No.	R	Estimating equation
1	0.783**	Stature = 83.122 + 2.449**(ss) - 0.200(lfw) + 0.154(lsw) + 0.973*(lfl) + 0.082(lsl) - 0.010(rfw)+ 0.437(rsw) + 0.717*(rfl) + 0.604(rsl)
4	0.777**	Stature = 86.719 + 2.658**(ss) - 0.033(lfw) + 6.566(lsw) + 1.629**(lfl)+0.498*(lsl)
7	0.779**	Stature = 86.959 + 2.604**(ss) - 0.053(rfw) + 0.471(rsw) + 1.222**(rfl) + 0.908**(rsl)
10	0.691**	Stature = 61.776 + 2.221**(rfw) + 3.332**(rfl)
13	0.707**	Stature = 57.928 + 1.737**(lfw) + 3.722(lfl)
16	0.724**	Stature = 53.553 + 0.518(lfw) + 2.375**(lfl) + 1.318*(rfw) + 1.477**(rfl)
19	0.768**	Stature = 98.658 + 2.975**(ss) - 0.230(lsw) + 0.364(lsl) + 0.691(rsw) + 1.092**(rsl)
22	0.701**	Stature = 73.287 + 0.140(lsw) + 0.887*(lsl) + 1.020*(rsw) + 2.041**(rsl)
25	0.669**	Stature = 77.918 + 1.444**(lsw) + 2.640**(lsl)
28	0.696**	Stature = 75.472 + 1.220**(rsw) + 2.817**(rsl)
31	0.760**	Stature = 103.520 + 3.278**(ss) + 0.495(lsw) + 1.178**(lsl)
34	0.767**	Stature = 99.330 + 3.018** (ss)+ 0.595(rsw) + 1.360**(rsl)

**Table 7: Logistic equation for sex determination**

No.	Sex equation	Total Correct Prediction (%)
1	Sex = -59.397 + 0.584**(ss) - 0.425(lfw) + 0.3(lsw) + 0.118(lfl) + 0.385*(lsl) +0.268(rfw) + 0.993*(rsw) + 0.547*(rfl) + 0.529**(rsl)	97.14
2	Sex = -50.741 + 0.703** (ss)- 0.087(lfw) + 1.103**(lsw) + 0.682**(lfl) + 0.671**(lsl)	97.14
3	Sex = -45.482 + 0.998**(lfw) + 1.490**(lfl)	85.71
4	Sex = -44.105 + 1.109**(lsw) + 1.19**(lsl)	100
5	Sex = -55.785 + 0.636**(ss) + 0.116(rfw) + 1.218**(rsw) + 0.624**(rfl) + 0.804**(rsl)	97.11
6	Sex = -44.422 + 1.333**(rfw) + 1.295**(rfl)	88.57
7	Sex = -49.504 + 1.27** (rsw) + 1.324**(rsl)	94.29
8	Sex = -63.596 - 0.358(lfw) + 0.220(lsw) + 0.274(lfl) + 0.422*(lsl) + 0.471(rfw)+1.106*(rsw) + 0.591*(rfl) + 0.590**(rsl)	97.14
9	Sex = -56.418 + 0.086(lfw) + 1.139**(lsw) + 0.933**(lfl) + 0.770**(lsl)	97.14
10	Sex = -61.307 + 0.444(rfw) + 1.216**(rsw) + 0.747**(rfl) + 0.952*(rsl)	94.29
11	Sex = -51.436 + 0.716**(ss) + 0.119(lsw) + 0.544**(lsl) + 1.015*(rsw) + 0.716**(rsl)	97.14
12	Sex = -42.897 + 0.868**(ss) + 1.018**(lsw) + 0.946**(lsl)	97.14
13	Sex = -46.217 + 0.806**(ss) + 1.226**(rsw) + 0.999**(rsl)	91.43
14	Sex = -51.872 + 0.193(lfw) + 0.869**(lfl) + 1.112**(rfw) + 0.754**(rfl)	91.43

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**Ethical Clearance:** No ethical treatments are involved in the research work so no need of ethical clearance.

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# Socio-demographic Study of Death Due to Burns

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## ABSTRACT

It is said that burns is a preventable disaster and more than 80% burns injuries can be prevented. Hence it is undisputedly accepted that prevention of burns is the best treatment of thermally injured. Total 106 cases with burn injuries and scald brought to the mortuary for autopsy is used as material for study purpose, during the period January 2014 to December 2014. Majority of the cases i.e. 41(38.68%) were in the age group of 21-30 years of age, 72.63% cases were females and 27.36% cases were males, 21(19.81%) were illiterate. Occupation wise most of the victims were house wives. Most of the victims 80(75.47%) were married. In 87(84.47%) cases kerosene oil was involved as inflammable material. Total 93(87.74%) incidence of fires occurred indoor and kitchen was the most common place. Maximum number of cases 40(37.74%) occurred between 6.00 PM and 12.00 AM.

**Keywords :** Burns, socioeconomic profile.

## INTRODUCTION

In India, approximately, there are 6 million burns cases annually, of which around 0.7 million cases require hospitalization, of which approximately, 0.12 millions die annually. Survival rate of burn patients in developing countries like India is around 50% where percentage of burns less than 40, while those in developed countries it is around 75-90% for 50% burns. It is said that burns is a preventable disaster and more than 80% burns injuries can be prevented. Hence it is undisputedly accepted that prevention of burns is the best treatment of thermally injured.<sup>1</sup>

The problem of burn in developing countries like India is more due to various socio-cultural factors present in the country. Some of these factors may be dowry, use of crackers in festival, poor housing conditions, custom of wearing sarees or dupatta, illiteracy, poverty, ignorance and also underlying social factors like interpersonal relationship in the

family, mental stress, male dominance,

Females are more affected in developing countries than developed countries. Domestic burns are more in developing countries while non-domestic burns are more in developed country.<sup>2</sup> It was seen that flame burn was more common among females while electrical and chemical burns were common among males. Scalds were common among children (0-10 years).<sup>3</sup>

By law all dry heat lesions have been designated as burns. Burns are the fourth most common type of trauma worldwide, following traffic accidents, falls and interpersonal violence. Illiteracy and negligence in proper use of fire and fire producing materials in lower socio economic group of peoples is one of the reason for burns incidence in them.<sup>4</sup>

The majority of the injuries occurs in the household and is not job-related. They are more common amongst the lower and lower middle class populations in both urban and rural areas alike. While accidental injuries remain the most common cause, suicidal and homicidal injuries are not very rare.<sup>5</sup> The medico-legal aspects in deaths due to burns deals with cause and manner of death.<sup>6</sup>

Deaths due to burning are the problem of great concern in India and burn has been reported to be the

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second most common cause of death in all medico-legal cases. According to studies, burn was found to be the cause of death in 16.7% cases, in Punjab state, 18.1% cases in Maharashtra and 23.3% in rural India.<sup>7</sup>

The present study was planned to study the different socio-demographic characteristics like age and sex incidence, marital status and duration of marriage, habitat i.e. urban or rural, place of incidence and cause of burn etc. The findings of study will help in identifying the crucial socio-cultural and demographic factors which play an important role in occurrence of burns injuries.

### MATERIAL & METHOD

Present study is carried out in Department of FMT, Indira Gandhi Govt. Medical College, Nagpur, during the period January 2014 to December 2014. The cases for the present study comprised of all the cases of death due to burn brought for post-mortem examination.

Total 106 cases with burn injuries brought for autopsy is used as material for study purpose. Those having postmortem burn, burns due to chemicals, electrocution and radiation are excluded.

**Table -1: Age and sex wise distribution**

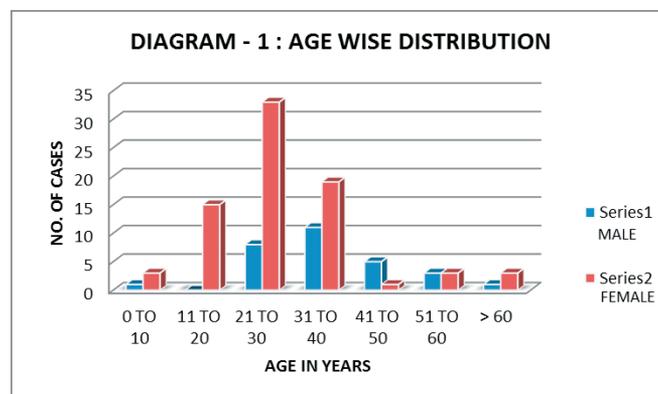
Age Group in Years	Male		Female		Total		M:F Ratio
	No.	%	No	%	No	%	
0 To 10	1	0.94	3	2.83	4	3.77	1:3
11 To 20	0	0	15	14.15	15	14.15	0:15
21 To 30	8	7.55	33	31.13	41	38.68	1:4.1
31 To 40	11	10.38	19	17.92	30	28.30	1: 1.7
41 To 50	5	4.72	1	0.94	6	5.66	5:1
51 To 60	3	2.83	3	2.83	6	5.66	1:1
> 60	1	0.94	3	2.83	4	3.77	1:3
<b>Total</b>	<b>29</b>	<b>27.36</b>	<b>77</b>	<b>72.63</b>	<b>106</b>	<b>100</b>	<b>1:2.7</b>

The information regarding age, sex, residence, marital status, date and time of incidence, detailed history of incidence, date and time of death gathered from police inquest report, dead body challan, relatives, friends, neighbors of the deceased and filled in standardized form in each case and the data is analyzed and presented.

Thorough and complete post mortem examination conducted on all the dead bodies; including both external and internal findings with attempts made to establish the cause of death and circumstances leading to death.

### OBSERVATIONS & RESULTS

In the present study, majority of the cases i.e. 41(38.68%) were in the age group of 21-30 years of age, followed by age group 31-40 years 30(28.30%). Lowest number of cases reported in the age group of 0-10 years and >60 years i.e. 4(3.77%) in each age group. Among 106 cases, 72.63% cases were females and 27.36% cases were males. Male and female ratio is 1:2.7. In all age group female outnumbers male except in age group 41-50 years. (Table -1 & Diagram -1).

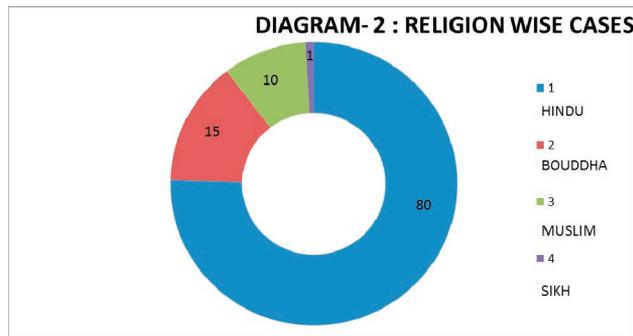


In this study most victims belong to Hindu community comprising 75.47% i.e. 80 cases ,followed by Buddha 14.15% i.e. 15 cases, Muslim 9.43% i.e. 10 cases and Sikh 0.94% i.e. only one case.( Diagram -2)

As regard to education, 21(19.81%) were illiterate, upto primary 12(11.32%), upto secondary 50(47.17%), upto higher secondary 16(15.09%), graduation 6(5.66%), postgraduate 1(0.94%). Occupation wise most of the victims were house wives. (Table-2)

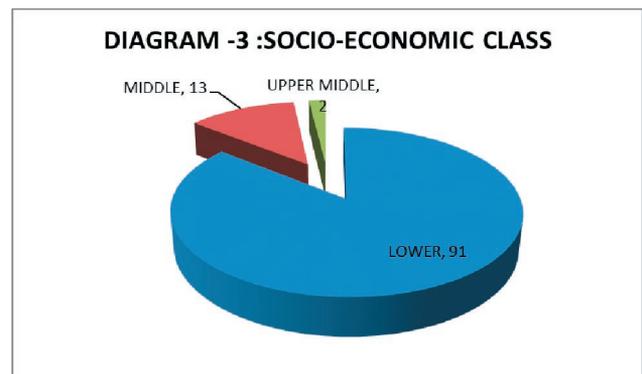
**Table -2: Educational and Occupational Status**

Sr.no	Male	Female	Total	%
<b>Education</b>				
Illiterate	5	16	21	19.81
Primary	7	5	12	11.32
Secondary	14	36	50	47.17
Higher Secondary	2	14	16	15.09
Graduate	1	5	6	5.66
Post Graduate	0	1	1	0.94
Total	29	77	106	
<b>Occupation</b>				
<b>Employed</b>				
Anganwadi Teacher	0	1	1	0.94
Police Constable	1	0	1	0.94
Driver	7	0	7	6.60
Cashier	0	1	1	0.94
Skilled Worker	1	2	3	2.83
Unskilled Worker	16	12	28	26.41
<b>Un-employed</b>				
House Wife	0	43	43	40.57
Farmer	2	3	5	4.72
Student	1	16	17	16.04
Total	28	78	106	



Most of the victims 80(75.47%) were married and among them 56(52.83%) were females and out of these 28(50%) were within 7 years of active marriage life.

Most of the victims 66(62.26%) belonged from rural area and rest of 40(37.74%) from urban area.



Majority of incidence 91 (85.85%) were low socio-economic class, 13(12.26%) in middle class and 2(1.87%) in upper class.( Diagram-3)

Of 106 cases, most of the cases were reportedly accidental 63(59.43%) followed by suicidal 43(40.57%). Further analysis of flame burns revealed that in 87(84.47%) cases kerosene oil was involved

and in 6(5.83%) cases petrol was used, 3(2.91%) cases LPG gas leads to flame burns. In rest of the flame burn cases 1 was due to burning cloth, 1 due to chullha, 2 from playing with crackers in Diwali, 1 during saving the burn victim, and 1 due to wood polish and in 1 case inflammable material was not known. In the present study 3 cases were from hot water burns. (Table-3)

**Table -3: Inflammable material**

Sr.No	Agent	No.of case	Percentage
1	Burning cloth	1	0.97
2	Chullha	1	0.97
3	Crackers	2	1.94
4	Lpg	3	2.91
5	Kerosene	87	84.47
6	Petrol	6	5.83
7	Saving other	1	0.97
8	Wood polish	1	0.97
9	Not known	1	0.97
		103	

According to history, total 93(87.74%) incidence of fires occurred indoor and kitchen was the most common place of occurrence, accounting for 51.89% of incidents, where as 12.26% of the cases, the incident had occurred outdoor.(Table-4)

**Table- 4: Place of incidence**

Place of occurrence	Male		Female		Total
	M	Um	M	Um	
Indoor					
I) kitchen	5	1	38	11	55
Ii) bedroom	0	0	4	0	4
Iii) living room	1	1	2	0	4
Iv)home ( not specified)	9	1	10	8	28
V)store room	0	0	1	0	1
Vi)toilet	1	0	0	0	1
Outdoor	9	1	1	2	13
<b>Total</b>	<b>25</b>	<b>4</b>	<b>56</b>	<b>21</b>	<b>106</b>

Maximum number of cases 40(37.74%) occurred between 6.00 PM and 12.00 AM, followed by 31 (29.25%) cases between 12.00 PM and 06.00 PM, while minimum number 8(7.55%) between 12.00

AM and 06.00 AM when most of the peoples are sleeping.(Table-5)

**Table -5: Time of incidence of burn injury.**

Time in hours	Male		Female		Total
	M	Um	M	Um/widow	
00.00 To 06.00	3	1	4	0	8
06.00 To 12.00	5	2	15	5	27
12.00 To 18.00	6	2	14	9	31
18.00 To 24.00	10	0	23	7	40
<b>Total</b>					<b>106</b>

## DISCUSSION

In the present study, there were 77(72.63%) cases of female and 29(27.36%) cases of male burn deaths having Male and female ratio is 1:2.7. Majority of the cases i.e. 41(38.68%) were in the age group of 21-30 years of age, followed by age group 31-40 years 30(28.30%). Our observations are consistent with other studies conducted at different period.<sup>1-13</sup>

In this study most victims belong to Hindu community comprising 75.47% i.e. 80 cases out of total 106 cases followed by Buddha 14.15% i.e. 15 cases, Muslim 9.43% i.e. 10 cases and Sikh 0.94% i.e. only one case. Similar findings are observed in other study.<sup>1,4,8</sup>

As regard to education, 21(19.81%) were illiterate, up to primary 12(11.32%), up to secondary 50(47.17%), up to higher secondary 16(15.09%), graduation 6(5.66%), postgraduate 1(0.94%). This observation is in accordance with the Shrivastava P having 22.3% women illiterate, 30.1% educated up to primary level, 27.2% up to secondary level and 8.7% women were graduate.<sup>1</sup> As per study by Gupta R, majority of the victims (49.2%) had obtained up to primary school level education. Uneducated victims amounting to 15.3% of the burn victims.<sup>8</sup> According to Chakraborty S et al 78.4% victims were literate.<sup>12</sup>, similar observation by Patel TC that almost 70% of cases were among undergraduate individuals.<sup>13</sup> As per Jagannath HS, 40% victims were literate and 60% were illiterate.<sup>2</sup>

Most of the victims 80(75.47%) were married and among them 56(52.83%) were females and out of these 28(50%) were within 7 years of active marriage life. Most of the victims 66(62.26%) belonged from

rural area and rest of 40(37.74%) from urban area. Majority of incidence 91 (85.85%) were low socio-economic class, 13(12.26%) in middle class and 2(1.87%) in upper class. Similar results were observed by Jagannath HS et al, that majority of cases 43.33% were from class IV followed by 36.67% from class III socio-economic group, also majority of cases i.e. 95.73% were married.<sup>2</sup> As per Shinde AB, 81.94% females were married and out of 16 male, 14 were married.<sup>6</sup> As per Gupta R, most of the victims i.e. 83.9% were married and among them 88.5% were females. Most of the victims (84.6%) were from rural areas and rest 15.4% belong to urban area.<sup>8</sup> Study by Buchade D, observed married females 114(76.51%) are most common victim followed by married male 63(71.59%).<sup>9</sup> As per Lal S, et al. out of total cases 76.28% were married, out of these married females were 56.73%, and 71.84% cases from rural area (71.84%)<sup>10</sup>. As per Zanzad NP, most of the cases i.e. 348(76.3%) were from rural region.<sup>11</sup> As per Chakraborty S, 57.8% of burn victims were from rural region.<sup>12</sup> According to Patel TC, incidence was higher in married person (71.19%). Out of married cases 128(73.99%) were females. Out of married females 44 cases (34.38%) were within 7 years of active marriage life. Incidence was more in rural areas (67.08%) as compared to that in urban area (32.92%). Majority of incidence (60%) of fire were occurred in lower socio-economic class and least in upper class (3%)<sup>13</sup>.

Total 93(87.74%) incidence of fires occurred indoor and kitchen was the most common place of occurrence, accounting for 51.89% of incidents, where as 12.26% of the cases, the incident had occurred outdoor. These findings are in accordance with Jagannath HS, where 97.56% of burns took place at home and 2.44% at work place.<sup>2</sup> Shinde AB, observed that in 46 (48.94%) cases female victims sustain burns in home and in 40 (42.55%) cases the place was alleged to be kitchen<sup>6</sup>, Gupta R, kitchen was reported to be the major culprit site of the incidence of the burns, accounting for 75% of the burn incidence, where as 13.8% of the cases, the incidence had occurred outdoors<sup>8</sup>, Lal S observed that more than 85% of burn injuries occurred at home<sup>10</sup>, Patel TC reported that total 175 (98%) incidences of fires occurred inside their home and kitchen was the most common place of occurrence for females.<sup>13</sup>

Maximum number of cases 40(37.74%) occurred between 6.00 PM and 12.00 AM, followed

by 31 (29.25%) cases between 12.00 PM and 06.00 PM, while minimum number 8(7.55%) between 12.00 AM and 06.00 AM when most of the peoples are sleeping. Similar observation were noted by Jagannath HS et al where maximum number of burns (37.78%) occurred between 5 pm and 11 pm while minimum number of burns (8.67%) occurred between 11 pm and 5 am.<sup>2</sup> Chaudhary BL et al, reported maximum burn incidence occurred between 6 pm to 12 midnight which is constituted 80(38.64%) cases followed by 51 (34.63%) cases between 12 noon to 6 pm.<sup>14</sup>, our findings are contrary to Shinde AB, reported 44.55% cases have sustained burn during night 22.01 to 06.00 hours,<sup>6</sup>. Although the timing are different in these studies, they might coincide with cooking hours.

## CONCLUSION

This study indicate that socio economic burden of burn injury is very high. Most of the burns injuries were domestic in nature and can be preventable. There is need to provide education so as to build awareness in the mindset of general population through school education programs, and mass media communication. Prevention is better than cure. Steps should be taken to prevent and reduce the incidence to minimum at least in cases where human ignorance, errors and illiteracy plays a major role for burn injury.

