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Middle Finger Length is a Good Measure to Predict the Human Stature–An Experience from a Cross-Sectional Study at a Rural Community in India

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ABSTRACT

Human populations vary in physical characteristics so it is obvious that their bones should also exhibit a variety of discernable differences. The need to establish the identity of dismembered or otherwise unidentified human remains arise in cases of mass disasters like explosions, bomb blasts, mass murders, transportation accidents and natural calamities which is known as Disaster Victim Identification (DVI). The study consists of two objectives. First one is estimation of the stature from the length of middle finger among the study subjects and second one is correlation of the stature from the length of middle finger among the study subjects. This study is an observational study following cross sectional design conducted in a rural community among 500 participants. The study revealed that middle finger length (MFL) is a better predictor for stature determination among males (R^2 =45.2%) than females (R^2 =9.2%). By using regression analysis, formula generated to predict the stature by using MFL and that can be used among males and females. There are obvious variations in the level of development for adults. Since this study was done only in one region of Karnataka, India, the result cannot be generalized to whole population of India.

Keywords: *Forensic anthropology, Stature, Middle finger length, Adolescents age group*

INTRODUCTION

In 1894 Dwight suggested that as human populations vary in physical characteristics so it is obvious that their bones should also exhibit a variety of discernable differences. Those ideas and findings of Dwight shaped the foundation and development of a new field in forensic science termed forensic anthropology hence Thomas Dwight is known as father of anthropology[1]. Human stature estimation is one of the important aspects of forensic anthropological investigation. Stature is defined as maximum height attained during one's lifespan. Anthropometry is a science which deals with methods and techniques of measurement of living as well as skeletons of individuals[2]. Forensic Anthropology is concerned with the building of ante mortem histories of individuals from skeletonised remains[3]. It is therefore useful in a medico legal context in suspected cases of infanticide, homicide and suicide. The main focus to process crime scenes and developing a biological profile[4] like age, sex, stature; which is one of the important and widely use factor to identify unknown or missing individuals. The need to establish the identity of dismembered or otherwise unidentified human remains may also arise in cases of mass disasters like explosions, bomb blasts, mass murders, transportation accidents and natural calamities which are known as Disaster Victim Identification (DVI). Disaster Victim Identification is defined as the procedures which are used to positively identify deceased victims of a multiple casualty event[5]. Stature estimation was started in late 20th century[6]. There are two main types of method available for adult stature estimation ''anatomical'' and ''mathematical'' method. Anatomical method was initially introduced by Dwight in 1894 which involves

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articulating the entire skeleton on a measuring board, correcting for the curvature of the spine and adding a correction factor for soft tissue and skin thus estimating the stature[7]. In 1956 Fully[8] reintroduced anatomical method with mild variation and named as Fully's procedure. The main disadvantage of anatomical method of stature estimation is that nearly a complete skeleton is needed. The mathematical method uses regression formulae (or ratios) based on the correlation of individual skeletal elements to living stature[7]. Karl Pearson[9] in 1899 made successful attempt to develop the first formal stature regression formulae to estimate stature from long bone measurements. Mathematical methods are also often preferred due to their simplicity and quickness, requiring the measurement of a single bone or if a combination of measurements is used, usually only up to two or three. This means that they can be used with incomplete remains, a very important consideration when dealing with forensic cases. Linear regression formulae have been shown to be highly accurate, but only when the specimen closely matches the sample population in ancestry and sex or perhaps in proportions.

Keeping this background in mind, the present study was undertaken with the following objectives:

1. To estimate the stature from the length of middle finger among the study subjects.
2. To correlate the stature from the length of middle finger among the study subjects.

MATERIALS AND METHOD

It was a community based observational descriptive study with cross-sectional design. A cross-sectional study was conducted in Harekela village with the approval of Institutional Ethical Committee during the period of May 2014 to October 2014 among 500 adults constituting 249 males and 251 females falling in the age group of 22 years to 40 years. To calculate the sample size, correlation coefficient value (r value) was selected which was least among all the previous studies. The correlation coefficient value found was 0.546 [26] at 5% of level of significance with power of study as 90%. Considering the r value as 0.546, sample size was found to be 152. To increase the impact of the study correlation coefficient value was anticipated as 0.3 at 5% of level of significance at 80% of power. The sample size was found to be 438 but for the feasibility to conduct the study round figure of 500 sample size was taken where 249 were males and 251 were females.