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# Cardiac Tamponade due to Myocardial Rupture - a Case Report

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## ABSTRACT

Cardiac Tamponade also known as Pericardial Tamponade, is a life threatening condition causing slow or rapid compression of heart due to pericardial accumulation of fluid, blood, pus or gas, as a result of effusion, trauma or rupture of heart. Postmortem examination of an 80 year old male with history of sudden death revealed tense hemopericardium and the rupture of left ventricle. Root of aorta, coronaries and their branches showed multiple raised atheromatous plaques. Coronary ostia were narrowed. Histopathological examination of ruptured ventricular wall showed features of "Acute Myocardial infarction".

**Keywords:** Sudden natural death; Left ventricular wall rupture, Cardiac tamponade.

## INTRODUCTION

Cardiac Tamponade (CT) is a clinical syndrome characterized by hemodynamic abnormalities resulting from an increase in pericardial pressure due to accumulation of contents such as serous fluid, blood, pus or gas<sup>1</sup>. Left ventricular free wall rupture in cases of acute myocardial infarction ranges from 1 to 6 %. Cardiac Tamponade typically leads to a crisis by decreasing venous return, which impairs diastolic ventricular filling. The diagnosis of free wall rupture is seldom made before death, and death is inevitable if intervention is not prompt. Advanced age is one of the risk factors for the development of this complication.<sup>3</sup>

## CASE REPORT

An 80 year old male dead body was brought to the mortuary of Chrompet GH, Chennai, for postmortem examination. The history provided by the investigating officer revealed that the individual died after acute chest pain. There was no past history of chest pain, diabetes or hypertension. On

postmortem examination: Rigor mortis was present all over the body; there were no external injuries anywhere on the body. Pericardium was intact & tense. On opening of the pericardium, the pericardial sac contained 200gms of clotted blood (Fig.1). Heart was enlarged in size, weighed 370 grams.



Fig. 1. Clotted blood in the pericardial sac

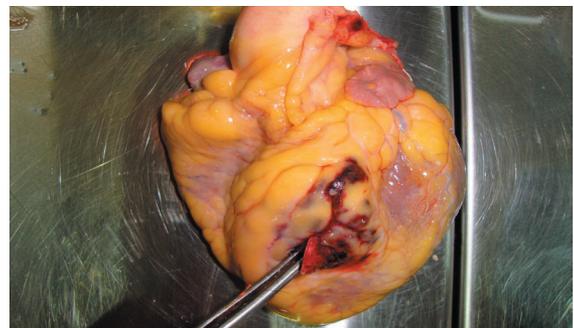


Fig. 2. Ruptured ventricle wall

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A reddish brown soft area measuring 3 X 2.5 cms on the anterolateral surface of middle part of left ventricle with surrounding hyperemia (Fig.2) and ventricular wall rupture measuring 1.5 X 1 cm in the centre of the reddish brown discolored area. All chambers of the heart were empty. Multiple raised atheromatous plaques were observed on the inner surface of aortic root and coronaries; coronary ostia were narrowed; coronary walls were thickened and lumen narrowed; Brain showed multiple atheromatous plaques on the inner surface of the branches of Circle of Willis. All other internal organs were normal in size; cut sections of the organs were congested.

Histopathological examination of ruptured ventricular wall showed inflammatory infiltrates of neutrophils in the eosinophilic background of necrosed myocardium (Fig.3).

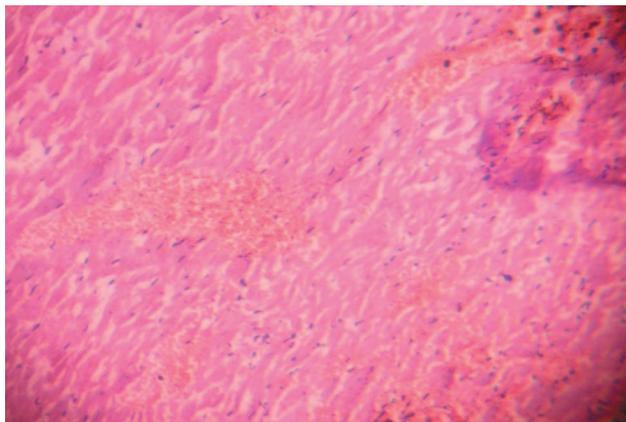


Fig.3. Histopathological examination of injured myocardium

The opinion as to the cause of death was "The deceased would appear to have died of Cardiac Tamponade due to postmyocardial infarction rupture of left ventricle of the heart".

## DISCUSSION

Cardiac Tamponade is a life threatening condition if untreated. Normally 15-50 ml of thin serous fluid will be present in the pericardial cavity. Sudden accumulation of 200ml to 300 ml of fluid in the pericardial sac may be fatal. Slow increase of pericardial fluid up to 2 litres is tolerable.

**Aetiology** includes post myocardial infarction (free wall ventricular rupture), penetrating injuries to the heart, post coronary intervention, pericardiocentesis, anti-reflux surgery at oesophagogastric junction, infective pericarditis

(Viral, bacterial (tuberculosis), fungal), malignancy followed by radiotherapy, infiltrative diseases of heart, aortic dissection and coronary artery aneurysm. Myocardial rupture is more likely to happen in elderly individuals without history of any previous cardiac illness, medical and surgical intervention. Death from rupture of free wall of heart in fatal cases of acute myocardial infarction ranges from 4 to 13%. Risk factor for ventricular rupture secondary to myocardial infarction are female gender<sup>6</sup>, age >55 years<sup>6</sup>, low body mass index<sup>6</sup>, 1st transmural infarction, Killip class I or II<sup>5</sup>, persistent ST segment elevation, persistent or recurrent chest pain, sudden or progressive hypotension, and sudden electromechanical dissociation<sup>3,4</sup>.

**Myocardial rupture** is the tearing of the walls of the ventricles or atria of the heart, of the interatrial or interventricular septum, of the papillary muscles or chordae tendineae or of one of the valves of the heart. It is a serious sequelae of an acute myocardial infarction.

The **cardiac rupture syndromes** result from softening and weakening of the necrotic and subsequently inflamed myocardium. Myocardial ruptures are classified into a) Type I- slit like tear occurs within 24 hours of an acute myocardial infarction. b) Type II - an erosion of the infarcted myocardium, which is suggestive of a slow tear of the dead myocardium and typically occurs 24 hours after the infarction. and c) Type III ruptures are characterized by early aneurysm formation and subsequent rupture of the aneurysm.

**Anatomical classification** of myocardial rupture is based on the portion of the heart that has ruptured. It includes 1) Rupture of the ventricular free wall (most common), with haemopericardium and cardiac Tamponade. 2) Rupture of the ventricular septum (less common), leading to an acute VSD and left-to-right shunting. 3) Papillary muscle rupture (least common), resulting in the acute onset of severe mitral regurgitation. Free-wall rupture is most frequent 3 to 7 days after Myocardial infarction, when coagulative necrosis, neutrophilic infiltration, and lysis of the myocardial connective tissue have weakened the infarcted myocardium (mean, 4 to 5 days; range, 1 to 10 days). Anterolateral wall at the mid ventricular level is the most common site for postinfarction free-wall rupture as in our case. Acute free-wall ruptures are usually rapidly fatal. Clinical

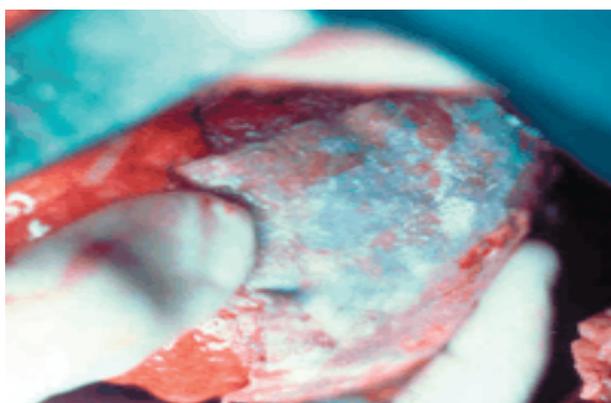
features of cardiac tamponade includes Beck's Triad (Hypotension, Jugulo-venous distension, muffled heart sounds). Other signs include Hepatomegaly, Kussmaul sign, abolished y descent jugular venous pulse, anxiety, shortness of breath, fatigue, chest pain / chest discomfort, palpitations, feeling faint, light headedness, dyspnoea, tachycardia, tachypnoea, cold and clammy extremities.

### DIFFERENTIAL DIAGNOSIS

Aortic dissection, Cardiogenic shock, Constrictive pericarditis, Pulmonary embolism, Right ventricular infarction, Acute severe asthma, Tension pneumothorax, Large pleural effusion, Tension pneumopericardium, sternal bone marrow aspiration, penetrating chest wall injury, oesophageal rupture, and bronchopericardial fistula may mimic or cause cardiac tamponade.

### TREATMENT

Oxygen, Volume expansion with blood, plasma, or saline to maintain adequate intravascular volume, followed by minimal invasive procedures such as Percutaneous pericardiocentesis, Echocardiography guided pericardiocentesis, Balloon pericardiotomy. Surgical procedures include Emergency subxiphoid percutaneous drainage, Pericardio-peritoneal window technique under local anaesthesia, Left anterior thoracotomy or sternotomy with "glue and patch" correction of the defect under general anaesthesia.



**Fig.4 A Teflon felt patch is glued over the area. Note that the felt is soaked by the glue, giving it a bluish coloration.**

Prognosis depends on the speed of diagnosis, the treatment provided and the underlying cause of the tamponade. Early diagnosis and treatment are crucial to reduce morbidity and mortality.

### CONCLUSION

On Autopsy, macroscopic features of myocardial infarction, on table demonstration of rupture of heart, site of rupture, histopathological examination of heart bit showing features of myocardial infarction helps in arriving at the opinion as to the cause of death as the cardiac tamponade due to rupture of ventricular free wall following myocardial infarction.

**Acknowledgement** - Nil

**Conflict of Interest** - None

**Source of Funding** - Self

**Ethical Clearance** - Obtained from Institutional Ethical Committee

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# An Autopsy Study of Sudden Cardiac Deaths among Young Adults

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## ABSTRACT

**Background:** Sudden deaths due to cardiovascular causes is an important component of sudden natural deaths holding a lions share. Given the current trends and projected burden of cardiovascular disease (CVD) in low- and middle-income countries (LMIC), it is likely that SCD will also increase in LMIC in the future. **Objectives:** To study the sudden cardiac deaths due to coronary artery disease and factors influencing these deaths. **Methodology:** A case series autopsy study of sudden deaths due to coronary artery disease in young adults among autopsies was conducted at department of forensic medicine, Victoria hospital, Bangalore Medical College, Bangalore, between January 2005 to December 2005. A sum total of 52 cases were studied and detailed autopsy was done in all the cases also taking aid of histopathological examination in all the cases. **Results:** Maximum numbers of deaths were seen, in the age group of 41-50 years (46.2%) followed by 31-40 years (42.3%), males (92%) outnumbered the females (8%) in being victims of coronary artery disease. Double vessel disease was seen in more than half of the cases (57.6%) followed by single vessel disease (34.6%) and triple vessel disease (7.6%). Atheromatous type of occlusion (77%) was seen in majority of cases followed by thrombosis (19.2%) and both atheromatous and thrombosis was seen in few cases (3.8%). Majority of the victims were obese (75%). Smoking and alcohol formed the fatal combination of habits contributing to coronary artery disease in nearly half of the victims (48.1%). **Conclusion:** In this study coronary atherosclerosis was the major cause of sudden cardiac death. Sudden death is a source of concern and a detailed postmortem examination is mandatory to ascertain the cause.

**Keywords:** Sudden cardiac death, coronary atherosclerosis, autopsy study.

## INTRODUCTION

Sudden death in young adults is a devastating event which causes a huge amount of unexpected trauma to his kith and kin and his closely associated social environment giving rise to several unanswered questions. Sudden deaths due to cardiovascular causes is an important component of sudden natural deaths holding a lions share. Sudden deaths due to

coronary artery disease is a very significant entity, sharing a majority of sudden cardiac deaths.

Sudden cardiac death (SCD) is defined as death from an unexpected circulatory arrest, usually due to a cardiac arrhythmia, occurring within an hour of symptom onset<sup>1</sup>. Given the current trends and projected burden of cardiovascular disease (CVD) in low- and middle-income countries (LMIC), it is likely that SCD will also increase in LMIC in the future<sup>2,3</sup>. Therefore, SCD threatens to become a global public health problem, affecting populations in LMIC as well as those in high-income countries (HIC). Most reports of the epidemiology of SCD have been confined to HIC<sup>4,5</sup>. Unfortunately, SCD data from LMIC are generally lacking, of variable quality, and derived from different methodologies.

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## OBJECTIVE

To study the sudden natural deaths due to coronary artery disease and factors influencing these deaths.

To co-relate the deaths with age, sex and life style factors.

## METHODOLOGY

**Study design and study setting:** A case series autopsy study of sudden deaths due to coronary artery disease in young adults among autopsies was conducted at department of forensic medicine, Victoria hospital, Bangalore Medical College, Bangalore, between January 2005 to December 2005.

**Sampling:** A total of series of 52 cases were sampled by convenient sampling method which included sudden deaths in young adults in the age group of 20 -50 years. Sudden deaths due other known systemic diseases were excluded from the study.

**Data collection:** A sum total of 52 cases were studied and detailed autopsy was done in all the cases also taking aid of histopathological examination in all the cases and obtaining detailed history by family members and friends in a prescribed proforma. The proforma consisted of three parts, first part had socio-demographic variables, second part had variables related to life styles and the third part consisted of autopsy and histopathology findings.

Ethical approval for the study was obtained from the institutional ethical committee.

## STATISTICAL ANALYSIS

Data entry and statistical analysis were performed using the Microsoft Excel and Statistical Package of Social Sciences (SPSS) windows version 17.0 software. The data was described using descriptive statistics like proportions and percentages.

## RESULTS

**Table no. 01:**

Socio-demographic profile of the patients			
Variables		Frequency	Percentage
Age group			
	21 - 30 yrs	6	11.5

	31 - 40 yrs	22	42.3
	41 - 50 yrs	24	46.2
Sex			
	Male	48	92
	Female	4	8
Religion			
	Hindus	43	82
	Muslims	4	8
	Christians	5	10
SES			
	Class I	8	15.4
	class II	6	11.5
	Class III	14	26.9
	Class IV	13	25
	Class V	11	21.15
Marital Status			
	Married	34	65.4
	Un Married	18	34.6
Food habits			
	Vegetarian	17	32.69
	Mixed	35	67.3
<b>Total</b>			
		<b>52</b>	<b>100</b>

An autopsy study of sudden death due to coronary artery disease in young adults among autopsies was conducted at department of forensic medicine, Victoria hospital, Bangalore Medical College, Bangalore, between January 2005 to December 2005. The objectives of the study included to estimate the number of sudden natural deaths due to coronary artery disease encountered among total autopsies conducted, to co-relate the deaths with the age and life style and to study the sex distribution. A sum total of 52 cases were studied and detailed autopsy was done in all the cases also taking aid of histopathological examination in certain required cases and obtaining detailed history by family members and friends in a prescribed proforma.

Maximum numbers of deaths were seen, in the age group of 41-50 years (46.2%) followed by 31-40 years (42.3%), males (92%) outnumbered the females

(8%) in being victims of coronary artery disease. Among the religion wise Hindus (82%) were the most commonly affected. The maximum number of victims belongs to class III of socio-economic status (26.9%), followed by class IV (25%) and class V (21.1%). Married people (65.4%) were more commonly affected than unmarried (34.6%). People with the mixed diet (67.3%) were the most common ones affected, majority of the victims were obese.

**Table no. 02:**

Distribution of risk factors among the study subjects			
Risk factors		Frequency	Percentage
Obesity	Obese	39	75
	Non Obese	13	25
Habits	Smoking	39	75
	Alcohol	3	5.7
	Smoking & Alcohol	25	48.1
	None	10	19.2
Family h/o CAD	Present	20	38.5
	Absent	32	61.5
Past h/o CAD	Present	12	23.1
	Absent	40	76.9
Reg Rx for CAD	Present	6	11.53
	Absent	46	88.46

Majority of the victims were obese (75%). Smoking and alcohol formed the fatal combination of habits contributing to coronary artery disease in nearly half of the victims (48.1%). Victims with an exclusive habit of smoking were the most affected (75%). Family history (38.5%) and previous episodes of coronary artery disease (23.1%) was present in few number of cases. Very few number of victims received pre medication (11.5%).

**Table no. 03:**

Distribution of cases based on pathological findings postmortem			
Pathological findings		Frequency	Percentage
Number of vessels Involved			
	Single Vessel	18	34.6
	Double Vessel	30	57.6
	Triple Vessel	4	7.6
Type of Branch Involved			
Left Coronary Artery			
	Left main	6	11.5
	Left anterior descending	32	61.5
	Left circumflex	14	26.9
Right Coronary			
	Involved	30	57
	Non Involved	22	42.3
Type of Occlusion			
	Atheroma	40	76.9
	Thrombosis	10	19.2
	Atheroma + Thrombosis	2	3.8
Type of Atheromatous Occlusion			
	Crescentric	35	67.3
	Concentric	17	32.7
Percentage of Occlusion in Left Coronary artery			
	50-60%	1	1.9
	61-70%	1	1.9
	71-80%	6	11.5
	81-90%	8	15.4
	91-100%	36	69.2

Percentage of Occlusion in Right Coronary artery			
	50-60%	15	42.8
	61-70%	11	31.4
	71-80%	4	11.4
	81-90%	2	5.7
	91-100%	3	8.6

Double vessel disease was seen in more than half of the cases (57.6%) followed by single vessel disease (34.6%) and triple vessel disease (7.6%). Left anterior descending artery was the most commonly involved artery (61.5%) followed by left circumflex 26.9%) and left main arteries (11.5%). In more than half of the victims Right coronary artery was also involved (57%). Atheromatous type of occlusion (77%) (Fig no. 03 and 04) was seen in majority of cases followed by thrombosis (19.2%) and both atheromatous and thrombosis (Fig no. 04) was seen in few cases (3.8%). Among the atheromatous occlusion crescentric type (67.3%) (Fig no. 03) was most common followed by concentric type (32.7%) (Fig no. 04). In majority of cases the occlusion of left coronary artery was 91-100% (69.2%), with the least being 50-60-% (1.9%) and 61-70% (1.9%). Among the occlusion of the right coronary artery 50-60% of occlusion (42.8%) was seen in majority of the cases followed by 61-70% (31.4%) and the least being 81-90% (5.7%).

## DISCUSSION

Medicolegally death is defined as permanent and irreversible cessation of functions of three interlinked vital systems of the body, namely the nervous, circulatory and respiratory systems<sup>6</sup>.

Death may be gradual process or a sudden phenomenon. The definition of sudden death varies according to authority and convention. The WHO defines sudden death within 24 hours from the onset of symptoms<sup>7</sup>.

A generally accepted definition of Sudden Cardiac Death (SCD) is natural death due to cardiac causes, heralded by abrupt loss of consciousness within 1 hour of the onset of acute symptoms, in an individual who may have known preexisting heart disease but in whom the time and mode of death are unexpected. Among adolescents and young adults, the incidence of SCD is approximately 1 per 1, 00, 000

population per year or 0.001 percent per year<sup>8</sup>.

Sudden cardiac death in young adults is the most dramatic and emotional moment of a persons life". The sudden cardiac death (SCD) is the major cause of death in adults. The commonest cause of sudden cardiac death is coronary artery disease accounting for as many as 80% of cases, followed by cardiomyopathy in 10 to 15 %. Other causes account for 5 to 10 % of cases<sup>9</sup>.

Data from postmortem examinations of SCD victims parallel the clinical observations on the prevalence of CHD as the major structural etiologic factor. More than 80% of SCD victims have pathological finding of CHD. The pathologic description often includes a combination of long standing, extensive atherosclerosis of the epicardial coronary arteries and unstable coronary artery lesions, which include various permutations of fissure or ruptured plaques, platelet aggregates, hemorrhage, and thrombosis<sup>8</sup>.

In the present study a total of 52 cases of SCD victims were studied where maximum numbers of deaths were seen, in the age group of 41-50 years (46.2%) followed by 31-40 years (42.3%), males (92%) outnumbered the females (8%) in being victims of coronary artery disease. Similar finding were revealed by a study done by Ahmad M et al<sup>10</sup> where majority of the cases were males and commonest age group affected was 21-50 years.

In adults the most common cause of sudden cardiac death is coronary atherosclerosis. In a clinicopathological study of sudden death by Kasthuri et al<sup>11</sup>, in India, 76.9% individuals died of coronary artery diseases and triple vessel disease was seen in 8 of 10 cases. Similar observations were made in this study where more than 80% cases showed various grades of atherosclerosis and double vessel disease was the predominant finding (58%). Some of the studies<sup>10,12</sup> 10-20% cases of sudden cardiac death of non-atheromatous origin have been reported.