The sample size of the present study was calculating using the following formulae

$$n = \frac{1\left[Z_\alpha + Z_\beta\right]^2}{C^2} + 3$$

Where

Z_α = 1.96 at 5% level of significance

Z_β = 0.8416 at 80 % power

$$C = 0.5 \ln\left(\frac{1+r}{1-r}\right)$$

r = 0.30

Required sample size = 438

Sample size taken by investigator = 500

All the right handed[56] males and females in the age group of 22 to 40 years were included in the study; systematic random sampling method was adopted to select the participants for the study. Individuals having congenital defects on right upper limb, congenital defects on right lower limb, pregnant woman, previous history of fracture in upper limb or lower limb Or any bony malformation due to rickets, osteomalacia was excluded from the study. The procedure and purpose of the study was thoroughly informed and explained to the study population. Information sheet was given to the study group where detailed information regarding the importance of study was mentioned and a written informed consent was taken from all study subjects. Measurements of female participants were taken in presence of female colleague.

To conduct the study following instruments are used–

1. Stadiometer which was used to measure height and
2. Digital sliding calliper was used to measure middle finger length.

Stature was measured accurately using stadiometer where participants were made to stand in erect posture on the board of standard stadiometer platform by keeping the foot in close contact without any footwear and arms hanging by the side, the trunk braced along the vertical board and eyes looking straight ahead and face adjusted in Frankfurt plane. The measurement was taken as maximum distance from floor to vertex of the head by bringing the

horizontal sliding bar to vertex[57]. Middle finger length was measured using digital caliper where participants were instructed to extend their hand and keep it on flat surface, then middle finger length was measured as the distance between midpoints of the proximal crease of middle finger to the tip of the finger[31].

RESULTS

Study was conducted at the aforementioned village and out of 500 participants 49.8% were males and 50.2% were females (Fig 1). Among male study subjects the mean (SD) value of middle finger length (MFL) was found to be 7.99 ± 5.96 cm. Among female study subjects the mean value of MFL was found to be 7.06 ± 0.56 cm. The mean (SD) value of stature among males was found to be 162.51 ± 7.56 cm and among females 153.59 ± 5.21 cm (Table 2 & 3). Correlation statistics was calculated and significant correlation was found between MFL and stature among all study participants (R=0.562, p<0.01). Gender wise correlation statistics was calculated between MFL and stature of males and females. Significant correlation was found in males (R=0.673, p<0.01) as well as females (R=0.303, p<0.01) (Table 3). Square of Karl Pearson correlation coefficient (R value) was calculated and it is clear that in case of males the value is 45.2% and for females value is 9.2% that denotes MFL as a predictor for stature is more reliable in males. R square value for the whole population was found to be 31.6% which reliably predicted overall MFL for stature of all study subjects. By using regression analysis, formula generated to predict the stature by using MFL is as follows-

In case of males, Stature (S1) = 65.764 + 12.963 x MFL

In case of females, Stature (S2) = 134.03 + 2.769 x MFL

In case of whole population, Stature (S) = 97.244 + 8.371 x MFL

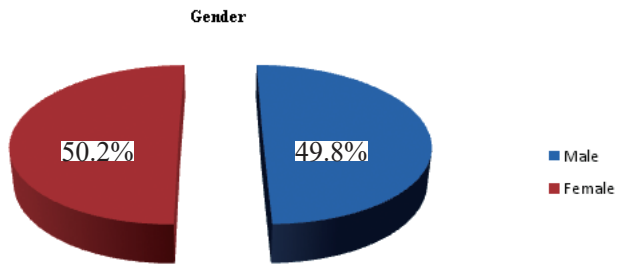

Figure 1: Distribution of study population according to gender

Table 1: Gender wise distribution of study population according to Middle Finger Length (MFL).

Gender	Variables	Mean	SD
Male (n=249)	MFL	7.99	5.97
Female(n=251)	MFL	7.06	0.56
Total (n=500)	MFL	7.52	4.25

Table 2: Gender wise distribution of study population according to stature

Gender	Variables	Mean	SD
Male (n=249)	Stature	162.51	7.56
Female(n=251)	Stature	153.59	5.21
Total (n=500)	Stature	158.03	7.87

Table 3: Gender wise correlation of stature with Middle Finger Length (MFL).

Gender	Variables	Pearson Correlation (R)	P value
Male	MFL	0.673	p < 0.01
Female	MFL	0.303	P < 0.01

Table 4: Distribution of study subjects according to coefficient of determination for gender and Middle Finger Length (MFL).

Gender	R (Predictors), (MFL constant)	R square	Adjusted R square	ANOVA P value
Female	0.303	0.092	0.088	P<0.01
Male	0.673	0.452	0.450	P<0.01
Total	0.562	0.316	0.315	P<0.01

DISCUSSION

Present study was conducted among 500 individuals among rural Mangalore population with mean age of 31± 5 years, out of those 249 were males and 251 were females with mean age of 31±5 years and 32±6 years respectively. In the study done by Bardale R.V et al [26] the mean age of male population was 21.52 years and the mean age of female population was 20.08 years. While in the study conducted by Krishan K et al [28] to estimate the stature from index and ring finger length subjects were in the age group of 14 to 18 years. We found that in our study mean stature among 500 individual was found

to be 158.03 ± 7.87 cm. Statistically significant stature difference between males and females was found in our study, mean stature among males was found to be 162.51 ± 7.56 cm and in females it was found to be 153.59 ± 5.21 cm. But in the study conducted by shivakumar AH [32] in South India and Chikhalkar BG [44] in Mumbai mean stature was found quite high in their studies as compared to the present study which was 167 ± 0.10 cm and 167.26 ± 8.494 cm respectively. Study conducted by Bardale RV et al [26] found that the mean height of men was 171.6 cm and mean height of women was 157.3 cm his study. The stature ranged from 137.2 cm to 178.5 cm in males and from 139.9 cm to 166.4 cm in females in the study done by Krishan K et al [28]. Rahule AS et al [30] observed that the mean stature of males was 169.97 cm with standard deviation of 5.71, in females observed mean stature was 154.20 cm with a standard deviation of 7.15. The mean middle finger length in our study was found to be 7.26 ± 0.53 cm. Similar results was seen in the study conducted by Rastogi P et al [31] in Manipal, South India which is very much similar to our study area and he found that mean middle finger length among male was 7.99 ± 0.52 cm and among females it was 7.31 ± 0.43 cm. Rahule AS et al [30] found that mean middle finger length among male was 7.92 ± 0.42 cm and among female was 7.30 ± 0.32 cm. By using regression analysis (Table 6), following formula generated to predict the stature by using middle finger length (MFL). In case of males, Stature= 65.764 + 12.963 x MFL. It shows that per unit increase in MFL there is 12.963 cm increase in stature of males. In case of females, Stature= 134.03 + 2.769 x MFL. It shows that per unit increase in MFL there is 2.769 increases in stature of females. In case of whole population, Stature= 97.244 + 8.371 x MFL. Suseelamma. D et al[29] found the formula of stature estimation for males, 65.764 + 12.963 x MFL; and for females, 134.03 + 2.769 x MFL. Rahule AS et al[30] found the formula of stature estimation for males 120.74 + 0.457 x MFL and for females 93.56 + 0.636 x MFL.

CONCLUSION

The variable used in the study (middle finger length) showed higher and better correlation coefficient values among males as compare to females. The following formula was arrived at to predict the stature using MFL. In case of males, Stature= 65.764 + 12.963 x MFL. In case of females, Stature= 134.03 + 2.769 x MFL. In case of whole population, Stature= 97.244 + 8.371 x MFL. There are wide-ranging differences in human growth. These differences are not only present in ethnic groups but also in regions. India is a vast country and has a very large population. There are obvious variations in the level of development for adults. Since this study was done only in one region of Karnataka, the result cannot be generalized to whole population of India.

Conflict of Interest: Nil

Source of Funding: Self

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Histopathological Differentiation of Abrasion, Electrocution and Flame Burns

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ABSTRACT

Examination of injuries is one of the important aspects of forensic experts at the time of medicolegal autopsy. Abrasion, electrocution and flame burns may appear similar on gross examination at the time of autopsy. The aim of the present study was to differentiate these three types of lesions on the basis of histopathological examination. 20 specimens of skin tissue from all three types of lesions was collected, processed and examined under light microscopy for six histopathological findings. Result showed significant relation between histopathological findings and type of lesion.