The right coronary artery was dominant in nearly 60% of our cases which correlates with other studies<sup>10,13</sup> where 80% of the hearts had right dominant artery. The right coronary artery has been suggested as the artery of sudden death because of its possible role in supplying both sinuatrial and atrioventricular nodes. The evidence of occlusive

coronary thrombi as a cause of sudden cardiac death in this autopsy study was 57% which is closer to other previous studies by Crawford et al<sup>14</sup> (64%) and James et al<sup>15</sup> (62%). However in a previous study by Luqman et al<sup>16</sup> complete blockage with thrombosis was not seen in any case.



Fig no. 01: Heart with multiple petechial haemorrhages



Fig no. 02: Ventricular wall showing infarction

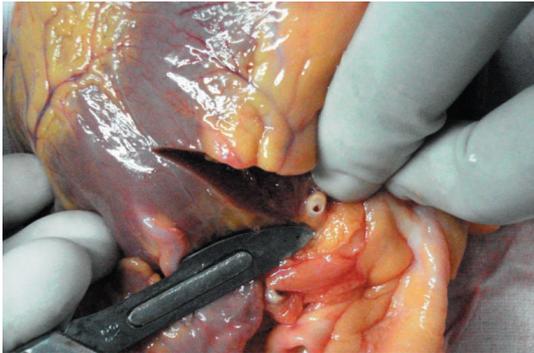


Fig no. 03: Section of the coronary artery showing crescentic type of atheromatous plaque.

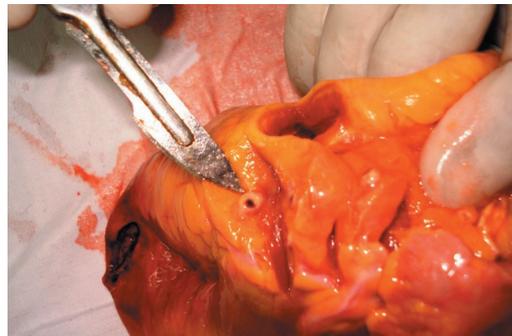


Fig no. 04: Section of coronary artery showing concentric type of atheromatous plaque and clot.

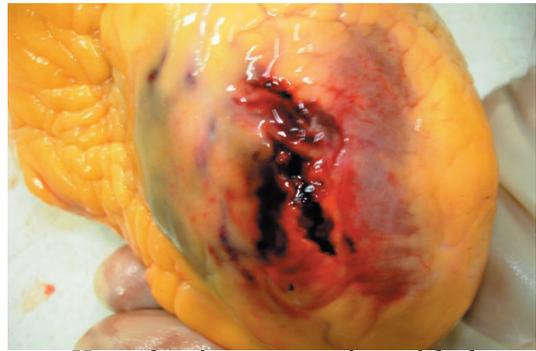


Fig no. 05: Heart showing rupture of ventricle due to infarction.

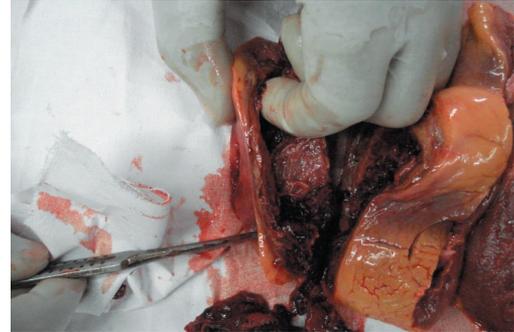


Fig no. 06: Old healed infarction showing thinning of ventricular wall.

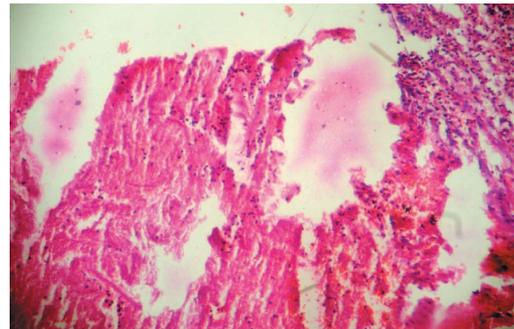


Fig no. 07: Section showing necrosed myocardium with neutrophilic infiltrate



Fig no. 08: Transverse section of coronary vessel showing atheromatous plaque with overlying thrombus.

## CONCLUSION

In this study coronary atherosclerosis was the major cause of sudden cardiac death. Sudden death is a source of concern and a detailed postmortem

examination is mandatory to ascertain the cause.

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**Conflict of Interest:** None

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# Health Care Facilities in Mitigating Fatal Occupational Hazards

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## ABSTRACT

**Background:** Medical intervention (preventive as well as curative) plays a crucial role in preventing fatal occupational accidents. Availability of emergency medical care determines the survival of accident victim; mortality is substantially reduced with immediate and well equipped emergency care. Even preventive measure such as regular health check up to determine the fitness of the individual or general health education, training in first aid etc. may mitigate the occupational hazard.

**Materials & Method:** A study all the cases brought to the department of medico legal autopsy with alleged history of deaths due to fatal industrial accidents were selected on continuous basis for period of 18 months from tertiary care hospital. Data such as pre recruitment medical checkup, availability of regular medical checkup facility at work place, first aid facility, distance of nearest medial emergency facilities, post-accident medical intervention were analyzed. 46% of the victims were treated in tertiary centers, 1.6% in secondary centers and 52.3% died before reaching medical establishments

**Results:** 128 cases of deaths due to fatal industrial accidents are studied. In 96.1% of the cases procedure of pre-recruitment medical checkup was not followed, in 99.2% of the cases facility of regular medical checkup at work place was not available, facility of first aid was not available in majority of the cases (99.2%).

**Conclusion:** it is imperative that an employer address all the potential risk factors regarding medical facilities at the workplace and educate all employees in risk awareness.

**Keywords:** Autopsy, Occupational Injuries, Emergency Medical Services, health education.

## INTRODUCTION

Medical intervention (preventive as well as curative) plays a crucial role in preventing fatal occupational accidents. Availability of emergency medical care determines the survival of accident victim. Mortality is substantially reduced with immediate and well equipped emergency care.<sup>2</sup> even preventive measure such as regular health check<sup>3</sup> up to determine the fitness of the individual or general

health education, training in first aid etc., may mitigate the occupational hazard. Study of accidents and their prevention is an important subject for the industrial physician. Mainly quarries, construction work, railway workshop and heavy industries such as steel are potentially known for accidents. An industry health team should study the cause of each and every accident and should try to prevent further occurrence and more than 90% of accidents are preventable.<sup>4</sup> A safety training program can also help a trainer to keep the required OSHA (Occupational Safety and Health Administration) mandated safety training courses organized and up-to-date.<sup>5</sup>

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In the present study effort is made to study the role of medical care with regards to their availability, distance from work place and readiness to deal with

severe injuries.

**MATERIALS & METHOD**

The present study of 128cases has been carried out in the department of Forensic Medicine, Victoria Hospital attached to Bangalore Medical College and Research Institute, Bangalore. All the cases brought to the department of medico legal autopsy with alleged history of deaths due to fatal industrial accidents were selected on continuous basis. The clearance for the study was obtained from the college ethnical committee.

Data such as pre recruitment medical checkup, availability of regular medical checkup facility at work place, first aid facility, distance of nearest medial emergency facilities, post-accident medical intervention and place of death was collected from the police and relatives and analyzed.

**RESULTS**

In 96.1% of the cases procedure of pre-recruitment medical checkup was not followed, only 3.9% of the workers have undergone this procedure as shown in Table 1.

**Table 1 Shows status of victims having undergone pre recruitment medical check up**

Pre recruitment Medical Check up	Frequency	Percent
Undergone	5	3.9
Not undergone	122	96.1

In 99.2% of the cases facility of regular medical checkup at work place was not available, only 0.8% of the workers had undergone regular medical checkup as shown in Table 2.

**Table 2 Shows distribution of accidents according to availability of regular medical checkup facility**

Regular Medical Checkup at work place	Frequency	Percent
Undergone	1	0.8
Not undergone	127	99.2

Table 3 shows that the facility of first aid was not available in majority of the cases (99.2%) and only 0.8 % had undergone first aid treatment at work site.

**Table 3 Shows distribution of injuries according to the availability of first aid at work site**

First Aid at the site	Frequency	Percent
Available	1	.8
Not available	127	99.2

Table 4 and shows in majority of the cases nearest medical emergency facility was more than 5 kms distance. In 33.6% of the cases it was at distance of 1 to 5 kms and only in 3.1 % of the cases it was within the distance of 1 km.

**Table 4 Shows distance of nearest medial emergency facilities from the site of accident**

Distance of Medical facility from the site	Frequency	Percent
< 1km	4	3.1
1-5 km	43	33.6
> 5km	81	63.3

**Fig.1 Depicts post- accident medical intervention to the victims**

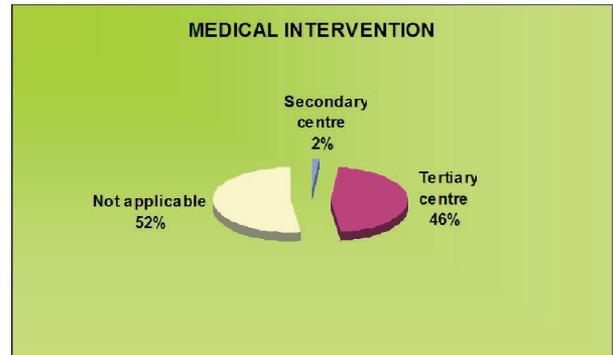


Fig.1 shows that 46% of the victims were treated in tertiary centers, 1.6% in secondary centers and 52.3% died before reaching medical establishments.

**DISCUSSIONS**

In our study it is observed that in 96.1% of the cases pre recruitment checkup was not followed. Also in 99.2% of the cases regular medical checkup facility was not available. The findings are in accordance with the report<sup>5</sup> which states that an effective training and proper recruitment procedures can reduce number of injuries and death and illness. Lack of these facilities had a clear impact on the outcome of fatalities in our study.

Helen Lingard<sup>2</sup> in her study observed that the first aid facilities and first aid training had positive

effect on occupational safety and health behaviors of the workers. First aid appeared to reduce 'self-other' bias, also appeared to reduce workers' willingness to accept prevailing level of occupational safety and health risks and helped to improve risk controlled behavior. In our study, it is observed that 99.2% of the cases first aid facility as well as first aid training were not available.

Demetriades D<sup>6</sup> et al observed a trimordial distribution of deaths in urban trauma system in which there were two distinct peaks of death. First peak [(50.2%) of death] occurred within the first hour of the injury, second peak occurred 1 to 6 hours after admission (18.3% of deaths). Similar findings were also observed in our study where 54% of deaths occurred in less than 1 hour, 9.4% deaths in 1 to 6 hours and 11.7% in 1 to 7 days. It is also observed in our study that in 31.3% of cases death occurred on spot and in 21.1% of cases death occurred en route to hospital. Together they contributed to 51.4% of deaths. It is also observed that in 63.3% of cases nearest emergency facilities were more than 5 kilometers away from the site of accident. In 33.1% they were at the distance from 1 km to 5km and only in 3% of cases they were within 1km of range. And also only 46.1 % of the cases could reach tertiary medical centres and had an opportunity for medical intervention. The severity of the injury, lack of first aid at worksite, longer distance to travel for medical facilities and probably the traffic congestion has contributed for crowding of cases within 1 hour after accident and failure to reach the medical emergency institutes.

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**Conflict of Interest**- Nil

## CONCLUSION

An occupational fatality is not just the fault of

the deceased worker; instead, it is the combination of unsafe work environments, lack of pre-recruitment medical checkups and regular medical checkup and insufficient safety training. This necessitates the provision of basic health care at the work place. In case of severe injuries emergency intervention to be made available to the victim as early as possible notwithstanding the traffic congestion and large geographical areas of ever expanding cities. Dedicated traffic-lanes for medical emergencies, which was recently in news for transportation of donated organs is a welcome step.

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# Rationally Used Antidotes in Organophosphorus Poisoning

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## ABSTRACT

A retrospective study was conducted at Katihar Medical College and Hospital, Bihar between July 2014- August 2015 to evaluate the utilization of two antidotes, atropine and pralidoxime, in organophosphorus poisoning (OPP). This study was carried out with data from prescription record sheet of OPP patients. Data was statistically analyzed in respect of demographic profile, signs of atropinisation and the health outcome after treatment with the antidotes. Demographic profile of 92 OPP cases between July 2014 - August 2015 revealed 100% suicidal tendency, 68.48% female, 45.65% in age group of 20-30 years and 79.34% from rural population. Following stomach wash, 9.78% patients improved; rest 90.22% received antidotes (atropine to all and pralidoxime to 59.04% cases). 40.96% patient got cured after treatment with atropine only and 45.78% cured after pralidoxime addition; rest got referred to the higher center.

**Keywords** - Organophosphorus poisoning, Antidotes, Atropine, Pralidoxime.

## INTRODUCTION

Organophosphorus (OP) compounds first synthesized in early 1800s were developed as insecticides

In early 1900s and found world wide application by 1941.<sup>(1)</sup>

Organophosphorus pesticide self-poisoning is an important clinical problem in rural regions of the developing world, and kills an estimated 200 000 people every year. Unintentional poisoning kills far fewer people but is a problem in places where highly toxic organophosphorus pesticides are available. Medical management is difficult, with case fatality generally more than 15%. We describe the limited evidence that can guide therapy and the factors that should be considered when designing further clinical studies. 50 years after first use, we still do not know how the core treatments—atropine, oximes, and diazepam—should best be given. However, consensus suggests that early resuscitation with atropine, oxygen, respiratory support, and fluids is needed to improve oxygen delivery to tissues. The role of oximes is not completely clear; they might benefit only patients poisoned by specific pesticides

or patients with moderate poisoning. Gastric lavage could have a role but should only be undertaken once the patient is stable.<sup>(2)</sup>

Organophosphorus pesticide self-poisoning is a major clinical and public-health problem across much of rural Asia. Of the estimated 500 000 deaths from self-harm in the region each year, about 60% are due to pesticide poisoning.<sup>(3)</sup>

The organophosphates have been used as pesticides for more than 50 years and are still used in most developing countries. It is believed that between 750,000 and 3,000,000 OP poisoning occur globally every year.<sup>(4)</sup>

## PHARMACODYNAMICS

Organophosphates/carbamates inactivate the enzyme Cholinesterase (ChE) by reacting at the esterase site, which leads to an increase in Acetylcholine (ACh) at the muscarinic receptors, nicotinic receptors and in CNS leading to toxic effects. The phosphorylated/carbamated enzyme complex subsequently undergoes hydrolysis spontaneously (carbamated complexes within minutes to hours whereas phosphorylated enzyme complexes take some 60 minutes to several weeks). The reactivation

time can be enhanced by oximes. Once OP – enzyme complex loses the alkyl group (Ageing) it can not be reactivated.<sup>(5)</sup>

## ANTIDOTE

Anticholinergics are competitive antagonist to Ach and reverse all muscarinic activities both in CNS and peripheral nervous system. Inj. atropine is the only life saving antidote. Full and early atropinisation is an essential and simple part of early management. Clinical toxicology text books describe varied atropine regimens. The sum total of 38 regimes found in literature is to start a Bolus loading dose followed by boluses after a fixed time interval varying from 5-15-30 min till atropinisation or Bolus loading dose followed by infusion.<sup>(6)</sup>

### CRITERIA OF ATROPINISATION

There are no comparative studies of markers for adequate atropinisation. Since patients usually die from respiratory or circulatory failure, air entry on chest auscultation, heart rate and blood pressure were given more importance than dilatation of pupil, rise in body temperature, dryness of mouth/skin.<sup>(7)</sup>

Atropine will probably remain the antimuscarinic agent of choice until high-quality randomized trials show another muscarinic antagonist to have a better benefit-to-harm ratio because it is available widely, affordable, and moderately able to penetrate into the CNS. No known randomized controlled trials have compared different regimens of atropine for either loading or continuation therapy. As a result, many different recommendations have been made—a 2004 review noted more than 30 dosing regimens, some of which would take many hours to give the full loading dose of atropine.<sup>(8)</sup>

### CHOLINESTERASE REACTIVATORS

Oximes reactivate acetylcholinesterase inhibited by organophosphorus. Pralidoxime was discovered in the mid-1950s by Wilson and colleagues, and was soon successfully introduced into clinical practice for patients with parathion poisoning.<sup>(9)</sup>

WHO guidelines recommended giving a 30 mg/kg loading dose of Pralidoxime over 10-20 min followed by a continuous infusion of 8-10 mg/kg/hr until clinical recovery or seven days have elapsed whichever is later. Their efficacy however has been questioned over last two decades by workers from

Sri Lanka, South Africa, Taiwan, Iran and India. All these studies have been criticized either on the basis of non-comparable groups of selected patients or inadequate doses of PAM.<sup>(10)</sup>

Since the idea is sound and animal experiments suggest it is useful, it is recommended preferably in moderate to severe cases.<sup>(11,12)</sup>

It is to be administered as early as possible post ingestion to offer benefit. Delayed presentation is not a contraindication. Though oximes are not recommended for Carbamate poisoning, their use should not be withheld in case of unknown cholinergic poisoning as definite harm to human beings has not been demonstrated.<sup>(13)</sup>

Despite the beneficial effects of pralidoxime first noted with parathion poisoning, its effectiveness has been much debated, with many Asian clinicians unconvinced of its benefit. In particular, two randomized controlled trials in Vellore, India in the early 1990s noted that low-dose infusions of pralidoxime might cause harm.<sup>(14, 15)</sup>

WHO recommends that oximes be given to all symptomatic patients who need atropine. To ensure a therapeutic concentration, a loading dose of pralidoxime chloride or obidoxime is given, then a continuous infusion. The loading dose of oxime should not be given rapidly as a bolus because this method causes vomiting (risking aspiration), tachycardia, and diastolic hypertension.<sup>(16) (17) (18)</sup>

Many study conducted worldwide and Literature available also revealed paucity in data regarding treatment modality of Organophosphorus poisoning. With this backdrop we conducted this study to find out outcome of OPP patients treated with Atropine and Pralidoxime.

## OBJECTIVES

1. To evaluate the utilization of atropine and pradoxime for the patients of organophosphorus poisoning in Katihar Medical College Hospital, Katihar, Bihar.
2. To evaluate the relationship among demographic profile of the patients and the health outcome after specific treatment.

## MATERIALS & METHOD

We designed an observational (non-interventional), open label, data based retrospective study carried out at Katihar Medical College Hospital, Katihar, Bihar. Data were collected from the Hospital records of the OPP patient treated in KMCH, Bihar. Study materials were the patient's admission tickets, history sheets, bed head tickets or treatment sheets available at the record room. A written permission was obtained from the institutional Ethics Committee.

Patient's data from July 2014- August 2015 were collected in a pre-designed Case Record Form. Collected data were analyzed in respect of patients' demographic profile, Time taking to reach hospital, type and amount of OPC consumed, treatment received (stomach wash, antidotes: atropine & pralidoxime, other medications), signs of atropinization (pupil size, secretion, pulse rate, temperature), outcome of treatment (cured and discharged, referred to higher tier and death). Obtained data were analyzed by descriptive and inferential statistical methods by using SPSS 16.0.

## RESULTS

Data of total 92 patients were obtained during one year period. All patients were admitted directly with a history of self-poisoning with an organophosphorus pesticide. Demographic profile shows that majority of the patients belongs to middle age group, 56.65% patients were between 20 – 30 years followed by 28.26% cases in the age group of 10-20 years. All cases of OP poisoning were suicidal in nature as per history given by patients and family members and mostly seen in females (68.48%) compared to males (40.22%). Majority of the patients ingested poison in afternoon and evening time (51.08%) followed by at night time (30.44%) and married patients (69.56%) outnumbered unmarried (26.10%) and widows/widower (4.34%). 79.34% patients were from rural areas.

All patients presented in emergency department with the history of ingestion of OP poison were first stabilized and then given stomach wash with normal saline and specific antidote administration of Atropine and Pralidoxime as per the standard protocols. Stomach wash with normal saline were given to all patients and after that only 9.78% patients showed significant improvement, rest of the patient were first treated by intravenous administration

Atropine and among them 40.96% cured with it and remaining 49 patients got intravenous Pralidoxime injection and 45.78% were cured.

About 13 % patients were referred to the higher center even after proper treatment. Among the categorical responses after atropinization, 85.86% cases showed reduced, 79.34% showed dilatation of pupil and 82.60 showed tachycardia.

## DISCUSSION

Aggressive use of agrochemical pesticides results in continuing hazards and is associated with high morbidity and mortality in the rural areas. Patients of our study on admission demonstrated manifestations of OPC activity at muscarinic and/or nicotinic receptors.