Keywords: *Abrasion, Electrocution, Flame burns, Intraepidermal separation, Subepidermal separation, Nuclear elongation.*

INTRODUCTION

In the practice of Forensic Pathology, while conducting an autopsy in cases of deaths due to alleged electrocution, lesions on the skin may resemble those caused by abrasions produced by blunt force impact and flame burns. In some cases the gross appearance may be similar and in such cases a thorough gross and histopathological examination helps in differentiating the three conditions.

Abrasion: Abrasion is a mechanical injury to skin in which there is removal of superficial layers of skin (epidermis) by friction against a rough force or destruction of the superficial layers by compression. Antemortem abrasions have reddish to brown appearance and heal without scarring. Any contact that rubs across the epidermis and removes the keratinized layer leads to discolouration and moistening of underlying cells by exuded tissue fluid even in absence of bleeding. If death ensues soon after injury, abrasion becomes stiff, leathery and of a parchment like brown color as a result of drying of the moist exposed surface, typically seen in the ligature hanging mark and grazed abrasions[1].

Electrocution: The development of an electric lesion (Electrical/Joule burns) is dependent on many electro-physical factors, in particular the current density under the point of contact and part of the body affected. A characteristic feature of electric mark is an areola of blanched skin at the periphery with a hyperemic border outside it. Though reddening may also be inside the pale zone, as the outermost rim of heated burn area. In low-voltage, features of electrocution may occur at the point of entry or exit. If the current enters over a broad surface area that offers minimal resistance, there may be no electrical burn. Usually electrical burns tend to be on the palms of the hands and tips of the fingers (entry sites) and soles of the feet (exit sites). In low voltage electrocutions, they may appear as either an erythematous area of blistering or as an irregular chalky white lesion,

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often with raised borders and a central crater. There may be some yellowish or black discoloration of the burn sites caused by heat.

Flame burns: When external heat is applied, the temperature/time relationship is important. In flame burns there is actual contact of body and flame with scorching of the skin progressing to charring. However, electrical burns and flame burns have similar morphological features leading to confusion in differentiation of these lesions. Gross appearance of burns may range from mere reddening over wide areas to almost total cremation. In absence of leathery coagulation or charring, flame burns appear reddened and blistered. The latter have a marginal red zone of variable width (5 -20 mm). Most antemortem blisters will have a bright red base and erythematous areola when burst[1,2]. The whole of the burned area may form one large blister or may be a colony of blisters which are usually collapsed at autopsy, so that sheets and shreds of white epidermis lie across angry red base. Where the burns are more severe, the skin may be stiffened, yellow- brown and leathery. Hair is singed or completely burnt in severe burns and in lesser degrees it may survive and the ends of hair may be clubbed (keratin melts at the distal end and resolidifies on cooling).

MATERIALS AND METHOD

The samples were collected from 60 cases came for medico-legal postmortem examination to the Department of Forensic medicine, Maulana Azad Medical College, New Delhi based on the causes of the lesions as per history given in Inquest papers. Cases were assigned into three groups comprising 20 cases each of electrocution, flame burns and abrasions.

1 cm X 1 cm size specimens were taken from each lesion for Histopathological examination. All the specimens were fixed in freshly prepared 10% formaldehyde solution for a minimum period of 48 hours. The fixed tissue samples were processed in automated tissue processor machine (Histokinette, Leica) comprising of 12 separate stages completing cycle in about 18 hours.

- Tissue fixation done with 10% Formalin.
- Dehydration with ascending grades of alcohol for about 5 hours in 6-7 jars.
- Clearing by xylene for 3 hours in 2 jars.
- Paraffin impregnation for 6 hours in two thermostat fitted wax baths.
- Embedding of tissue in molten wax, blocks prepared using L (leuckhart's) moulds.
- Blocks are then trimmed followed by sectioning by rotatory microtome.

Slides were stained with Haematoxylin and Eosin stains and were examined under light microscope (Olympus Magnus MLX) under 10X and 40X magnifications.

Each type of lesion were studied and compared for following six Histopathological findings–

- Intraepidermal separation (Yes or No).
- Subepidermal (dermoepidermal) separation (Yes or No).
- Coagulation necrosis in the epidermis (Yes or No).
- Nuclear elongation in the epidermis (Spindle shaped nuclei in the epidermis arranged parallel to each other). They were evaluated as absent, mild to moderate and severe elongation corresponding to the following scores: 0, 1, and 2, respectively.
- Dark-staining epidermal nucleus was evaluated as absent, slight to moderate increase and considerable increase in the density of chromatin and corresponding scores were given 0. 1 and 2 respectively.
- Depth of homogenization in the dermis was evaluated as lack of homogenization, superficial homogenization, homogenization as far as the half depth of the dermis and widespread homogenization and corresponding scores were assigned as 0, 1, 2 and 3 respectively.

The findings were observed, tabulated and appropriate statistical analysis was done.

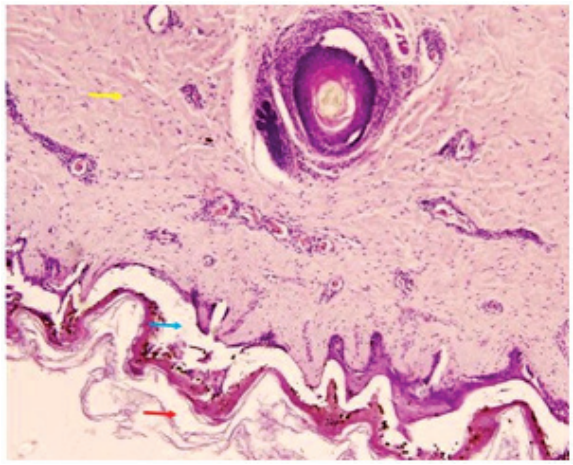
RESULTS

Maximum case with lesions of abrasion, flame burns and electrocution were seen in 21–30 years age group. Predominance of electrocution and abrasion was in males whereas burns were predominantly seen in females. Abrasions were commonly found on upper

limbs. In all cases of electrocution the lesions were found on the upper limbs. In cases of burns, head and neck was the common site of involvement.

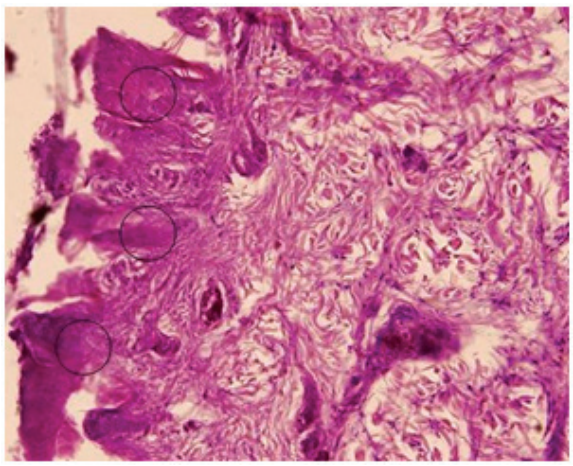
Histopathological examination:

1. Intraepidermal Separation (Photograph 1): was present in 18 cases of electrocution followed by 5 cases of flame burns and 1 case of abrasion.
2. Subepidermal separation (Photograph 1): was present in 19 cases of flame burns followed by 6 cases of electrocution and 4 cases of abrasions.
3. Coagulative necrosis (Photograph 2): was seen in 5 cases of electrocution followed by flame burn lesions in 3 cases, where as it was not seen in any case of abrasion.
4. Nuclear elongation in the epidermis (Photograph 3): Nuclear elongation was present in all type of lesions except 1 case of electrocution and 4 cases of abrasion. Mild to moderate nuclear elongation was present in 17 cases of burns followed by 12 cases of abrasion and 10 cases of electrocution. Severe nuclear elongation was mostly seen in electrocution (9 cases) followed by abrasions (4 cases) and least in flame burns in 3 cases.
5. Dark-staining epidermal nucleus (Photograph 3): was present in all type of lesions except for 1 case of electrocution. Mild to moderate dark staining of epidermal nucleus was seen maximally in electrocution (15 cases) followed by abrasion (9 cases) and flame burns (7 cases). Highest number of severe grade of dark staining of epidermal nucleus was seen in flame burns (13 cases) followed by abrasions (11 cases) and electrocution (4 cases).
6. Depth of homogenization in the dermis (Photograph 1): was present in all type of lesions except 4 cases of electrocution. Mild homogenization of dermis was maximally seen in electrocution (9 cases) followed by burns (5 cases) and abrasion (3 cases). Moderate homogenization of dermis was maximum in flame burns (11cases) followed by abrasion (8 cases) and electrocution (4 cases). Severe grade of homogenization of dermis was mostly found in abrasions (9 cases) followed by flame burns (4 cases) and electrocution (3 cases).