Meiosis was the most common sign as observed by the treating physicians. Few patients had a reduced level of consciousness. Our study revealed that all were suicidal cases without death; critical patients were referred to higher referral centers. Self-poisoning with pesticides is one of the most predominant means of suicide in rural areas,<sup>(19)</sup> this corroborates with our findings. In our study preponderance of suicide attempt was in the age group of 20-30 years, and number of female suicide attempters exceeded that of the male attempters which was in contrast of females. Cause of self-harm, occupational, socio-economic and educational status and quantity of poison consumed could not be revealed as we had to depend only on retrospective data which were lacking in such rural health center.

Agriculture is the main livelihood of people in surrounding area of the Katihar Medical College and Hospital as a general rule farmers of this area use to OPCs as pesticides and insecticides to yield high crops. As there is no control on the sale or purchase, different varieties of pesticides are easily available through an open local market, even sold from grocery shops in the villages of this region. Strategic psychosocial intervention might be beneficial in suicide prevention, but it is not feasible in such remote area. Thereby medical management remains the mainstay of prevention of suicide death from acute OPP.

In the present study patients were managed by ensuring an adequate upper airway, removal of poison by gastric lavage and by the specific

pharmacological therapy. Atropine showed significant positive categorical therapy. Atropine sulphate and pradoxime chloride are the two most widely used effective salts for treating OPP, but specific salt of those two antidotes were not recorded in our study. Number of controversies exists on the most effective treatment.<sup>(20-26)</sup> in the past, atropine alone was used as an antidote for treatment of OPP.

In our study most of the patients got cured with atropine. Textbooks suggest that atropine reverses only muscarinic effects of acetylcholine, therefore, neuromuscular effects are not inhibited by atropine and patients can develop respiratory failure due to paralysis of respiratory muscle. Oximes on the other hand, reverse the nicotinic effects. So, oximes are said to improve the result of the treatment of OPP when they are added to atropine. A few studies have questioned the role of oximes in OPP.

The reports claim that oximes, especially in lower doses, do not convey any added advantages over atropine alone.<sup>(20) (22) (26)</sup> since oximes are expensive drugs and can also have major side effects, oximes may not be concluded that addition of pralidoxime whether exerts any effect on the outcome or not, as only 34.66% patients were cured with pralidoxime in addition to atropine. Addition of palidoxime might increase the probability of survival.

Many textbooks consider OPP to be broadly similar and equally responsive to treatment. But differences in chemistry have major consequences for effectiveness of treatment for specific pesticides.<sup>(19) (22)</sup> Patients can suddenly develop peripheral respiratory failure while conscious after recovering from cholinergic crisis. This is an important cause of death in patients who have been resuscitated and stabilized on admission to hospital.<sup>(20) (22)</sup>

Recovery rate depends on various factors such as the OPC consumed, the amount ingested, the time interval for hospitalization, and the general health of the patient. Chances of recovery were higher in our study when the patient hospitalized at the earliest indication, small amount and less toxic OPC ingested, and management could be started earlier. Finding of this study highlight the usefulness of antidotes in the management of OPP and also advocate the cautious use of pesticides at community level and to store them safely beyond the easy reach of young adult and female members who were the major victims in our study.

## CHARTS

**Table – 1: Mode of suicide**

MODE OF SUICIDE	Number of patients (%)
Accidental	0
Suicidal	92 (100%)
Homicidal	0

**Table – 2: Age group**

AGE	Number of patients
< 10	0 (0%)
10-20	26 (28.26%)
20-30	42 (45.65%)
30-40	19 (20.65%)
40-50	9 (9.78%)
> 50	4 (4.34%)

**Table – 3: Sex distribution**

SEX	Number of patients
FEMALE	63 (68.48%)
MALE	37 (40.22%)

**Table – 4: Time of suicide**

TIME OF CONSUMPTION	Number of patients
08.00 am – 12.00 pm	14 (15.22%)
12.00 pm – 08.00 pm	47 (51.08%)
08.00 pm to 04.00 am	28 (30.44%)
04.00 am to 08.00 am	3 (3.26%)

**Table – 5: Habitat of the patients**

Habitat	Number of patients
Rural	73 (79.34%)
Urban	19 (20.66%)

**Table – 6: Marital status**

Marital status	Number of patients
Married	64 (69.56%)
Unmarried	24 (26.10%)
Widow/Widower	4 (4.34%)

**Table – 7: Response after treatment –**

Type of treatment	Number of patients	Dose	Outcome
Stomach wash	92		9 (9.78%)
Antidote received –			
Atropine given	83 (90.21%) 11(13.25%) 18 (21.68%) 37(44.57%) 09 (10.84%) 08 (9.63%)	➤ 200 mg 150-200 100-150 50-100 >50	Cured – 34 (40.96%)
Pralidoxime (PAM) given	49 (59.04%)		Cured – 38 (45.78%)

**Table – 8: Symptoms relieved**

Type of response	Secretions	Pupil size	Pulse rate
Positive response	79 (85.86%)	73 (79.34%)	76 (82.60%)

**CONCLUSION**

Skilled and prompt treatment can provide a good outcome for a potentially lethal condition. Majority of the OPP patients may be cured with timely administration of atropine only in adequate doses without promoting for purchasing costly antidote (pralidoxime). Thus, cost of treatment can be reduced, and suicidal death may be prevented with improved management of pesticide poisoning. We expect that in the next decade evidence from continuing research by a number of groups across Asia will finally provide clear guidance on how to treat poisoning with organophosphorus pesticides. Hopefully, this new guidance will include the use of novel antidotes that will reduce the case fatality from pesticide poisoning, and therefore reduce the worldwide number of deaths from self-harm.

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**Ethical Clearance –** Ethical clearance was obtained from Ethical committee, Katihar Medical College, Katihar, Bihar.

**Conflict of Interest –** Our primary interest of the study is to know the efficacy of atropine and pralidoxime in the treatment of organophosphorus poisoning cases and secondary interest is to use this data for the improvement of treatment plan of organophosphorus poisoning cases.

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# Profile of Deaths due to Poisoning in a Medical College Teaching Hospital

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## ABSTRACT

Poisoning deaths are more in developing countries and they vary from one place to other. Retrospective study done at RIMS Hospital, Karnataka. 100 poisoning cases of 2014-15 were considered for the study. The study done to know the age, sex, commonest type of poisons and manner of poisoning. In this study 70 percent of the cases were due to Organophosphorus compound, followed by Snake Bite (10 percent) Aluminium Phosphide (6 percent) and others respectively. Among males, maximum number (25%) belong to 21 to 30 years age group followed by 31 to 40 years age group (15%) the least (1%) was 0 to 10 years age group. Among females maximum (10%) was common to both 11 to 20 years and 21 to 30 years age group. Least was more than 70 years age group (0%). organophosphorus compound (70%) was commonest in males (50%) and also in females (20%). Least was miscellaneous poisoning (2%). suicidal poisoning is more common (75%). The percentage being more in males (55%) than females (20%). The least common was homicidal poisoning (7%) comparatively more in males (5%) than in females (2%). The study found suicidal poisoning is more common than accidental and homicidal poisoning. Hence the study suggests stringent rules for commercial sale of poisons.

**Keywords:** Poisoning Deaths, Organophosphorus compound, Snake Bite.

## INTRODUCTION

Deaths due to poisoning are one of the common causes of unnatural deaths. Deaths due to poisoning may be suicidal homicidal or accidental in nature. Insecticides are commonest cause for poisoning in India and other developing countries. The main reason for this is agriculture. Poisoning method depends on various factors like age, sex, socio economic status, and poison availability, cultural and religious aspects. It also varies from country to country and from one place to the other

## MATERIALS & METHOD

About hundred cases of medico legal autopsy cases with history of poisoning at RIMS hospital mortuary, Raichur, between 2014 and 2015 considered for the present retrospective study. The data collected

from case records of hospital, police inquest reports, autopsy and forensic science laboratory reports. Bodies, which were decomposed, and un-identified bodies excluded from the study

## RESULTS

In the present study, following results found. Among 100 cases of poisoning deaths 70 were males and 30 were females with a ratio of 2.3:1. Incidence was more in the age group of 21 to 30 years (35%) followed by 31 to 40 years (20%) and 41 to 50 years (20%).

**Table1: Age and Sex wise distribution of poisoning deaths.**

Age	Male	Female	Total	%
0-10 years	1	1	2	2
11-20 years	5	10	15	15
21-30 years	25	10	35	35
31-40 years	15	5	20	20
41-50 years	18	2	20	20
51-60 years	2	1	3	3
61-70 years	2	1	3	3
More than 70 years	2	0	2	2
<b>Total</b>	<b>70</b>	<b>30</b>	<b>100</b>	<b>100</b>

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**Table2: Type of Poisons**

Poison	Male	Female	Total	Percentage
Organophosphorous	50	20	70	70
Snake bite	7	3	10	10
Aluminium phosphide	4	2	6	6
Organochlorine	4	1	5	5
Alcohol	2	1	3	3
Carbamates	1	1	2	2
Pyrethroids	1	1	2	2
Miscellaneous	1	1	2	2
<b>Total</b>	<b>70</b>	<b>30</b>	<b>100</b>	<b>100</b>

**Table3: Manner of Death**

Manner of Death	Male	Female	Total	Percentage
Suicidal	55	20	75	75
Accidental	10	8	18	18
Homicidal	5	2	7	7
<b>Total</b>	<b>70</b>	<b>30</b>	<b>100</b>	<b>100</b>

## DISCUSSION

Among unnatural deaths, poisoning is one of the causes of death worldwide. During the study<sup>1</sup> occurrence of poisoning was more in males than females. The incidence was more in 21 to 30 years age group followed by 31 to 40 years. The cases were least common in 0 to 10 years. The common type of poisoning was with organic Phosphorus compound followed by aluminium phosphide<sup>2</sup>. However, in a study<sup>3</sup> pesticide poisoning was common followed by drug overdose. In this study, there were only 2 cases of drug poisoning.

In this study<sup>4</sup>, suicidal poisoning was more than the incidence of accidental or homicidal poisoning. The suicidal poisoning occurred more in males than females. Suicidal poisoning was more than accidental or homicidal poisoning. However, saccidental poisoning was more common in males and suicidal poison pattern was more common in females.

In another study<sup>5</sup> females were more susceptible for suicidal poisoning than males. Suicidal poisoning was more in males compared to females. These findings are consistent with the present study.

In a study<sup>6</sup>, accidental Poison with kerosene was common occurrence in children. However, the commonest was organophosphorus compound poisoning in the adults

In yet another study<sup>7</sup>, most common cause was OP followed by aluminium phosphide poisoning. In majority of cases manner of death was suicidal. Males outnumber the females. However, in this study OP poisoning followed by snakebite and Aluminum phosphide was the finding.

## CONCLUSION

There is increase in trend in number of poisoning cases and reason for this is easy availability of agricultural poisons and increase in the stress of people because of changing lifestyle methods leading to Psychiatry problems resulting in death of an individual. There should be stringent rules for commercial sale of poisons. Poison information centers are to be established. A uniform guideline for Poison treatment in emergency should be mandatory in all hospitals. All poisoning cases are to be informed to the police and assessed by psychiatry consultants so that it will be helpful for statistics as well as for legislature to bring strict laws for sale of such poisonous compounds.

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**Ethical Clearance:** Has been obtained

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# A Study of Electrocardiographic Changes in Patients with Scorpion Sting in and around Tirupati, AP

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## ABSTRACT

**Objective** : The objective of this study is to examine the electrocardiographic features of patient stung by scorpions.

**Methods** : Forty patients stung by scorpions were gathered in the study. 12 lead derivations electrocardiography (ECGs) was performed. The determined parameters were: PR segment and QRS duration, QTmin, QTmax, QTc, QT dispersion (QTd) intervals, minimum P wave duration (PWmin), maximum P wave duration (PWmax) and P wave dispersion (PWd).

**Results** :19 males and 21 females (mean age: 34.7±14.7 years) were included in this analysis. Heart rate (83,5±13,8 beat/min), QRS (96,8±11,8 msn), QTc (414±27,4 msn), QTd (412±27,4 msn), PWmin (412±27,4msn) and PWd (41,4±19,7 msn) were found. Scorpion sting lead to electrocardiographic variability.

**Conclusion** : The commonest changes included were ST changes, sinus tachycardia, atrial ectopic beat, bradycardia, and ventricular ectopic beat.

**Keywords**: Electrocardiographic variability; Heart rate; Scorpion sting.

## INTRODUCTION

Scorpion envenomation is common in tropical and subtropical regions. A direct effect of scorpion venom on the myocardial has also been shown in several studies. Finally, cardiac dysfunction might be due to myocardial ischemia, whether related to massive catecholamine outpouring or coronary abnormality<sup>1</sup>.

Electrocardiographic abnormalities are frequently recorded on admission or several hours later<sup>2</sup>. Sinus tachycardia is initially recorded in the majority; however sinus bradycardia may be present in 24% of the victims. Bizarre, broad notched, biphasic T wave changes with additional ST elevation

or depression in the limb and precordial leads are recorded, sometimes accompanied by beat-to-beat T wave abnormalities<sup>3</sup> followed by the appearance of tiny Q waves in the limb leads, consistent with acute myocardial infarction like pattern; occasionally electrical alternant of the QRS was recorded; the QTc was prolonged in the majority of patients and a transient deviation of the QRS frontal axis to the left or right accompanied by incomplete RBBB was also observed<sup>4</sup>.

India is the most affected, with a reported incidence of 0.6%.<sup>1</sup> A retrospective analysis of the calls received by the national poison information center (NPIC) between April 1999 and March 2002 showed that, out of 995 calls, 6 involved scorpion sting.<sup>14</sup> During hot months March to June and September to October daily cases of sever scorpion sting are received at endemic areas western Maharashtra, Karnataka, Andhra Pradesh, Saurashtra and Tamil Nadu.

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The aim of this study was to examine the electrocardiographic changes in patients presenting with envenoming following a scorpion sting.

## METHOD

This is a retrospective study of 40 consecutive patients with scorpion stings admitted to Sr Sri Venkateswara Institute of Medical Sciences from June 2013 to July 2014. The protocol was approved by the institutional ethics committee. Repeat 12 derivation electrocardiography (ECGs) were obtained per 6 h during admission from all patients. Only the ECG that was obtained from the patients when their pain was at the highest level was recorded for determination. Minimum QT duration, maximum QT duration and QT dispersion were measured. QT dispersion was calculated as the difference between maximum QT duration and minimum QT duration (QT dispersion = maximum QT duration – minimum QT duration). Increased QT dispersion (QTd) is an indicator of heterogeneous ventricular repolarization and is useful for prediction of lethal arrhythmia such as ventricular tachycardia<sup>5</sup>. Minimum P wave duration, maximum P wave duration and

P wave dispersion was calculated. P wave dispersion was calculated as the difference between maximum P wave duration and minimum P wave duration (P wave dispersion = maximum P wave duration – minimum P wave duration). The P wave of the electrocardiogram may show alterations that can be associated with atrial arrhythmias<sup>6</sup>. Prolonged P wave duration and increased P wave dispersion have been reported to an increased risk for atrial fibrillation<sup>7</sup>. Corrected values (QTc, QpTc) were calculated from these values according to the Bazett formula: (QTc = QT/QR-R, Q peakTc = QpT/R-R (sec). Additionally, Q peakT values were found by measuring the interval between the initial point of the QRS complex and the highest point (peak) of the T wave.

## STATISTICAL ANALYSIS

SPSS software package (SPSS 15; SPSS Inc., Chicago, IL, USA) was used for statistical analyses. The data were analyzed using Student's t-test and the numeric data were expressed as the mean  $\pm$  standard deviation. Chi-square test and the results were expressed in percentages.

## RESULTS

The mean values and statistical comparisons of 40 patients are presented in Table 1. Forty patients (19 males and 21 females, mean age; 34,7 $\pm$ 14,7 years) were included in this analysis. The ECG which were performed when the patients had maximum (grade 3) pain were obtained for determination.

Heart rate (83,5 $\pm$ 13,8 beat/min), QRS (96,5 $\pm$ 11,8 msn), QTc (414 $\pm$ 27,4 msn), QTd (412 $\pm$ 27,4 msn), PWmin (412 $\pm$ 27,4msn) and PWd (41,2 $\pm$ 19,7 msn) were found. In patients, sinus tachycardia, atrial ectopic beat, ventricular ectopic beat, sinus arrhythmia, ST changes, LBBB, RBBB, first-degree AV block, LAHB, LPHA that were not needed treatment were 17,1%, 2,6%, 13,2%, 2,6%, 7,9%, 13,2%, 1,3%, 2,6%, 6,6%, 6,6%, and 2,6% respectively.

## DISCUSSION

The scorpionism and its consequences are an actual public health problem in several parts of the world; especially in north-Saharan Africa, Sahelian Africa, South Africa, Near and Middle-East, South India, Mexico and South Latin America, east of the Andes<sup>9</sup>. Approximately 1500 species of scorpions are described. About thirty of them are recognized as potentially dangerous for humans<sup>9</sup>. Approximately 94% of the accidents occur during the night at homes especially in rural areas, and 88% do not require any hospitalization<sup>8</sup>.

Climatic conditions, dryness and heat, are also important risk factors<sup>10</sup>. The effects of the stings depend on the delivery dose of the scorpion, the age of the offender, the season, and the size of the victim<sup>11</sup>.

Adults and among them males are most frequently stung by scorpions. However, envenomations are more severe in children in whom mortality is dramatically higher than in adults<sup>3</sup>. The death can occur early due to cardiovascular collapse. The incidence is underestimated resulting in the absence of exhaustive report of the cases; mortality is probably better known. More than 1,200,000 scorpion stings occur annually while the number of deaths could exceed 3250<sup>9</sup>. Average case fatality rate is 0.27%<sup>9</sup>. Soker et al<sup>12</sup> reported a higher mortality rate (12.5%) from west and southeastern part of Anatolia among 64 children patients with scorpion stings. In contrast, in our study no deaths were recorded

among the 36 cases from our region.

The pathogenesis of cardiac dysfunction and myocardial damage secondary to scorpion envenomation had largely been the subject of debate in the past. The most accepted hypothesis was the increased catecholamine circulating secondary to a direct stimulatory effect of the venom on the adrenals and on sympathetic nerve endings. This hypothesis was confirmed by some clinical and experimental<sup>13</sup> studies. In effect, it is possible that the venom affected the myocardial cell membranes directly, altering its permeability as well as electrical properties, and through abnormal electrolytes fluxes and shifts, causes functional damages<sup>1</sup>. However the myocardial dysfunction may be due to myocardial ischemia<sup>14</sup>. This hypothesis was advanced on some clinical, electrocardiographic, echocardiographic<sup>15</sup>, and radionuclide<sup>20</sup> studies.

It was reported in this study that, the incidence of pulmonary edema ranged from 7% to 46% and cardiac arrest rate was 7%<sup>3</sup>. It is reported in many studies<sup>17</sup> that, the clinical signs of involvement of cardiovascular system are tachycardia (rarely bradycardia with hypotension) with hypertension, in a large number of the victims. Alpay et al<sup>18</sup> evaluated the ECG findings in two cases; in first case they had shown sinus rhythm with normal PR and QT intervals, presented 1 mm ST depression on precordial and extremity derivations where 2 mm ST elevation was found on aVR. Sinus tachycardia, U wave and mild QTc elongation (QTc=0.46 sn) was found in ECG of the second case.

QTd is related to serious arrhythmia and sudden cardiac death<sup>19</sup>. In many studies, it is accepted that regional differences in repolarization (QTd) of the heart triggers these events<sup>20</sup>. QT disturbed regional repolarization of ventricle<sup>20</sup>, namely, it reflects homogeneity disturbance (inhomogeneity) in the repolarization process<sup>21</sup> Alan et al<sup>19</sup> thought that, persons who have been bitten by scorpions, myocarditis could develop, homogeneity of myocardium could be disturbed due to inflammation or toxic effects in myocardium, and arrhythmias may occur through QTd. Therefore they examined QTd in patients. They did not detect a significant difference in QT and QTd value patients and control group. In our study QRS, QTd, and PWd were found to be statistically significant.

There were no cases of hypersensitivity reactions, cardiogenic shock and pulmonary edema in present study. All patients were discharged with recovery. Cheema et al<sup>22</sup> reported that epinephrine and norepinephrine extended the maximum period of P wave. It was reported by Tukek et al<sup>23</sup> that, the increase in sympathetic activity causes increasing in P dispersion. The P wave of the electrocardiogram may show alterations that can be associated with atrial arrhythmias<sup>6</sup>. The P wave dispersion was not determined in previous studies due to scorpion stings. Our study is the first in this subject. We think that, the significant different between P wave dispersion and minimum P wave period is related to both increased early atrial beat number and also increased sinus arrhythmia. This condition is related to the sympathetic activity that caused by scorpion venom.

Bouaziz et al<sup>24</sup>, reported that, the most observed abnormalities in electrocardiogram were sinus tachycardia

(84.8%) (>120/min in children and 90/min in adult patients) and T-Wave changes (17.8%). Other ECG abnormalities were also observed including ST segment depression or elevation (15%), and sinus bradycardia (0.4%). Also, it was determined in this study that, of patients, 61.5% had a pulmonary edema, while 20.5% had a cardiogenic shock<sup>24</sup>.

Bahloul and his colleagues<sup>14</sup> made a study to determine the myocardial ischemia in six patients with severe scorpion envenomation. In this study the most common abnormality observed in ECG was tachycardia (>110 beat/min) (100%). 1/3 of patients improved cardiogenic shock. Other ECG abnormalities were also observed, including ST segment depression or elevation observed in two patients, T-wave change was observed in four patients and right bundle branch block in one. In our study, the most common ECG abnormality was sinus tachycardia. The rate of patients with bradycardia and ST-T changes were similar to the literature.

In Blum and his colleagues's<sup>4</sup> study the ECG demonstrated a normal sinus rhythm. There were deep large inverted T waves in leads II, III, and AVF, with huge U waves in precordial leads V1-V4<sup>4</sup>. In another study that was made by Bentar et al.<sup>25</sup>, cardiac problems rate and ECG abnormalities was reported as 23,1% and 13,7% respectively.

**Table 1. Comparison of ECGs findings of the patients**

Sinus tachycardia (n/%)	13/ %17,1
Heart (Rate beat/min)	83,5±13,8
Atrial ectopic beat (n/%)	10/ %13,2
Ventricular ectopic beat (n/%)	2 /%2,6
Bradycardia (n/%)	2 /%2,6
Sinus arrhythmia (n/%)	6 /%7,9
ST changes (n/%)	10 /%13,2
LBBB (n/%)	1/ %1,3
RBBB (n/%)	2 /%2,6
1. AV block (n/%)	5 /%6,6
LAHB (n/%)	5/ %6,6
LPHB (n/%)	2/ %2,6
PR duration(msn)	159,1±34,1
QRS duration(msn)	96,8±11,8
QTmin (msn)	342,4±32,8
QTmax(msn)	377,1±33,4
QTc(msn)	414±27,4
QTd(msn)	36,3±21,5
Pmin wave duration (msn)	68,4±19,3
Pmax wave duration (msn)	105,9±21,1
PWd (msn)	41,4±19,7
QpeakT (msn)	87,1±20,1

QTd:QT dispersion, PWd:P wave dispersion

### CONCLUSION

The majority ECG abnormality was sinus tachycardia. Other ECG abnormalities were also observed, includes ST segment changes, bradycardia, AV block, LBBB, and RBBB. QRS, QTd, and PWd were found to be statistically significant. The most common changes are ST changes, sinus tachycardia, atrial ectopic beat, bradycardia, and ventricular ectopic beat.

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**Conflict of Interest:** We declare that there is no conflict of interest

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# Socio-Demographic Study of Poisoning Cases at I.G.G.M.C. Nagpur

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## ABSTRACT

Acute poisoning is an important medical emergency and one of the causes of death. A thorough knowledge of the profile of the victim is essential for management and prevention of poisoning. The current study was conducted at a major Government Hospital in central India to evaluate socio demographic profile of poisoning death with special reference to various influencing and precipitating factors, also to study current trends in death due to poisoning.

Out of 72 poisoning death, 68.05% of the cases were males with female to male ratio 1:2.1. Peak incidence was observed in age group 21-30 years (45.71%). More than four times of the cases belonged to medium socio economic class. 59.72% cases were from the rural areas. Majority of cases were literates and married. Organophosphorus compounds were the most commonly abused agents. Based on these findings preventive measures like restriction of sale and strengthening the legislature on the availability of poison, promoting poison center etc. have been put forward.

**Keywords:** *Poison, poisoning death, socio demographic profile.*

## INTRODUCTION

Toxicology is the branch of medical science which deals with poison with reference to their source, character and properties, the symptoms and signs which they produce on the human body, the lethal dose, the nature of the fatal results, the remedial measure which should be employed to combat their actions or effects, the methods of their detection and estimation and autopsy findings.<sup>1</sup>

Poison is defined as a substance either solid, liquid, gaseous, which if introduced in the living body or brought into contact with any part thereof, will produce ill-health or death, by its constitutional or local effects or both. Poisoning both accidental and

suicidal are a significant contributor to mortality and morbidity throughout the world.<sup>2</sup>

According to WHO (1999) more than 3 million poisonings have been reported annually. Out of which, 90% of fatal poisoning occurs in developing countries, predominantly among farmers due to various kinds of poisoning, including poisonous toxins from natural products that are handled.<sup>3,4</sup>

The common agents for mortality and morbidity by poisoning in India appear to be pesticides, sedatives, drugs, chemicals, alcohol, plant toxins, snake bite, scorpion sting and household poisons, mostly cleaning agents of late. Among these, organophosphorus compounds poisoning is more common cause of insecticide poisoning in India. More recently aluminium phosphide poisoning has emerged as the most common source of suicidal agricultural poisoning in northern India.<sup>5</sup>

It has been estimated that, in India five to six persons per lakh population die due to acute poisoning every year. Patterns of poisoning in a particular region depend on various factors like

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availability and access to the poison , socio economic status of an individual ,educational status ,knowledge on pesticides and their proper usage etc. <sup>6</sup>

In spite of such high mortality due to poisoning in India, much less concern is being paid towards mitigating it and towards research pertaining to it. A thorough knowledge about the nature and the magnitude of the problem in a particular area is essential for the doctors in hospital practice. Present study was taken up to identify the more common causative agents and to analyze the socio demographic factors. <sup>7</sup>

**MATERIAL & METHOD**

This is a prospective study conducted from the period of Jan 2014 to Dec 2014 at Indira Gandhi Government Medical College and Hospital, Nagpur. All admitted cases of poisoning who and were subjected to medico legal autopsy were included in this study.as

The identification of poison consumed was based on reliable information from the victim, relatives, friends and also from the police . Examination of the container from which the poison had been consumed was done. The clinical diagnosis of the nature of poison was done from the clinical features and laboratory investigations, which upon death was further confirmed on post mortem examination and chemical analysis of the viscera. The socio demographic details were obtained from the relatives, and treatment record. The socio economic status of poisoning cases was determined by B.G. Prasad socio economic classification, 2014. <sup>14</sup>

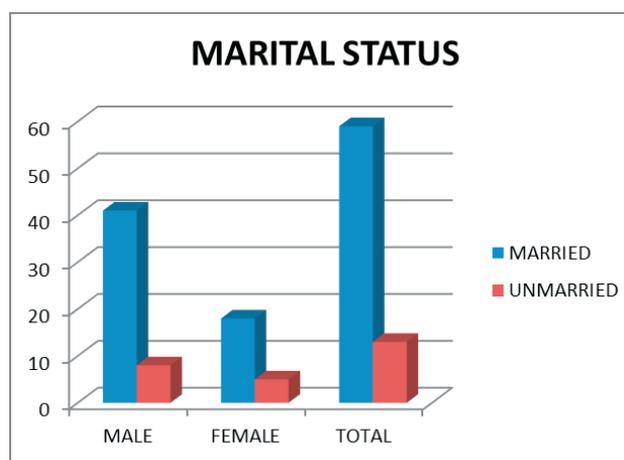
**OBSERVATIONS & RESULTS**

72 (14.54 %) out of 495 admitted cases of poisoning were expired while treatment . Out of a total of 72 cases of poisoning death, 49 cases (68.05 %) were males and 23 cases (31.94 %) were females, with a female to male ratio of 1:2.1. (Table-1). Most of the cases were from the rural area (43 cases – 59.72 %), urban area reported total (29 cases – 40.27 %) . Literacy status of the victims reveals that 54 cases (75 %) were literate. Among the 72 cases, 46 cases (63.88 %) were from Hindu community. (Table -1)

**Table 1: Showing incidence of sex ,domicile pattern , literacy status and religion of cases**

Category	No. of cases	Percentage
Sex		
Male	49	68.05 %
Female	23	31.94 %
Domicile		
Rural	43	59.72 %
Urban	29	40.27 %
Literacy Status		
Literate	54	75 %
Illiterate	18	25 %
Religion		
Hindu	46	63.88 %
Muslim	14	19.44 %
Others	12	16.66%

**DIAGRAM -1**



AXIS X- SHOWS GENDER AND TOTAL

AXIS Y – NUMBERS OF CASES

Out of 72 poisoning deaths, 49 (68.05%) cases were males and 23 (31.94%) were females. Out of total 49 male cases included in this study ,41 (83.67%) cases were married and out of 23 female cases as many as 18 (78.26%) were married . (Table -2 )

**Table 2: Showing Marital Status of Cases**

Marrital Status	Male (%)	Female (%)	Total (%)
Married	41 (83.67%)	18 (78.26%)	59 (81.94 %)
Unmarried	08 (16.32%)	05 (21.73%)	13 (18.05 %)
<b>Total</b>	<b>49 (68.05%)</b>	<b>23 (31.94%)</b>	<b>72 (100%)</b>

As far as the age of the victim was concerned, young adult belonging to the age group 21 to 30 years constituted the majority 32 cases ( 45.71 %), followed by the age group 31 to 40 years (20.83 %). A

significant decrease in the higher age group 41 to 50 years ( 11.11%) ,51 to 60 years (06.94 %) and above 61 years ( 05.55 %) was observed. (Table -3)

It was evident that 51 (70.88 %) cases were of medium socio economic status (Table-4). As far as occupation of the victim was concerned housewives were the commonest ones with 14 cases (20%) followed by farmers (15.27%). (Table 5 )

The commonest route of poisoning was oral, followed by inhalational. Commonest poison was insecticide (34.72%) followed by alcohol (18.05%). Organophosphorus were the most commonly abused poisons. (Table-6)

Considering the time of poisoning ,it was seen that that the majority of cases consumed poison (47.22 %) during the afternoon i.e.12 noon to 06 pm, followed by 06 pm to 12 mid night (30.55 %). (Table-7) As far as the time interval between consumption of poison and hospitalization is concerned it was observed that most of the cases reported between 03 to 06 hours (45.83%), followed by between 01 to 03 hours (38.88%) after consumption. (Table -8). The majority of the cases (38.88 %) survived for 12 to 24 hours, followed by 01 to 03 days (29.16 %) (Table-9).

**Table 3 : Showing age wise distribution of cases**

Age Group (in years )	No. of cases	Percentage
0-10 years	01	01.38 %
11-20 years	07	09.72 %
21-30 years	32	45.71 %
31-40 years	15	20.83 %
41-50 years	08	11.11 %
51-60 years	05	06.94 %
Above 61 years	04	05.55 %
<b>Total</b>	<b>72</b>	<b>100 %</b>

**Table 4 : Showing socio-economic status of patients**

Socio economic status	No. of cases	Percentage
Upper Class	08	11.11 %
Medium Class	51	70.83 %
Lower Class	13	18.05 %
<b>Total</b>	<b>72</b>	<b>100 %</b>

**Table 5 : Showing occupation of victims**

Occupation	No. of cases	Percentage
Farmer	11	15.27 %
Student	07	09.72 %
House wife	14	20 %
Service	06	08.33 %
Self-business	08	11.11%
Unemployed	09	12.85 %
Others	17	23.61 %
<b>Total</b>	<b>72</b>	<b>100%</b>

**Table 6 : Type of toxic agent**

Type of poison	No. of cases	Percentage
Insecticide	25	34.72 %
Alcohol	13	18.05 %
Corrosives	04	05.55 %
Rat kill poison	04	05.55 %
Aluminum Phosphide	06	08.33 %
Copper sulphide	03	04.16 %
Snake Bite	06	08.33 %
Others	11	15.27 %
<b>Total</b>	<b>72</b>	<b>100%</b>

**Table 7 : Showing timing of poisoning**

Time of consumption of poison	No. of cases	Percentage
06 am to 12 noon	09	09.72 %
12 noon to 06 pm	34	47.22 %
06 pm to 12 mid night	22	30.55 %
12 mid night to 06 am	07	09.72 %
<b>Total</b>	<b>72</b>	<b>100 %</b>

**Table 8 : Showing time interval between poisoning and hospitalization**

Time interval in hours	No. of cases	Percentage
Up to 01 hour	06	08.33 %
01 to 03 hours	28	38.88 %
03 to 06 hours	33	45.83 %
More than 06 hours	05	06.94 %
<b>Total</b>	<b>72</b>	<b>100 %</b>

**Table 9 : Showing survival period**

Survival period	No. of cases	Percentage
Upto 12 hours	13	18.05 %
12 hours to 24 hours	28	38.88 %
01 to 03 days	21	29.16 %
More than 03 days	10	13.88 %
<b>Total</b>	<b>72</b>	<b>100 %</b>

## DISCUSSION

Out of 495 poisoning cases admitted to Indira Gandhi Government Medical College and Hospital, Nagpur during the period of Jan 2014 to Dec 2014, 72 (14.54%) patient expired during treatment and were subjected to medico legal examination .

In the present study the sex incidence affected with poisoning was more with males which outnumbered the females, the ratio being 2.1:1 and tallies with the previous studies.<sup>8,9</sup> Poisoning was more common in married individuals (81.94 % ) In both sexes. The incidence of poisoning in married males (83.67%) was more than that in married females. The observations are comparable with the pre- existing literature i.e from Dash et al 2005; Singh et al 1984 studies <sup>6</sup>. The high proportion of poisoning among males might be due to change in life style, cultural pattern in this area, psychological and financial problems and they are more often exposed to the stress and strain of day to day life as well as occupational hazards than the females in this area.

This area mostly comprising of agricultural land, the geographic distribution of the cases chiefly are being from rural areas and comprising of 59.72% cases . The findings are in accordance with the other similar studies <sup>8,10</sup>, which can be reasoned out that the occurrence is due to poverty, large family size , high illiteracy ,ignorance , complete dependence on the fate of their crop both in field and in the market and abundant use of insecticide in agricultural field and inhabitation of poisonous reptiles in the rural areas etc.

In respect of the incidence of literacy status in the present study, it is seen that majority of cases (54) were literates. Failure in life and tolerance to the problems are better understood by the literates than the illiterates. In present study majority of cases belong to age group of 21 to 30 years (45.71 %), which is similar to that in other studies<sup>6</sup>. It is because this age group was the most active physically ,mentally and socially ,they were more prone to stress and strain during this period ,also from family problems ,love failure , unemployment ,failure in examination and inability to live up to the expectation of others ,easy availability ,comparatively painless death and improper knowledge regarding pesticides.

Insecticides were the commonest agent being 34.72 % responsible for deaths , which is similar

with the pre -existing literatures.<sup>11</sup> The reason being agriculture based economy, poverty and easy availability of highly toxic insecticides<sup>3</sup>. In the present study house wives, farmers, unemployed and students were more prone to poisoning which correlates with the findings of Kora SA et al <sup>12</sup> . Most of the cases from middle class ( 70.83 % ) , followed by lower class ( 18.05 % ) which correlates with the study carried by Kumar S et al and contradicts to study carried by Naveen N et al <sup>13</sup> where 70. 6% cases were observed in lower economic status.

## CONCLUSION AND SUGGESTIONS

A young literate married unemployed male from rural surrounding is more prone to poisoning. Poisoning is the preventable non- random event and developing effective poisoning prevention strategies can effectively reduce its impact on the health of the general rural population. It is a high time to evaluate the old and to introduce the new and latest effective preventive measures.

The incidence of poisoning can be reduced by strict control of sales ,distribution and storage by mass awareness and by strengthening the available legislation on the marketing of poison and it is more essential to strengthen the preventive measures like educating peoples through drug awareness programs, promoting the poison information centers, introducing separate toxicological units in the hospitals and upgrading the peripheral health centers to manage the poisoning cases as immediate treatment can help in saving the lives in many case . Apart from the medical efforts, social efforts in the form of Government, NGO, another social groups help through sincere and severe work at many levels like economy, poverty, agriculture ,irrigation and market is the need of hour.

The fundamental dictum being "prevention is better than cure", most of the poisoning death can be and should be prevented or at least reduced by drastic and combined efforts all concerned.<sup>3</sup>

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# Study of Knowledge and Attitudes of Medical Students Towards Medico-Legal Autopsies

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## ABSTRACT

A survey was conducted on 200 medical students and interns in Navodaya medical college Raichur Karnataka India to assess their attitude and knowledge regarding medico legal autopsy. The study also included the knowledge of the procedure, attitude and perception towards medico legal autopsy. In present study majority of students were aware where medico legal post mortem examination is mandatory as per the laws followed in the country. They also have awareness regarding viscera for chemical analysis and histo pathological examination for the purpose of medico legal autopsy.

60%males and 40% females were included in the study. 97% medicos believed that medico legal autopsy is mandatory. 98% thought that autopsy means viscera examination for histo pathological examination and chemical analysis.

85% students opined that the post mortem examination is done to the cause of death 50% opined that post mortem examination means causing disfigurement of the dead body. 70% denied that the post mortem examination procedure is a disrespect to the dead body. 90% opined that they were knowledgeable about the procedure of post mortem examination. 50%were comfortable and another 50%were were not comfortable on the first exposure to post mortem examination procedure. 80% opined that students should watch more autopsies. 60% opined positively for conducting post mortem examination on relatives when required. 90% students said that they don't have personal disliking for viewing autopsy and did not have unpeeled experience of them.

**Keywords:** Medico legal autopsy, forensic medicine, medical students, attitude, knowledge.

## INTRODUCTION

For centuries post mortem examination has been the central element in medical education training. Post mortem examination was fundamental in the medical education at the beginning of 20th century. The post mortem examination is essential to determine cause of death time of death and medico legal issues surrounding death. In spite of its benefits, it's use in medical education has declined. Lack of legislature support, legal, bureaucratic political and religious

reasons have been major hurdles for declining use of post mortem examination as teaching tool. Medical teachers strongly feel that post mortem examination provide great benefits in medical education training.

## MATERIALS & METHOD

This study was conducted in Navodaya medical college Raichur Karnataka. It's an observational descriptive study done over a period of six months. A total of 200 students, 100 boys and 100 girls were asked to fill pre-designed proforma after a brief introduction of the proposed survey. The work was carried during 2014 Jan - June. These students were earlier exposed to dissection of the cadaver as well as postmortem examination during their academic curriculum. The students who did not have exposure to medico legal autopsies, not willing to participate in the study were excluded from the study.

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## RESULTS

**Table 1: Awareness about Postmortem Examination**

Sl. No	Question	Yes (%)	No (%)	Do not know (%)
1.	Autopsy mandatory in all unnatural death cases	98	2	0
2.	Awareness about examination of viscera for histopathological examination and toxicological analysis for Medico legal autopsy	98	2	0
3.	postmortem examination causes disfiguration of the body	50	50	0
4.	Postmortem examination is disrespect to the human body	25	75	0
5.	Postmortem includes both Internal and External Examination along with viscera examination.	90	9	1

**Table 2: Students opinion about Academic Uses and Personal views about Autopsy**

Sl.No	Question	Yes (%)	No (%)	Don't Know (%)
6.	Medical students should witness Autopsy	80	10	10
7.	Like to have a postmortem examination of self/ relative if required after unnatural death	60	40	0
8.	viewing autopsy is useful academically	80	11	9
9.	viewing autopsy lead to stress	30	70	0
10.	Not interested in witnessing autopsy	15	85	0

**Table 3: Students opinion about Autopsy and Medical curriculum**

Sl.No	Question	Yes (%)	No (%)	Don't know (%)
11.	Autopsy Should be scrapped from medical education curriculum	10	90	0
12.	Autopsy will be helpful academically	70	30	0
13.	Autopsy serves as a important tool for training of medical students	90	10	0
14.	Autopsy should be mandatory	80	5	15
15.	Given a choice would you choose not to watch autopsy?	10	90	0

The study revealed that 98% opined that post mortem examination was mandatory. 98 % thought for examination of viscera after post mortem examination. 50% students disliked because there was disfigurement of the dead body. 25 % students opined that the post mortem examination is disrespect to the human body. 2% were unaware that post mortem examination was mandatory in all unnatural sudden unexpected and suspicious deaths. 90% students said

that they knew post mortem examination procedure involves both external and internal examination as well as examination of viscera for chemical analysis.

80% students wished to view more autopsies for academic purpose. 80% opined it as academically useful experience. 70% felt that without post mortem examination experience, grasping of the subject of forensic medicine would not be complete. 90% students were against the removal of autopsy from

medical examination. 30% students were at stress during post mortem examination.

Maximum number of students knew that it's done to know the cause of death (90). Half of the students were at comfort and half of the students were at discomfort. Many students felt that going to view post mortem examination on another institution was not a waste time. Half of the students felt that live demo of the autopsies is better than watching autopsies through videos. 50 % students did not agree that they can learn forensic medicine through books only without autopsy demonstration. 80% liked to witness autopsy in small groups only. 90% students liked to witness autopsy in mortuary only. 50% students regarded that students should do post mortem examination under supervision during internship training.