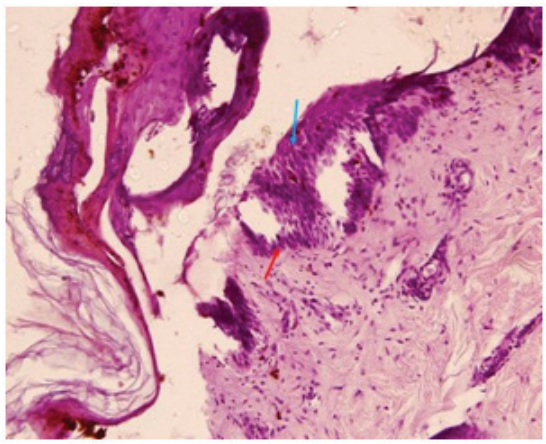
Photograph 1

- Intraepidermal separation as shown by Red Arrow
- Subepidermal separation as shown by Blue Arrow
- Homogenisation of dermis as shown by Yellow Arrow



Photograph 2

- Coagulative necrosis as shown in encircled area in the dermis



Photograph 3

- Nuclear elongation in epidermis as shown by Red Arrow
- Dark staining of epidermal nucleus as shown by Blue Arrow

Combination of histological findings:

- Intraepidermal Separation with Nuclear Elongation and Dark staining of Nucleus was seen in total of 23 cases out of which 17 were of electrocution followed by 5 burns and 1 abrasion. 32 of total lesions showed nuclear elongation without any intraepidermal separation.
- Intraepidermal Separation with Homogenisation of Dermis was seen in 21 cases out of which 15 were of electrocution followed by 5 burns and 1 abrasion.
- Subepidermal Separation with Nuclear Elongation was seen in 28 cases out of which 19 were of burns followed by 6 electrocutions and 3 abrasions.

Significance of the histological findings:

- **Electrocution:** Intraepidermal separation (p=0.000); Coagulative Necrosis (p=0.047); Nuclear Elongation (p=0.041) and Dark Staining of Epidermal Nucleus (p=0.010).
- **Flame burns:** Subepidermal separation (p=0.000).
- **Abrasion:** Homogenization of Dermis (p=0.014).

DISCUSSION

In the present study, all three types of lesions were seen mainly in the 21 – 30 years age group (33.3%). This being the peak age group involved in outdoor working making them prone to electric injuries, thermal injuries and road traffic accident. Male predominance was seen in abrasions (75%) and electric lesions (85%) over females which could be attributed to the outdoor working nature of males. Marginal preference was seen in flame burns to female sex (55%) as females are more exposed to hazards of fire while cooking, committing suicides or killed by their in-laws for the demands of dowry. These findings of our study in relation to age and sex group involvement were in consistent with studies by Gupta R.K.et al[3] from Kanpur and Singh D et al[4] from Chandigarh.

Histopathological findings: Separation in the epidermis, formation of microvesicles and separation of the epidermis from dermal papillae frequently occur in electrical lesions[5]. Depending on an increase in heat, tissue fluids may evaporate, which in turn causes separation of epidermal cells[1].

In our study, we found significantly higher rate of intraepidermal separation in electric lesions (90%) and subepidermal separation in flame burns (95%). Ibrahim Uzun et al[6], in their study found significantly higher rate of intraepidermal separation in electrical lesions (73.3%) and subepidermal separation in burns (90%). It can be explained by differences in adhesiveness between the cells[7]. In fact, electricity might have increased heat in tissues more than flames and abrasions and caused separation in the most resistant layer.