### DISCUSSION

Post mortem examination of the dead body plays an important role in determining the cause of death, manner of death and Time since death. Medical curriculum is prepared considering the various factors and public needs of the society. Many medical educators across the world believe that autopsy demonstration serves as excellent tool for medical education training<sup>1</sup>.

In a study<sup>2</sup> it was found that many did not agree for post mortem examination on them and their relatives after death of needed. But in other study<sup>3</sup> it was found that many wished for post mortem examination on themselves and relatives after death of required for the betterment of the society.

In this study students felt that lack of facilities for demonstration of medico legal autopsies would definitely hamper or hinder their progress in learning the concepts of forensic medicine as well as medical knowledge. Majority of the students were aware of the rules for medico legal autopsy as well as hospital autopsy. Students are also aware of basic dissection techniques, viscera preservation for chemical analysis and histo pathological examination. The source of information was from curriculum as opposed to other sources. These findings were consistent with other studies<sup>4,5,6,7</sup>.

This study shows curiosity and emotions of medical students towards post mortem examination and autopsy demonstration is most valuable

academic aid for training medical students. It must be appreciated because of its implications on the civilized society in general and medico legal issues of the country in particular.

### CONCLUSION

Medico legal Autopsy is being practiced since many centuries to understand the basic concepts of fatal diseases. Because of this there's been a tremendous advancement in modern medical knowledge. Even today they have not lost their significance and usefulness. This study concludes with a note that post mortem examination is mandatory for medical students in Medical education curriculum as well as for the society.

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# Estimation of Time Since Death From Rigor Mortis

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## ABSTRACT

Rigor mortis-RM is an important indicator of PMI-postmortem interval. In the present study 100 medicolegal cases examined for degree of rigor mortis in N-neck, F-face, EL- eyelid, UL- upper limbs, TRUNK, LL- lower limbs and fingers and toes at the time of postmortem examination in the department of Forensic Medicine Indira Gandhi Medical college, Nagpur. We have got the average PMI for well marked RM in whole body is 12 hours irrespective of season and average minimum PMI at which we get absent rigor mortis is 21.47 hours in the summer

**Keywords:** Rigor mortis, postmortem interval.

## INTRODUCTION

The estimate of the time since death, in early postmortem is determined by routine appliance of conventional methods of corpse examination and detecting the postmortem changes. Due to the big variation in time of occurrence and duration of such corpse changes, influenced by many endogenous and exogenous factors, it allows only approximate determination of the time of death in few hours interval after death.<sup>4</sup> A uniform time of appearance and disappearance of rigor mortis cannot be made applicable throughout a vast country like India where different weather conditions exists throughout its various parts at given time.<sup>3</sup> The present study was done to determine postmortem interval from rigor mortis

## MATERIAL & METHOD

100 medicolegal autopsies were selected where the exact time of death was known and the body had been kept in prevailing room temperature and observed before postmortem examination. Rigor mortis was tested by lifting the eyelids with the

help of pulp of index finger, in face it was tested by depressing the jaw by exerting the slight pressure over the chin. By gentle try to bend the neck forward and backwards and by lateral movements the rigor in the neck have been tested. By eliciting gently the passive movements at various joints the rigor in the limbs at various joints have been tested. The degree of rigor was observed by feeling the marked, moderate and no resistance at various muscle groups at different joints at the time of postmortem examination

## OBSERVATION & RESULTS

In the present study 68 cases were males 32 cases were females, 37 cases were studied in summer 38 cases were studied in rainy days, 25 cases were studied in winter. Environmental temperature ranges from 46-30°C in summer, 22-39°C in rainy days and 18-33°C in winter. Alleged cause of death in 23 cases was poisoning in 11 cases was blunt trauma to chest in 16 cases was coronary artery disease in 13 cases was burns in 9 cases was hanging in 1 was snake bite in 5 cases was electrocution in 3 cases was alcoholic intoxication in 10 cases was septicemia in 2 cases was drowning in 3 cases was peritonitis in 1 case was cirrhosis of liver and 3 bilateral pulmonary consolidation cases

Out of 100 case, 5 cases of electrocution and 10 cases of septicemia analyzed separately in remaining 85 cases we found in 32 cases rigor mortis was well marked in whole body, minimum PMI at which we

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found well marked RM in whole body was 6 hours and 15 minutes and maximum PMI was 21 hours and 20 minutes with average of 12 hours

We found absent RM in whole body in 3 cases at minimum PMI 20 hours and maximum PMI 23 hours and 30 minutes with average of 21.47 hours in the summer

In 6 cases RM was well marked in N, F, EL and absent in all other parts of body at minimum PMI 2 hour and 5 minutes and at maximum PMI 3 hours and 30 minutes

In 4 cases RM was well marked in EL, F, N, and partial in UL and absent in all other parts of body at minimum PMI 3 hours and 15 minutes and maximum PMI 3 hours and 40 minutes with average of 3.31 hours

In 5 cases RM was well marked in F, N, EL and partial in UL, LL, and TRUNK absent in fingers and toes at minimum PMI 4 hours and 15 minutes and maximum PMI 6 hours and 20 minutes with average of 5 hours

In 6 cases RM was well marked in whole body except in fingers and toes at minimum PMI 4 hours and maximum PMI 5 hours and 45 minutes with average of 4.82 hours

In 4 cases RM was well marked in LL and fingers and toes partial in TRUNK and UL absent in all other parts of bodies at minimum PMI 13 hours and maximum PMI 21 hours and 30 minutes with average 17.75 hours

In 19 cases RM was partial in LL, FINGERS and TOES absent in all other parts of bodies at minimum PMI 12 hours and 10 minutes and maximum PMI 25 hours with average of 18.56 hours

In 5 cases of electrocution in 3 cases we found well marked RM in whole body at PMI 3, 5, 6 hours respectively in another case we found absence of RM at PMI 21 hours and 30 minutes

In 10 cases of septicemia we did not found well marked RM it was either absent or partially present irrespective of PMI

## DISCUSSION

Rule of 12: it is generally considered that it takes about 12 hours after death to develop rigor mortis,

remains for another 12 hours and takes about 12 hours to pass-off.<sup>2</sup>

Vij stated that rigor mortis gets well-established in the entire body in about 9 – 12 hours<sup>5</sup>

Niderkorn's early work (1874) on 113 bodies showed a range of 2-13 hours for rigor to be complete, the main cluster being from 3 to 6 hours after death, after death.<sup>6</sup>

Among the voluntary muscles, rigor mortis usually develops sequentially and follows a descending pattern, the so-called Nysten's law: it first appears in the muscles of eye lids (orbicularis oculi) [3-5 h], then in jaw, facial muscles [4-5 h], neck, thorax [5-7 h], upper limb (from shoulder to hand) [7-9 h], abdomen, lower limb (from hip to the foot) [9-11 h], and lastly in the small muscles of fingers and toes [11-12].<sup>8</sup>

We also found the average PMI at which we found rigor mortis well marked in whole body is 12 hours irrespective of season

When body is subjected to temperature above 65°C, rigidity develops in body<sup>2</sup>

Seth stated that when body is exposed to temperature above 60°C, rigidity is produced, it is seen in deaths from burning, high voltage electric shock, from falling into hot liquids<sup>7</sup>.

We also found 6 cases of burns with heat stiffening

In India, usually it lasts 18 to 36 hours in summer<sup>1</sup>. Vij also stated that the usual duration of rigor mortis is 18 – 36 hours in summer<sup>5</sup>

We also found average PMI at which we get absent rigor mortis is 21.47 hours in the summer

Rigor mortis is frequently absent in persons dying from septicemia<sup>1</sup>

We also found the same result

Onset of rigor is early and duration is short in death from diseases causing great exhaustion e.g., electrocution etc<sup>1</sup>

We also got the same result

## CONCLUSION

From the present study the following conclusions were drawn The average PMI for well marked RM in whole body is 12 hour irrespective of season and average minimum PMI at which we get absent rigor mortis is 21.47 hours in the summer

In electrocution onset of rigor is early and duration is short. Rigor mortis is frequently absent in persons dying from septicemia

When body is subjected to temperature above 65°C, heat stiffening develops in bodies

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# Study of Pattern of Cases Presenting to the Casualty of a Medical College Teaching Hospital

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## ABSTRACT

This study conducted on 500 patients who visited the emergency and Casualty of RIMS Hospital, Raichur, Karnataka, India. To study the pattern of cases in the Casualty of hospital and to study the case mix pattern was the main objective of the study.

Medicine and its allied specialties contributed to the maximum number of patients attending the casualty. Maximum number of patients visiting the casualty had small complaints and did not suffer from any life threatening problems, which actually required Care and admission for the purpose of emergency medical care. This results in increase of unnecessary workload for the staff working mainly in the Casualty, deputed there for providing emergency care.

**Keywords:** Medico-legal cases, casualty, hospital.

## INTRODUCTION

A medico legal case is a case where attending doctor after proper history and examination suggests investigations by law enforcement authorities as per the law of the land<sup>1</sup>. Casualty is a place where apart from handling emergency care to the patients, provides platform for all medico legal cases to complete all the required formalities as per legal procedure of the country<sup>2</sup>. Profiling of medico legal cases is an integral aspect for the prevention of casualties. It helps to study crime rate in an area<sup>3</sup>.

## MATERIALS & METHOD

The study conducted in the Casualty of RIMS teaching hospital, Raichur, Karnataka during the

year Jan to Jun 2015. Total 500 cases studied, who visited the casualty for seeking care. The details of the patients obtained from casualty register and medical records section of the hospital. The patients were categorized under various speciality of medicine, surgery, orthopedics, pediatrics, OBG, ENT, ophthalmology and psychiatry. This grouping done to study the case mix pattern and the patients again grouped under the four categories as below.

- 1) Emergency cases
- 2) Serious but not emergency
- 3) Cases requiring skilled treatment without any admission
- 4) Casual patients with minor ailments

## RESULTS

**Table 1: Age and sex wise distribution of patients**

Sex	Age								Total
	0-10 yrs	11-20 yrs	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	61-70 yrs	71-80 yrs	
Male	36	46	102	36	34	24	12	2	292
Female	22	26	56	24	26	42	10	2	208
Total	58	72	158	60	60	66	22	4	500
Percentage	24	28	64	24	24	26	8	2	100

**Table 2: Case mix pattern of the patients and Specialty**

Sl. No.	Specialty	Patients	Percentage
1	Medicine	292	44
2	Surgery	120	24
3	Orthopedics	69	14
4	Pediatrics	31	06
5	OBG	21	04
6	ENT	13	03
7	Ophthalmology	20	04
8	Psychiatry	04	01
	Total	500	100

**Table 3: Type wise distribution of cases**

Types	No. of patients	Percentage
Type I	32	06
Type II	190	38
Type III	70	14
Type IV	208	42
Total	500	100

**Table 4: Type of cases [MLC v/s Non-MLC]**

Type	Cases	Percentage
Medico legal cases	102	20
Non-Medico legal cases	398	80
Total	500	100

**Table 5: Pattern of Medico legal cases**

	Road traffic accidents	History of fall	Poisoning	Assaults	Thermal burns	Others	Total
Number of cases	32	50	04	06	04	06	102
Percentage	31	49	04	06	04	06	100%

## DISCUSSION

Table I shows age wise and sex wise distribution of cases. Male patients (292) outnumbered female patients (208) in attending the casualty department. Male preponderance observed in all age groups. Similar findings observed in other study in which, majority of the cases involved were adults and many of them were males<sup>4</sup>.

Table II shows case mix pattern. Maximum patients belonged to medicine. Surgery, orthopedics, pediatrics, OBG, ENT, ophthalmology and

Psychiatry followed this. This findings are consistent with the other study in which it was found that maximum patients belonged to medicine and its allied specialty it was found that large proportion of patients attending the Casualty department work as well at Andy's and as such did not constitute a real emergencies<sup>5</sup>.

Table III shows the grouping of patients under various categories. category I, 6% percent of the patients, category II, 38% patients, category III, 14% patients and category IV, 42% patients. The study findings clearly show that maximum 50% of patients

belong to Category IV. A study revealed that road traffic accidents constituted majority of the cases most being assault cases followed by mechanical injury cases. Male predominance was quite evident. The affected age group was 21 to 30 years, followed by 31 to 40 years indicating young patients' exposure to such casualty emergencies<sup>6</sup>.

Table IV shows MLC and Non-MLC comparison. Out of 500 cases, 20% were MLC and 80% were Non MLC. Table V shows the pattern of medico-legal cases. 4% were thermal burns, 4% were poisoning, 6% were assault, 31 % were road traffic accidents, 49% gave the history of fall and 6% were others. This analysis regarding disposition of patients differs from other research study in which burn cases were maximum followed by assault and Poison cases<sup>7</sup>.

Table V shows medico legal cases. Maximum numbers of cases were history of fall followed by road traffic accident. This finding differs with another study in which, poisoning was the commonest mode of injury followed by road traffic accidents among the patients coming to the hospital<sup>8</sup>.

### CONCLUSION

This study concludes that maximum number of patients brought to Casualty were patients with minor ailments which did not require much intervention. Since, most of the patients attending the Casualty were casual attendees there is unnecessary workload on Casualty staff. Maximum time spent in dealing with non-emergency cases may trouble the patients seeking emergency care. Separating casual attendees and emergency cases at the Casualty and sending the casual care seekers to OPD, minimizing the burden on Casualty staff. Without revision of Healthcare services, patients use casualty as an alternative to general practice. Injuries can be prevented by awareness and training of staff which are required to be implemented strictly. The doctors who are involved in handling medico legal cases need to expertise in such work. In addition, the need for round the clock availability of forensic experts in Casualty and emergency departments to handle medico legal cases is must.

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**Ethical Clearance:** Has been obtained

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# Unexpected Post-Operative Death in a Case of Polytrauma Diagnosed at Autopsy - a Case Report

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## ABSTRACT

Pulmonary embolism remains an important diagnostic and therapeutic challenge. In fact pulmonary thromboemboli are reported in more than half of all autopsies. Furthermore this complication occurs in 1% to 2% of postoperative patients over the age of 40 years. In the present case a man aged about 40 years was met with road traffic accident near Bakarapeta KADAPA (Dist) on 09.12.2009 at 3:00 P.M. and sustained multiple injuries, Immediately patient was shifted in 108 ambulance to R.I.M.S hospital. Patient was taken treatment at R.I.M.S hospital. He died consequently after 12 days.

**Keywords:** Long bone fracture, pulmonary thromboembolism, Age factor.

## INTRODUCTION

Embolism is the passage through the venous or arterial circulations of any material capable of lodging in a blood vessel and there by obstructing the lumen. The usual embolus is a thrombo embolus – that detaches from the vessel wall and travels to a distant state. Pulmonary embolism remains an important diagnostic and therapeutic challenge. In fact pulmonary thromboemboli are reported in more than half of all autopsies. Furthermore this complication occurs in 1% to 2% of postoperative patients over the age of 40 years. The risk increases with advancing age obesity length of the operative procedure, post operative infection, the presence of cancer and preexisting venous disease. The large majority of pulmonary emboli (90%) arise from the deep vein of the lower extremities: most of the fatal ones arise from the veins. Only half of patient with pulmonary thromboembolism have signs of deep vein thrombosis. Some thrombo emboli arise from the pelvic venous plexus and others from the right side of the heart. Emboli are also derived from thrombi around indwelling lines in the systemic

venous system or the pulmonary artery. The upper extremities are rare sources thromboemboli.

## MASSIVE PULMONARY EMBOLISM

One of the most dramatic and tragic calamities typically complicating hospitalizations is the sudden collapse and death of a patient who appeared to be well on the way to an uneventful recovery. The cause of this catastrophic is often massive pulmonary embolism as a consequence of the release of a large deep venous thrombus from a lower extremity. Classically a post operative patient succumbs immediately on getting out of bed for the first time. The muscular activity dislodges a thrombus that formed as a result of the stasis associated with prolonged bed rest. Excluding deaths related to surgery itself, massive pulmonary embolism in the most common cause of death after major orthopedic surgery and in the most frequent non obstetric cause of postpartum death. A large pulmonary embolus often lodges at the bifurcation of the main pulmonary artery (Saddle embolus) there by obstructing the blood flow to both lungs. Somewhat smaller lethal emboli may be found in the right or left pulmonary arteries or in multiple primary and secondary branches. With acute obstruction of more than half of the pulmonary arterial tree the patient often goes into shock immediately and may die within minutes.

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## CASE HISTORY

A man aged about 40 years was met with a road traffic accident near Bakarapeta Kadapa (Dist) on 09-12-2009 at 3:00pm. Immediately patient was shifted in 108 ambulances to RIMS Hospital. Patient was admitted in male Orthopedics ward in RIMS Hospital. He has under care of orthopedic surgeon. On 12-12-2009 patient posted for operation and was shifted to post operative ward. He was recovering well and his vitals were stable. On 22-12-2009 patient has complained severe chest pain, shortness of breath and died within few minutes. Inquest held over dead body of deceased concerned in Cr.No-159/09 U/s337, 338 sections altered to 304(A) IPC Ps Siddout. Inquest commenced on 22-12-2009 at 2:30pm at the scene of offence.

## AUTOPSY FINDINGS

**External appearances:** Body wrapped in brown bed sheet, dark to bright color with black hair on the scalp and beard, moderately built, hospital bandage over both legs bellow knee joint, blue nails both hands, eyes congested, sacred thread on the shoulder, swelling right thigh, sutures two as right and left lower part of the knee joints of both knees and one suture right side, two suture bellow and lateral on both legs. Ecchymosed present front of chest both upper arms front back of neck and on back of shoulders.

**Anti -mortem injuries:** Anti mortem injuries present over the dead body externally and internally.

### Externally:

1. Grazed abrasion 1.5cmX1cm back of right elbow joint.
2. Grazed abrasion lowers 1.3 right thighs laterally 2cmX1cm.
3. Laceration 0.5cmX0.4cm on the nose.
4. Impact abrasion 1cmX1cm on the forehead black in color.

### Internal:

1. Closed fracture right tibia middle, after cutting open the fractured area longitudinally from the upper end of tibia, surgical hole is found on the upper end of tibia 1cm diameter.

2. Steel rod is present in right tibia with 39 cm in length and 1cm in breadth.
3. Closed fracture left tibia middle, after cutting open the fracture area longitudinally from the upper end of tibia surgical hole is found on the upper end of tibia 1 cm diameter.
4. Steel rod is present left tibia with the same length as in left tibia with the same length as in right tibia.
5. Closed fracture lower 1/3<sup>rd</sup> of right thigh left alone fracture through and through separated bone.
6. Lungs congested edematous on cut section frothy fluid present.
7. Embolus found in pulmonary artery 7.5 cm in length.
8. Brain congested petechial hemorrhage present.
9. Embolus 1.5cmX0.5cm present in right atrium.

## CAUSE OF DEATH

Pulmonary thromboembolism due to Fracture of Long Bones

## DISCUSSION

Death from massive pulmonary thromboembolus is due to impaction of dislodged thrombi in the pulmonary artery or its main tributaries. Most pulmonary thromboemboli originate in the deep veins of the lower extremities. Any trauma to the lower extremities or pelvis may injure a vein and cause the formation of thrombi, which can be subsequently dislodged. Pulmonary embolism caused sudden death<sup>4</sup>. More than 95% of all pulmonary emboli arise in thrombi within the large deep veins of the lower limbs. Differences in size of thromboemboli have great consequences not only for the clinical effects and for mortality, but also for the evaluation of the prevalence of pulmonary thromboembolism. Large emboli obstructing pulmonary trunk or main pulmonary and primary thrombi or their sequelae. In peripheral, particularly muscular pulmonary arteries, thrombi are most likely primary, especially when associated with advanced age and with pulmonary hypertension. However, small arteries may be subject to extensive micro embolism following fragmentation of large thromboemboli. Thrombotic arteriopathy is the pulmonary arterial disease based upon either primary thrombosis or embolism. It

is often associated with pulmonary hypertension, and characterized by irregular, nonlaminar, often oblitative, intimal fibrosis. Recanalization channels, sometimes widening to separate intravascular fibrous septa, are characteristic features. Reversibility of postthrombotic lesions is very limited. Thrombus in arteries will not remain undetected when these vessels are opened at autopsy. However, lobar and segmental pulmonary arteries are not regularly cut systematically, so that emboli in these vessels may escape detection. This explains that the percentage of grossly recognizable emboli in routine autopsies of adult patients varies widely, from 1.5% to almost 30%.<sup>5,6</sup>

In the present case injury to lower limbs causing damage to the vessels and also as the patient was bed ridden after surgery thrombus might have formed in the veins of lower limbs and dislodged to cause

### CONCLUSION

While treating cases of trauma to lower limbs and also people who are bedridden for prolonged period deaths due to thromboembolism can be prevented by giving prophylactic treatment. While conducting autopsy the history of the case should alarm in the mind about the possibility of pulmonary embolism and proper examination of pulmonary arteries should be undertaken to diagnose the cause of death.

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# Road Traffic Accidents: Patterns and Predisposing Factors

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## ABSTRACT

**Background:** Road traffic accidents are multifactorial in nature which involves human, environmental factors and vehicular factors. The present study will help us to shed light into factors facilitating the occurrence of accidents. **Objectives:** To study the socio-demographic profile and injury patterns among the victims and study the factors facilitating the occurrence of road traffic accidents.

**Methodology:** A hospital based cross-sectional study was done under the setting of tertiary care hospital, VIMS, Ballari, Karnataka during the period from November 2014 to October 2015. Victims of RTA who were attending casualty department and department of Orthopedics, Surgery, Neurosurgery were included. Data related to socio-demographic profile, factors influencing the onset of the accident, injury pattern were collected on clinical examination of the victim. **Results:** Mean age of the victims  $35.12 \pm 15.7$  years, male to female ratio of 3.9:1, motorized two wheeler (38%), three wheeler (16%) and truck/lorry (22%) were common vehicles involved in RTAs. Excess speeding (66.8%) of the vehicle and under the influence of alcohol (22.8%) were the predominant predisposing factors for the occurrence of the RTAs. **Conclusion:** The victims were young adults and there was male preponderance in the occurrence of RTAs. Excess speeding of the vehicle and under the influence of alcohol was the predominant predisposing factors for the occurrence of the RTAs.

**Keywords:** Road traffic accidents, injury pattern, predisposing factors

## INTRODUCTION

Accidents represent a major epidemic of non-communicable disease in the present century throughout the world not only in social and health aspects but also in economic terms. They are no longer considered to be accidental. They are the part of the price we pay for technological progress. Road traffic injuries are growing public health issue. Over 90% of the world's fatalities on the roads occur in low-income and middle-income countries<sup>1</sup>. Accidents carry high economic and social costs, which are not easy to ascertain. Road traffic accidents cost between

1% to 2% of their gross national product in low-income and middle-income countries which is more than the total development aid received by these countries<sup>2</sup>. Road traffic accidents are multifactorial in nature which involves human, environmental factors and vehicular factors. The present study will help us to shed light into factors facilitating the occurrence of accidents.

## OBJECTIVES

1. To study the socio-demographic profile of the victims
2. To study the injury pattern among the victims
3. To study the factors facilitating the occurrence of road traffic accidents.

## METHODOLOGY

A hospital based cross-sectional study was done under the setting of tertiary care hospital,

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Vijayanagara Institute of Medical Sciences, Ballari, Karnataka during the period from November 2014 to October 2015. For the purpose of the study, Road Traffic Accident was defined as “an accident which took place on road between two or more objects, one of which must be any kind of moving vehicle.” RTA occurring in Ballari Municipal Corporation limits and in near Sandur taluka, Hospet taluka were considered for the study. Victims of RTA who were attending casualty department and department of Orthopedics, Surgery, Neuro-surgery were included.

The survived victims were interviewed using a pretested semi-structured questionnaire and in case of dead victims immediate relatives were interviewed for collecting data related to socio-demographic profile, factors influencing the onset of the accident. Data about the injury pattern was collected on clinical examination of the victim. Institutional Ethical Committee clearance was obtained for the conduct of the study.

The collected data was entered into an excel sheet and after appropriate data cleaning was transferred and analysed using SPSS software version 17. Results were expressed in terms of proportions, percentages and means.

### RESULTS

**Table no. 01: Sociodemographic profile of the RTA victims (N = 250)**

Variable		Frequency	Percentage
<b>Age group</b>			
	< 20 yrs	32	12.8
	20 - 40 yrs	143	57.2
	41 - 60 yrs	68	27.2
	> 60 yrs	7	2.8
	Mean ± SD	35.12 ± 15.7	
<b>Sex</b>			
	Male	199	79.6
	Female	51	20.4
<b>Religion</b>			
	Hindu	214	85.6
	Muslim	9	3.6
	Christian	27	10.8
<b>Caste</b>			
	Backward class	112	44.8

	SC	55	22.0
	ST	20	8.0
	Others	63	25.2
<b>Type of family</b>			
	Nuclear	161	64.4
	Joint	85	34.0
	Single	4	1.6
<b>Marital status</b>			
	Unmarried	72	28.8
	Married	175	70.0
	Divorce	2	0.8
	Widow	1	0.4

More than half of the RTA victims were in the age group of 20 – 40 years (57.2%) followed by 41 – 60 years (27.2%) and the mean age of the victims was 35.12 years with a standard deviation of 15.7 years. Most of the victims were males (79.6%) with a male to female ratio of 3.9:1. Majority of them were Hindus (85.6%) and most of them were married (70%).

**Table no. 02: Sociodemographic profile of the RTA victims (N = 250)**

Variable		Frequency	%
<b>Education</b>			
	Post graduate	9	3.6
	Graduate	34	13.6
	Pre university college	32	12.8
	High school	60	24.0
	Middle school	29	11.6
	Primary	38	15.2
	Illiterate	46	18.4
	NA	2	0.8
<b>Occupation</b>			
	Unemployed	14	5.6
	Unskilled	56	22.4
	Semiskilled	37	14.8
	Skilled	26	10.4
	Semiprofessional	29	11.6
	Professional	10	4.0
	House wife	30	12.0
	Students	48	19.2

**(Cont...) Table no. 02: Sociodemographic profile of the RTA victims (N = 250)**

SES			
	Class I	17	6.8
	Class II	66	26.4
	Class III	71	28.4
	Class IV	73	29.2
	Class V	23	9.2
Habits			
	Tobacco smoking	42	16.8
	Tobacco chewing	27	10.8
	Alcoholic	70	28.0
	Alcoholic and smoker	30	12.0

In the study nearly one-sixth (18.4%) who were involved in RTA were illiterates, 24% had education up to high school and 13.6% were graduates. Among the victims, unskilled workers (22.4%) constituted the highest number followed by students (19.2%) and semiskilled workers (14.8%). More than one third of the study population belong to upper lower and lower class, more than half of them belong to upper middle (26.4%) and lower middle class (28.4%).

**Table no. 03:**

Injury patterns among the RTA victims (N = 250)			
Variable		Frequency	Percentage
Type of injury			
	Simple	57	22.8
	Grievous	193	77.2
Pattern*			
	Abrasions	189	75.6
	Contusions	127	50.8
	Lacerations	96	38.4
	Fractures	112	44.8
Part involved*			
	Head and neck	184	73.6
	Thorax	57	22.8
	Abdomen	39	15.6
	Upper limbs	172	68.8
	Lower limbs	242	96.8

\*Multiple responses

Majority of the victims suffered from grievous injury (77.2%) where the common pattern of injury was abrasions (75.6%) followed by contusions (50.8%), fractures (44.8%) and lacerations (38.4%). Among the victims multiple injuries involving different parts of the body was seen where lower limbs (96.8%) were more affected in majority of cases compared to other areas.

**Table no. 04: Distribution of RTA based on vehicle type, mode and type of road users (N = 250)**

Variable		Frequency	%
Type of vehicle			
	Bicycle	10	4.0
	Motorised two wheeler	95	38.0
	Motorised three wheeler	40	16.0
	Motorised four wheeler	35	14.0
	Bus	14	5.6
	Truck/lorry	55	22.0
	Tractor	1	0.4
Mode of RTA			
	Collision b/w two vehicles	94	37.6
	Being knocked down	43	17.2
	Vehicle hitting a stationary object	44	17.6
	Over turning of vehicle	25	10.0
	Fallen down from vehicle	34	13.6
	Run over	6	2.4
	Slipped from bus	4	1.6
Type of Road users			
	Pedestrian	32	12.8
	Driver	130	52.0
	Pillion rider	16	6.4
	Occupant of the vehicle	72	28.8

Motorised two wheeler was the commonest vehicle involved in the RTA followed by truck/lorry (22%), three wheeler (16%) and four wheeler (14%). Collision between the two vehicles was the common mode of RTA followed by being knocked down

(17.2%, vehicle hitting a stationary object (17.6%) and fallen from the vehicle (13.6%). Driver was the commonest person affected (52%) by the RTA followed by occupant of the vehicle (28.8%).

**Table no. 05: Time and Place wise distribution of the RTA (N=250)**

Variable		Frequency	Percentage
<b>Week day</b>			
	Monday	24	9.6
	Tuesday	37	14.8
	Wednesday	28	11.2
	Thursday	40	16.0
	Friday	23	9.2
	Saturday	56	22.4
	Sunday	42	16.8
<b>Time of the day</b>			
	0.00 - 3.59 hrs	22	8.8
	4.00 - 7.59 hrs	28	11.2
	8.00 - 11.59 hrs	50	20.0
	12.00 - 15.59 hrs	30	12.0
	16.00 - 19.59 hrs	75	30.0
	20.00 - 23.59 hrs	45	18.0
<b>Place of accident</b>			
	Highways	82	32.8
	City/municipal road	106	42.4
	Inner roads	62	24.8
<b>Location of occurrence of accidents</b>			
	Straight roads	145	58.0
	Curve roads	35	14.0
	4 way intersection	31	12.4
	T junction	27	10.8
	Y junction	11	4.4
	Others	1	0.4
<b>Local conditions*</b>			
	Defective road	142	56.8
	Poor visibility	120	48.0
	Congested road	121	48.4

\*Multiple responses

Saturday (22.4%), Sunday (16.8%) and Thursday (16%) were the common week days of occurrence of RTA where in the common time of occurrence of RTA was between 4pm to 8pm (30%) and 8am to 12 noon (20%). Common place of accidents were city/municipal roads (42.4%) followed by highways (32.8%). Commonest location of RTA were on straight roads (58%) followed by curve roads (14%) and 4 way intersection roads. Defective road (56.8%), poor visibility (48%) and congested road (48.4%) were some of the environmental conditions at the time of RTA.

**Table no. 06: Precipitating factors for the occurrence of RTA (N=250)\***

Factor	Frequency	Percentage
Using cell phone	15	6.0
Under the influence of alcohol	57	22.8
Under the influence of personal conflicts	10	4.0
Under anxiety to reach destination	45	18.0
Influence of friends while driving	5	2.0
Deprived sleep	15	6.0
Excess speed	167	66.8
Animals on road	25	10.0
Improper lighting	6	2.4
Sudden braking of moving vehicle	37	14.8

\*Multiple responses.

In more than two third of the cases excess speed (66.8%) was the precipitating factor for RTA. Under the influence of alcohol (22.8%), under anxiety to reach destination (18%), sudden braking of moving vehicle (14.8%) and animals on road (10%) were other common precipitating factors for the occurrence of the RTA.

## DISCUSSION

**Burden:** Around the World and India, the proportion of fatal accidents in total road accidents has consistently increased since 2002 from 18.1 percent to 24.4 percent in 2011. The severity of road accidents, measured in terms of persons killed per 100 accidents, has also increased from 20.8 in 2002

to 28.6 in 2011<sup>3,4</sup>. Karnataka shares fourth position among the road accidents whereas Maharashtra tops the list with highest road traffic accident. Regarding injuries Tamil Nadu tops the list while Karnataka is in second position<sup>4</sup>.

### SOCIODEMOGRAPHIC PROFILE

More than half of the RTA victims were in the age group of 20 – 40 years (57.2%) followed by 41 – 60 yrs (27.2%) and the mean age of the victims was 35.12 years. Similar observations were noted in other studies conducted elsewhere<sup>5-8</sup>.

Male preponderance in the occurrence of the RTA was observed in our study which was in consonance with other studies which can be attributed the more usage of vehicles by males compared to females<sup>5,6,8,9</sup>.

### INJURY PATTERNS

Majority of the victims sustained grievous injury (77.2%) almost every victim had lower limb involvement where the fractures, contusions and aberrations were the common pattern of injuries. Predominant involvement of lower limbs in RTAs was also reported other studies<sup>6,13</sup>. Whereas as Khare N et al (2012)<sup>14</sup> observed that upper limb (21.3%) is more involved than lower limbs (13.7%). Chaudhary BL et al (2005)<sup>15</sup> showed that head was the commonest site involved in 53.5% cases, followed by lower limb in 41.6% cases. Mohammad Hussain Khan et al (2006)<sup>16</sup> observed that fractures of the bones were seen in 60% of accident cases.

### PREDISPOSING FACTORS

In our study, motorized two wheelers constitute the commonest vehicle involved in RTAs (38%). Similar observations were noted by D Rao et al (2010)<sup>9</sup>, Vaibhav Bagaria et al (2007)<sup>17</sup> and by Chaudhary B L et al (2005)<sup>15</sup>. However Ballari being a mining area the proportion of RTA involving truck/lorry (22%) is more compared to other studies. Collision between two vehicles was higher in our study (37.6%) as compared to studies conducted by Nilambar Jha et al (2004)<sup>18</sup> and Archana Kaul et al (2006)<sup>19</sup>.

Most of the RTA occurred on Saturdays (22.4%) and Sundays (16.8%). Abhishek Singh et al (2011)<sup>20</sup> in their study observed that 45.8% of accidents took place on weekends and Nilambar Jha et al (2004)<sup>18</sup> reported that 17.1% of accidents took place on Sundays

followed by Tuesdays 15.9% and Thursdays 15.8%. In our study accidents were reported high (30%) during 4 to 8 pm. Similar findings were reported by Akhilesh Pathak et al (2004)<sup>21</sup> where the peak timings of RTA were either during morning hours of 9-12 or evening hours of between 18-21 hours and Anand Menon et al (2005)<sup>22</sup> reported high RTA during 12 – 18 hours (39%) followed by 18 – 24 hours.

In our study excess speed (66.8%), under the influence of alcohol (22.8%) and under anxiety to reach destination (18%) were the predominant precipitating factors for the occurrence of the RTA. Similar results were shown by a study done by Badrinarayan Mishra et al (2010)<sup>23</sup> in Manipal and Pramod kumar verma et al (2004) in Delhi<sup>12</sup>. Zhou JH et al (2003)<sup>24</sup> in their study observed that main reasons for the crashes were due to improper driving (26%), violation of driving norms (9%) and carelessness (6%).

### CONCLUSIONS

The victims were young adults and there was male preponderance in the occurrence of RTAs. Grievous injury was common with involvement of fractures, contusions and abrasions. Excess speeding of the vehicle and under the influence of alcohol was the predominant predisposing factors for the occurrence of the RTAs.

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# The Job of a Forensic Expert in Railway Fatalities – Redefined!

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## ABSTRACT

The number of people dying due to Railway Fatalities is increasing enormously every year. During the study period i.e. from 01-11-2013 to 31-10-2015 the total number of autopsies conducted at mortuary of Gandhi Hospital, Secunderabad were 9483 out of which 480 cases were due to railway fatalities upto 4.79% of the total cases in the I year of study and 5.31% of the total cases in the II year of study thereby showing an increase of 0.52%. Many times a Homicide or suicide might go unnoticed or is mistaken for an accident and justice is not done to the deceased.

It is very difficult for a Forensic Expert to come to a conclusion whether the injuries are ante-mortem or post-mortem, because the bodies are often mangled, crushed, stained with oil, dirt, grease, mud, gravel etc., estimating time since death also becomes a great big challenge. On several occasions the findings are totally altered while shifting the bodies. Therefore this study emphasises on the fact that the Forensic Expert should approach any Railway fatality with a high index of suspicion and working as a Medico-Legal Expert, the Forensic Expert should also do the job of an Investigating Officer and help The Judiciary in administering Justice!

**Keywords:** Railway fatalities, Forensic Expert, Accidents, Homicides, Suicides.

## INTRODUCTION

The number of people dying due to Railway fatalities is increasing very fast. According to railway ministry data, 16,336 died on the tracks in 2012 and the number has increased to 19,997 in 2013. It further says that the railway tracks have claimed 18,735 lives till October this year<sup>[1]</sup>. An average of 8 to 10 persons are fatally knocked down daily by trains. The question often raised by the relatives of the deceased in a Railway Fatality is "Is it a real Accident or a Homicide or a Suicide? Many times a Homicide or suicide might go unnoticed or is mistaken for an accident and justice is not done to the deceased.

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For any crime to reach its logical end, the Investigating Officer, The Judiciary and the Forensic Expert have to work as a team and their own job is defined. Law defines that a Forensic Expert is an Expert witness who can give opinion on the facts observed by him or other's and thereafter answer questions based on the same<sup>[2]</sup>. But in a Railway Fatality, often the facts required for the Forensic Expert are more at the crime scene along with those on the body on the autopsy table. This study was taken up to emphasise upon the fact that a Railway Fatality should be approached with high index of suspicion because many a times there is a possibility that a homicide can be mistaken for an accident.

## AIMS

It is very difficult for a Forensic Expert to come to a conclusion whether the injuries are ante-mortem or post-mortem, because the bodies are often mangled,

crushed, stained with oil, dirt, grease, mud, gravel, etc. estimating time since death also becomes a great big challenge. On several occasions the findings are totally altered, because shifting of Railway Fatality bodies to the mortuary in not properly done. The Forensic Expert instead of being in a position to guide the former with clear cut pointers in the case is unknowingly prejudiced by the IO's opinion. With the above reasons in mind, this study was taken up with the following aims and objectives.

1. To emphasize the possibility of mistaking a homicide or a suicide for an Accident, in Railway Fatalities.
2. To study the pattern of injuries in these cases and to arrive to a reasonable conclusion on their contribution to the deaths.
3. To identify the problems faced by a Forensic Expert Railway Fatalities while opining about Cause of death and the exact time since death.

### MATERIAL & METHOD

All the Railway Police cases brought for Post-mortem Examination to Gandhi Hospital Mortuary, Secunderabad from 1<sup>st</sup> November 2013 to 31<sup>st</sup> October, 2015 were chosen for this study. During the set period of 2 years, a total of 480 cases were recorded. The preliminary data was collected from the Inquest reports, relatives, Police, hospital case sheets, etc. Identity was established wherever possible. Details about the psychological, family, financial and health status were also acquired. All the details required for the study were acquired with a preset proforma which was similar to those used in previous studies [3][4]. Care was taken to note details about the circumstances around the incident, eyewitness, position of the deceased in relation to tracks, injuries, stomach contents, cause of death, manner of death.

### FINDINGS

Between 01-11-2013 and 31-10-2015 the total number of autopsies conducted at mortuary of Gandhi Hospital, Secunderabad were 9483 out of which 480 cases were due to Railway Fatalities. Therefore Railway Fatalities amounted to 4.79% of the total cases in the I year of study and 5.31% of the total cases in the II year of study thereby showing

an increase of 0.52%. When Railway Fatalities are not so common compared to the other cases, there is possibility that a Homicidal Railway Fatality might go unnoticed, unless the Forensic Expert shows great vigilance.

The number of Unknown Railway fatalities reported are 54 and 66 in the I&II years. The number of Unknown Railway cases constituted about 8.26% of the total Unknown cases in the I year of Study and 8.73% in the II year of the Study. There is an increase of 0.47% in Railway fatalities which are unknown.

**Table No: 1: Distribution Of Unknown Railway Fatalities**

	Railway Fatalities	Unknown cases	%
<b>I Year of Study</b>	223	54	24.12
<b>II Year of Study</b>	257	66	25.52
<b>Total</b>	480	120	25

The number of Unknown Railway Fatalities in the study period was 120 cases which comes upto 25% of the total Railway Fatalities i.e. 480. Thereby showing that a greater portion of the Railway autopsies are unknown and should be dealt carefully.

**Table No. 2: Railway Fatalities According To Time Occurrence**

Time	Total	%
<b>6.00 am to 12 pm</b>	166	34.51
<b>12.00 pm to 6 pm</b>	98	20.35
<b>6 pm to 6 am</b>	216	45.14

In case of fatalities occurring between 6.00 pm to 6.00 am, most of the cases are reported to the police in the early hours of the next day, that is why a block period of 12 hours from 6.00 pm to 6.00am has been taken as a single unit.

Most of the cases reported as accidents during this time cannot be proved otherwise unless the Forensic Expert wants to, since there are no eyewitnesses. But it is in these cases that the relatives would come up with a suspicion.

**Table No. 3: Railway Fatalities According To The Circumstances**

	Circumstance	Total	%
1	While crossing the railway line	271	56.34
2	Hit from behind while walking in direction of the train on the tracks	101	20.63
3	Hit head-on while walking against the train on the tracks	58	11.90
4	Fall from a running train	20	03.96
5	Slipped from footsteps while getting into the train	20	03.96
6	Slipped from footsteps while getting down from the train	5	00.88
7	Miscellaneous	5	00.88
<b>Total</b>		<b>480</b>	

If a person is hit by a train while crossing the tracks, the injuries should obviously be seen on the side of the body. In those wanting to commit suicide the injuries are seen on the front because they face the train. But in those who are hit by the train from behind which makes up to 20.63% of the study group, it is very suspicious why they did not get away from the tracks unless it is proved that they are either deaf or intoxicated or mentally ill.