In this study, both intraepidermal and subepidermal separation was found mainly in electrical lesions in 30% cases, which was also consistent with study by Ibrahim Uzun et al[6]. This is due to more severe heat production as a result of electrocution.

In abrasions, we found subepidermal separation in 20% lesions and intraepidermal separation only in 1 case (5%). Ibrahim Uzun et al[6] reported 63.3% cases of subepidermal separation in abrasions and none of their abrasions showed intraepidermal separation. These findings were consistent with our study. Amount of heat produced in abrasion may not be sufficient to cause intraepidermal separation.

If the skin is exposed to extremely increased heat, coagulation necrosis involving the epidermis may occur[5]. In the present study, we found the rate of epidermal necrosis was relatively higher in the electrical lesions (25%), which is found to be slightly significant for electric lesions (p=0.047). This finding is consistent with Ibrahim Uzun et al[6], in their study it was found that the rate of epidermal necrosis was also significantly higher in electrical lesions. In fact, increase in heat caused by electricity might have been sufficient to cause necrosis in the epidermis.

It is known that changes such as nuclear elongation, pyknosis and palisading appear in electrical lesions[5]. The electromagnetic effect of electricity causes pyknotic and elongated nuclei which get arranged in the direction of electric currents[8, 9]. However, in addition to electric lesions, nuclear elongation can be seen in thermal burns, blunt traumatic skin injuries, cauterization, drying, and freezing, and around blisters due to barbiturate poisoning.

It was agreed that epidermal nuclear elongation was an indication of increased heat and that the dermis, which became oedematous due to heat, compressed the epidermis[8,10], which in turn flattened the nuclei.

In the present study, gradation of nuclear elongation was done and found that severity of elongation increases from thermal to electric burns. 45% of electric lesions were found to have severe degree of nuclear elongation (p=0.041). Ibrahim Uzun et al[6] in their study, found the degree of nuclear elongation to be significantly higher in electrocution. It can be explained by higher degrees of heat in the tissues in cases of electrical shock.

There have been studies which show that nuclei stain dark due to chromatin condensation in electrical and heat lesions[10-14]. In this study, epidermal cell nuclei stained dark in all cases except one electrical lesion. Increased heat might have lead to condensation of chromatin which appears as dark stained nuclei. However, significantly higher rates of dark-staining of nuclei in the flame burn group support this (p=0.010). We found all cases (100%) of flame burns and abrasions to possess dark staining of epidermal nucleus and 95% of electric lesions to possess dark staining of nucleus. In a study by Ibrahim Uzun et al[6], dark staining of epidermal nucleus was significantly higher for abrasion group which was consistent with the findings of our study.

In electrical injuries, swelling and denaturation of collagen fibrils in the dermis causes homogenization[9]. These changes may also occur in thermal burns. In our study, homogenization was present in all cases except four cases of electric lesion, though in varying degrees. The rate of homogenization was higher in the abrasion group, it was significant (p=0.014) and is consistent with Ibrahim Uzun et al[6]. Homogenization can also be considered a sign of increased heat.

CONCLUSION

- Intraepidermal separation alone or a combination of intraepidermal and subepidermal separation, severe degree of epidermal nuclear elongations and intraepidermal separation with dark staining of nuclei or epidermal nuclear elongation were consistent with electrocution.
- Subepidermal separation alone or in combination with epidermal nuclear elongation or dark staining of nucleus was consistent with flame burns.
- Dark staining of nuclei and homogenization in dermis with or without elongation of epidermal nuclei was consistent with abrasions.

Conflict of Interest: Nil.

Source of funding: Self.

Ethical Clearance: Taken from Institutional Ethical committee, Maulana Azad Medical College, New Delhi.

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External Findings in Deaths Due to Hanging at NSCB Medical College, Jabalpur, MP

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ABSTRACT

Introduction: In the year of 2012 Jabalpur has reported highest rate suicides of 45.1 among 53 mega cities across India. This study focuses on external findings in cases of deaths due to hanging so as to get a comprehensive profile of findings.

Material and Methods: The details about the victims with regard to the age, sex, and type of ligature material, details of ligature mark were obtained prospectively during postmortem examination.