**Table No. 4: Railway Fatalities According To Place Of Death**

Place of death	Total	%
Spot death	425	88.52
<b>On the way to Hospital</b>	5	01.02
<b>In the Hospital</b>	35	07.34
<b>Place not known</b>	15	03.12

It is very alarming to see that most of the cases reported as spot dead, the inquest report does not mention any eye witnesses, which calls for a special consideration from the Forensic expert to differentiate a true Railway Fatality from a false one and also to give opinion on whether the injuries were ante-mortem or post-mortem.

**Table No. 5: Railway Fatalities According to Manner of Death**

Manner of Death	I year of Study		II year of Study	
	Cases	%	Cases	%
<b>Accident</b>	127	56.95	147	56.75
<b>Suicide</b>	95	42.60	108	42.48
<b>Homicide</b>	1	00.44	2	00.77

The above figures are based on the eye witnesses or Investigating Officer's opinion. It should be

noted that only 0.77 % of the cases are reported as Homicides, which is against human logic. It is very easy for an assailant to kill a person and throw him/her on the tracks and get it recorded as a Railway accident and go scot-free. Hitherto, increasing the burden on the Forensic Expert.

**Table No. 6: Position of the bodies in relation to the tracks**

	Whole body		Head or Upper part of the body	Trunk
	Between rail tracks	Outside rail tracks	Between rail tracks	Between rail tracks
Nature				
Suicides	76	21	58	41
Accidents	89	113	20	62

From the above figures it is seen that in accidents, most of the time the body was outside the tracks, where the kith and kin of the deceased would question that the person was killed and then put near the tracks<sup>[5]</sup>.

**Table No. 7: Distribution of pattern of injuries**

Injury	No. of cases	% out of 480 cases
<b>Fractures</b>		
1 Skull	230	48.1
2 Spine	249	51.95
3 Clavicle	221	46.10
4 Ribs	320	66.8
5 Sternum	321	66.95

Cont... Table No. 7: Distribution of pattern of injuries

6	Pelvis	49	10.00
7	Upper limbs	95	19.95
8	Lower limbs	57	11.95
<b>Visceral injuries</b>			
1	Brain	290	60.62
2	Spinal cord	297	61.95
3	Heart	53	11.06
4	Lungs	138	28.76
5	Diaphragm	45	09.3
6	Stomach	34	07.1
7	Intestines	55	11.50
8	Liver	131	27.43
9	Kidney	83	17.26
10	Urinary bladder	21	04.42
11	Testis	11	02.21
<b>Bleeding</b>			
1	Intracranial	295	61.50
2	Intrapleural	159	33.18
3	Intraperitoneal	176	36.72

It is observed that whether external or internal, it is the upper part of the body which is most of the time injured, and the same is true in cases of death due to violence. Moreover, in these cases it was very difficult to differentiate ante-mortem injuries from post-mortem injuries because – the injuries are stained with grease, oil, dust, tissues are crushed and lost, decomposition starts earlier in these bodies.

Table no. 8: Railway Fatalities according to cause of death

Cause of death	Total	%
Multiple injuries	203	42.32
Decapitation	48	09.92
Transection of trunk	78	16.25
Head injury	66	13.67
Crush injury head	34	07.01
Crush injury of limbs	15	03.15
Crush injury of chest/abdomen	9	01.89
Others (electrocution, fracture of single limb, etc)	27	05.79

All the above mentioned causes of death are very common in cases of Railway Fatalities but, to give an opinion about the ante-mortem or post-mortem nature of these injuries is very difficult.

### CONCLUSION

Problems related to railway fatalities may

call upon an entire gamut of Forensic Expertise. The Medico-Legal Expert is entrusted with the responsibility of assessing the injuries, the mechanism by which they were inflicted and also in deciding the Cause and Manner of death. To conclude about the predisposing causes, the expert has to take into consideration the inquest report and relevant data pertaining to the incidence. The toxicology opinion may be required sometimes. The statement of Engine Driver, and the onlookers, would help a lot.

It was noticed that most of the cases were brought for autopsy as Unknown cases; hence much importance has to be laid on establishing the identification<sup>[10]</sup>. In the present study 25% of railway related deaths, were reported as unknown. In many cases the standard Identification data mentioned in Essentials of Forensic Medicine and Toxicology were enough to fix the identity<sup>[2]</sup>. In known cases the bereaved remain puzzled for the rest of their life about whether the deceased really succumbed to an accident or a homicide.

Examination of the crime scene in railway fatalities often revealed blood staining on the track and spurting of blood, over metal and on the track. Thus the ante-mortem nature of railway injuries could be well established in the present study<sup>[8]</sup>. Soiling of clothes of the deceased was invariably observed with the black engine oil, lubricant grease in railway fatalities in the present study.

The pattern of injuries has always helped in giving the correct opinion. Multiple small irregular and bizarre patterns of injuries, involving large surface area of the skin, and also in specific cases uniform patterned abrasions, multiple in nature involving skin surface from the pressure against the metal on rail road is almost specific<sup>[6]</sup>. The margins of crush injuries found in run over fatalities, causing traumatic decapitation and bisection of the body revealed a wider zone corresponding with the width of the rail tracks and the wheels of the locomotive, which was found to be helpful in reconstructing the railway accident. Crush injuries due to run over railway fatalities involving the middle part of the trunk have shown a large skin flap formation which is observed in road accidents also<sup>[9] [12]</sup>. Therefore avulsion of skin is possible in railway fatalities also. Bisection of the body was seen more often with suicidal deaths as compared to accidental ones, as usual. The spinal column was separated along with

either fragmentation or missing of two to three vertebrae in the corresponding area only in Railway fatalities.

In Poly trauma of suicidal and accidental nature, the pattern and distribution of injuries are same. In such cases Primary impact injuries and Secondary injuries are more or less same<sup>[5][6]</sup>.

A tendency to mimicking homicidal deaths as a railway fatality is possible only when it is committed by a group of people<sup>[7][13]</sup>. In such deaths the pattern of injuries differ from Accidental Railway Fatalities i.e. blunt trauma to head, with postmortem decapitation, presence of stab injuries or postmortem mutilation. In these cases the injuries caused by railway impact or contact clearly show their postmortem nature. But the real difficulty arises in cases, where allegations are made, that the individual is first strangled or throttled, and later being mimicked as a decapitation case due to railway run over. It is difficult to establish trauma in the neck structures like contusions in the ribbon muscles, fracture of hyoid or thyroid cartilage commonly seen in strangulation cases, as they are grossly destroyed by a railway run over and difficult to recognize. So at the most, the medico-legal expert can opine that the body was subjected to postmortem decapitation, by a railway run over<sup>[11]</sup>.

Examination of the scene of offence is more important in this type of cases. Spurting of blood stains is absent and pooling of blood stain is minimal in these types of cases. More over the margins of the neck injuries will not show any evidence of vital reaction, in the form of contusions, blood clots, which in cases of doubt should be confirmed by histopathological examination. It can be summed up, hence that in cases of Railway fatalities while working as a Medico-Legal Expert<sup>[11]</sup>, the Forensic Expert should also do the job of an Investigating Officer and help The Judiciary in administering Justice!

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# Profile of Acute Paediatric Poisoning Cases Admitted in a Tertiary Care Centre in North India

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## ABSTRACT

The present study was carried out to determine the profile and outcome of acute paediatric poisoning presented in paediatrics emergency department of Jawaharlal Nehru Medical College, AMU, Aligarh. A retrospective study was carried out on 102 cases of acute poisoning among victims less than 18 years of age from period 1<sup>st</sup> July 2006 to 30<sup>th</sup> June 2007. Out of 102 cases, 39.2% cases were accidental, 56.9% cases were suicidal while 3.9% cases were homicidal. There were 59.8% males while 40.2% female. Among children less than 12 years of age, all were cases of accidental poisoning and among them 81.5% were in the age group of 1-6 years. Among age group 12-18 years, most common manner of poisoning was suicidal. The exact nature of consumed substances could not be assessed in 18.7% of our patients. 19.6% children died. We need to take preventive measures for intentional and accidental poisoning in children and adolescents. There is a need to spread awareness in our community about the emerging epidemic of childhood poisoning.

**Keywords:** Paediatric poisoning, Accidental poisoning, Suicide, Homicide.

## INTRODUCTION

Poisoning is a global phenomenon. According to World Health Organization (WHO), 1.8 lakh people died in 2010 due to various poisoning agents.<sup>1</sup> Childhood poisoning is one of the common medical emergencies encountered in emergency department all over the world.<sup>2</sup> Childhood poisoning may be unintentional. It can cause significant morbidity and mortality among children throughout the world.<sup>3</sup> Although in developing countries the documentation of paediatric poisoning is poor.<sup>4,5</sup>

There is paucity of studies in this part of the country that describes pediatric poisoning in detail. Keeping this in mind we did this study with the aim of determining the profile and outcome of children presenting with acute poisoning.

## MATERIAL & METHOD

This was a retrospective study of acute poisoning cases that was carried out by Department of Forensic Medicine through the emergency services section (Casualty section) of the hospital in collaboration with the Department of Paediatrics, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh.

**Inclusion criteria:** All children who reported to the casualty section of the hospital up to the age of 18 years with a definite history and suspected cases of acute poisoning were included.

**Exclusion criteria:** We excluded the cases of bites, food poisoning and chronic poisoning.

**Study period:** One year, from 1<sup>st</sup> July 2006 to 30<sup>th</sup> June 2007.

The details were obtained from medical records kept in Medical records section. The study tool was a predesigned proforma containing various details like age, sex, residence, manner of poisoning, time of poison ingestion and hospital outcome. The diagnosis of the type and nature of poison consumed were

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based on reliable clinical history and examination. The final outcome of the treatment of the patients whether expired, discharged or left against medical advice (L.A.M.A) was recorded.

#### **Data management and Statistical analysis:**

Data was entered in MS excel 2007 and analyzed by using Statistical Package of Social Sciences (SPSS) 12. Appropriate statistical tests were applied. Z test was used as parametric test. The Chi square test was applied. A *p* value of <0.05 was taken as statistically significant.

## **RESULTS**

Total of hundred and ten children in the age group of one year to eighteen years were enrolled in the study. Eight were excluded as the data was incomplete. Hundred and two children were included in final analysis. Out of these 40 (39.2%) cases were accidental, 58 (56.9%) cases were suicidal while 4 (3.9%) cases were homicidal. There were 61 (59.8%) males while 41 (40.2%) female giving a male-to-female sex ratio of 1.5:1 ( $Z=2$ ;  $p= 0.0475$ ). So, males are significantly affected more than females. The mean age of boys was 12.2 years ( $SD=6.8$  years) while the mean age of girls was 14.9 years ( $SD=4.9$  years). So, the average age of poisoning cases was significantly more among females than males ( $Z= -2.3293$ ;  $p= 0.0198$ ). The age group which was affected most was 12-18 years (71.6%, 73/102). 21.6% of victims were of the age group 1-6 years. Among 27 children less than 12 years of age, all were cases of accidental poisoning and majority (81.5%, 22/27) were in the age group of 1-6 years. Among age group 12-18 years, most common mode of poisoning was suicidal (79.5%, 58/73). Homicidal cases were seen only among this age group (**Table 1**).

Out of 102 cases of acute poisoning, 43 (42.16%) cases were of insecticide and pesticides. Organophosphates (19.6%), Aluminium phosphide (11.8%), acids and alkalis (11.8%) and drugs/pharmaceutical agents (13.7%) were the agents most frequently implicated in our patients. The exact nature of consumed substances could not be assessed in 19 (18.7%) of our patients. The drugs that were ingested included: clonazepam, diazepam, alprazolam, phenobarbitone and dicyclomine (**Table 2**).

Present study observed predominance of poisoning in urban children as compared to rural

children (52% vs 48%). Although organophosphorous poisoning was more among rural children (85%), other poisoning like Aluminium Phosphide (58.3%), Zinc Phosphide (72.7%) and drugs ingestion (71.4%) was more among urban children. This may be attributed to higher availability of these agents in urban areas (**Table 3**).

Majority of cases came in September (15.7%). Maximum victims consumed poison in noon from 12 pm to 6pm (**Figure 1 and 2**)

Total of 20 victims expired out of 102 cases giving a mortality rate of 19.6% due to acute childhood poisoning. Among these, maximum (50%; 10/20) died due to aluminium phosphide poisoning, 3 (15%) due to organophosphates, 2 (10%) due to zinc phosphide and 4 (20%) due to unknown agent. A patient of 17 years of age who consumed 25 tablets of diazepam also died (**Figure 3**)

## **DISCUSSION**

In our study, 40 (39.2%) cases were accidental, 58 (56.9%) cases were suicidal while 4 (3.9%) cases were homicidal. Males are significantly affected more than females giving a male-to-female sex ratio of 1.5:1 and it is comparable with most of the other studies. It may be because boys are more active, curious, explorative and adventurous by nature and have more freedom in a patriarchal society like in India.<sup>6-9</sup>

Ram *et al* found in their study that the cause of acute pediatric poisoning varies in different age groups.<sup>10</sup> Nearly 1/5<sup>th</sup> of victims were of the age group 1-6 years. Similar findings were seen in other studies.<sup>11</sup>

Among children less than 12 years of age, all were cases of accidental poisoning while among age group 12-18 years, most common mode of poisoning was suicidal. It was also seen in other studies.<sup>12,13</sup>

Deliberate self harm is not uncommon in adolescent age group as seen in our study and observed in other studies too. It may be due to frustration, inadequacy to cope with some stressful situations, impulsive behaviour, and school stress, conflicts with oneself and with parents, all leading to emotional insecurity.<sup>14,15</sup>

In our study, the most common form of poisoning was by organophosphates (19.6%). Other studies have also seen the dominance of Organ phosphorus

poisoning among acute poisoning cases.<sup>16</sup>

Drugs or pharmaceutical agents accounted for 13.7% of all causes of poisoning. A similar result was seen from a study in South India.<sup>17</sup> There was a predominance of poisoning in urban children as compared to rural children. Other studies have also shown similar findings.<sup>18,19</sup>

The mortality rate in our study was 19.6%, whereas the mortality rate ranged from 1% to 16% in various study. The reason for a little higher mortality may be attributed to the fact that only serious cases might have been referred to our facility from various centres as our hospital is the only tertiary care centre

in this region.<sup>20-24</sup>

Another reason is high incidence of Aluminium Phosphide poisoning as there is no specific antidote available for it. Aluminum phosphide (trade name: Celphos) poisoning has emerged as one of the leading causes of poisoning among children, with a mortality up to 100%.<sup>25</sup>

**Limitation of the study:** This was a single centre retrospective study in a tertiary care centre in North India. So, we cannot generalise the results for all the places in India. Many cases would not have come to our centre and might have gone to peripheral centres.

**Table 1: Distribution of children (victims) according to age and nature/ manner of poisoning**

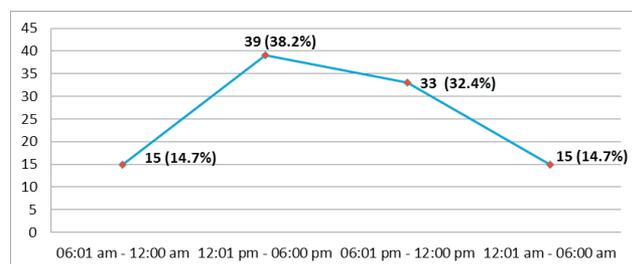
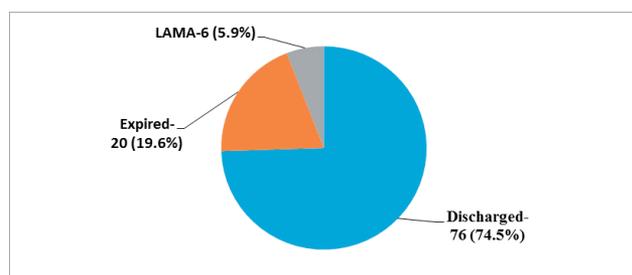
Age Group	Accidental		Suicidal		Homicidal		Total		Total (M+F)
	M	F	M	F	M	F	M	F	
1-6 years	17	5	0	0	0	0	17	5	22 (21.6)
6-12 years	6	1	0	0	0	0	6	1	7 (6.9)
12-18 years	7	4	27	31	4	0	38	35	73 (71.6)
Total	30	10	27	31	4	0	61 (59.8)	41 (40.2)	102 (100.0)
Total (M+F)	40 (39.2)		58 (56.9)		4 (3.9)		102 (100.0)		
$\chi^2 = 10.768; p = 0.005$									
M: Males; F: Females; Figures in parenthesis are in percentages									

**Table 2: Major toxic agents involved according to nature/ manner of poisoning**

Toxic agents	Accidental	Suicidal	Homicidal	Total (% of Total)
Organophosphates	6 (30.0)	14 (70.0)	0 (0.0)	20 (19.6)
Aluminium Phosphide	1 (8.3)	11 (91.7)	0 (0.0)	12 (11.8)
Zinc Phosphide	2 (18.2)	9 (81.8)	0 (0.0)	11 (10.8)
Drugs	4 (28.6)	10 (71.4)	0 (0.0)	14 (13.7)
Acids & Alkalis	8 (66.7)	3 (25.0)	1 (8.3)	12 (11.8)
Kerosene	6 (100.0)	0 (0.0)	0 (0.0)	6 (5.9)
Bhang	0 (0.0)	0 (0.0)	1 (100.0)	1 (0.9)
Naphthalene Balls	0 (0.0)	1 (100.0)	0 (0.0)	1 (1.0)
Spirit	2 (100.0)	0 (0.0)	0 (0.0)	2 (2.0)
Datura Seeds	0 (0.0)	1 (100.0)	0 (0.0)	1 (0.9)
Hydrogen Peroxide	1 (100.0)	0 (0.0)	0 (0.0)	1 (0.9)
Petrol	1 (50.0)	1 (50.0)	0 (0.0)	2 (2.0)
Unknown	9 (47.4)	8 (42.1)	2 (10.5)	19 (18.7)
Total	40 (39.2)	58 (56.9)	4 (3.9)	102 (100.0)
$\chi^2 = 60.451; p = 0.000$				

**Table 3: Distribution of poisoning agents among cases according to residence and outcome**

Toxic agents	Residence		Outcome	
	Rural (%)	Urban (%)	Discharged	Expired
Organophosphates	17 (85.0)	3 (15.0)	15 (83.3)	3 (16.7)
Aluminium Phosphide	5 (41.7)	7 (58.3)	2 (16.7)	10 (83.3)
Zinc Phosphide	3 (27.3)	8 (72.7)	9 (81.8)	2 (18.2)
Drugs	4 (28.6)	10 (71.4)	12 (92.3)	1 (7.7)
Acids & Alkalis	3 (25.0)	9 (75.0)	12 (100.0)	0 (0.0)
Kerosene	4 (66.7)	2 (33.3)	6 (100.0)	0 (0.0)
Bhang	0 (0.0)	1 (100.0)	1 (100.0)	0 (0.0)
Naphthalene Balls	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)
Spirit	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)
Dhatura Seeds	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)
Hydrogen Peroxide	0 (0.0)	1 (100.0)	1 (100.0)	0 (0.0)
Petrol	1 (50.0)	1 (50.0)	1 (100.0)	0 (0.0)
Unknown	8 (42.1)	11 (57.9)	13 (76.5)	4 (23.5)
<b>Total</b>	<b>49 (48.0)</b>	<b>53 (52.0)</b>	<b>76</b>	<b>20</b>
$\chi^2 = 24.999; p = 0.015$			$\chi^2 = 36.672; p = 0.000$	
<b>NB: Six LAMA cases were extended from outcome for better comparison</b>				

**Fig. 1. Month-wise Distribution of poisoning cases (percentages only)****Fig. 2. Distribution of cases according to time of ingestion of poison****Fig. 3. Outcome of cases**

## CONCLUSION

Incidence of acute poisoning in children still poses a significant challenge for doctors despite so much advancement in treatment modalities currently available. Accidental poisoning is much common in children less than 12 years of age. Suicidal mode of poisoning is still prevalent among adolescents. The reason for high incidence of insecticide consumption in our study may be attributed to its easy availability in rural households. It also shows the lack of safety measures adopted by parents in handling these hazardous substances.

## RECOMMENDATIONS

Multicentric studies should be conducted to find out the loopholes in management of these cases. Conditions such as free availability of these toxic compounds have to be addressed. Strict law enforcement for drugs should be adopted so that nobody can buy drugs without prescription by a qualified doctor. The awareness and education about different aspects of poisoning have to be converted into action for better results. Proper counselling is the need of the hour for adolescents as they are having high tendency for suicidal poisoning. Small children are very inquisitive and they explore everything and put them in mouth. So, all medicine or poisons should be put in cupboard lock up. Accidental poisoning

among younger children can be reduced by simple measures like parental education, replacing the poisoning agents with one of lower toxicity and legislation related to child resistant packaging of poisons. Poison information centres should be established in every district to generate awareness among people and monitor the situation of poisoning among all age groups in general and among children in particular.

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