Results: Single turn was observed in 94 (83.92%) cases. Out of 112 cases of hanging the mark was incompletely encircling the neck in 102 (91.07%), was obliquely placed in 104 (92.85%) cases, and placed above thyroid cartilage in 106 (94.64%) cases. Breadth of the ligature mark in maximum number of cases i.e. 56 (50%) cases, was between 1.1 to 2 cm. Commonly, the soft ligature materials were used by the victims.

Discussion: In this study, in most of the cases, the mark was incompletely encircling the neck (91.07%). Similar finding was observed in the study done by Sarangi[6] (97.87%). Collectively, soft ligature material was used most commonly [46 (41.07%) cases]. Similar findings were observed in study done by Naik and Patil[8] (soft material, 53.97%). Salivary stains over angle of mouth and anterior aspect of chest over cloths were observed in 33.92% cases. Our findings similar to those of study done by Shaikh et al[11] (38.37%).

Conclusion: Mostly the mark of hanging is oblique, incomplete and above thyroid cartilage. Soft cloth is more commonly used as ligature material by the victims of suicide. External injuries other than ligature mark are found in some cases and are not common. Salivary stains over angle of mouth and anterior part of chest petechial hemorrhages and cyanosis are not present in all cases, so these are not universal findings.

Keywords: *Hanging, ligature mark, ligature material*

INTRODUCTION

Death by hanging is one of the leading causes of death in persons committing suicides. In the year of 2012 Jabalpur has reported highest rate suicides of 45.1 among 53 mega cities across India. The pattern of suicide reported from 53 mega cities showed that hanging (59.6%) was the prominent means adopted by the suicide victims in the cities[1]. Many times Medical officers in periphery surrounding Jabalpur refer the case of hanging due to inability to correctly diagnose the hanging death. Usually these medical officers were unable to conclusively opine about, weather the case is that of hanging, or strangulation and ante mortem or postmortem. The difficulty gets accentuated when the external findings were obscure. This study focuses on external findings in cases of deaths due to hanging so as to get a comprehensive profile of findings to ease the process of making correct diagnosis of hanging or to rule the same out.

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MATERIAL AND METHOD

A total of 112 cases of deaths due to hanging reported for autopsy at NSCB Medical College mortuary, Jabalpur

MP, from 1 January 2016 to 31 December 2016, were considered for the study. The details about the victims with regard to the age, sex, and type of ligature material, details of ligature mark were obtained prospectively during postmortem examination. Findings were noted in a Performa after meticulous postmortem examination. The consent from relatives of each dead body was obtained prior to the examination. Ethical clearance was obtained from institutional ethical committee. The data thus obtained were analyzed for the study.

RESULTS

Age group-wise and sex-wise distributions of number of cases of deaths due to hanging are shown in Tables 1 and 2, respectively. Number of turn of ligature marks around neck is shown in Table 3. Single turn was observed in 94 (83.92%) cases. Out of 112 cases of hanging the mark was incompletely encircling the neck in 102 (91.07%), was obliquely placed in 104 (92.85%) cases, and placed above thyroid cartilage in 106 (94.64%) cases (Table 4). Breadth of the ligature mark in maximum number of cases i.e. 56 cases (50%), was between 1.1 to 2 cm. [Table 5]. Ligature material was found in 64 (58 cases in situ over the neck. Commonly the soft ligature materials like Lungi, Sari, Shawl, chunni, gamchha were used by the victims Table 6. Injuries other than ligature mark like abrasions, contusion, and lacerations were present in 12 (10.71%) cases, cyanosis is present in 42 (37.5%) cases, salivary stains were present in 38 (33.92%) cases, and petechial hemorrhages over external body surface were present in 24 (21.42%) cases.

Table 1: Age group wise distribution

11-20	21-30	31-40	41-50	51-60	61-70	91-100
20 (17.85%)	34 (30.35%)	22 (19.64%)	18 (16.07%)	6 (5.35%)	6 (5.35%)	2 (1.78%)

Table 2: Gender wise distribution

Male	Female	Total
74 (66.07%)	38 (33.93%)	112 (100%)

Table 3: Number of turns of ligature material

Number of turns	No. of cases
1	94 (83.92%)
2	16 (14.28%)
3	02 (1.78%)

Table 4: Peculiarity of ligature mark

Peculiarity of ligature mark	No. of cases
Complete	10 (8.92%)
Incomplete	102 (91.07%)
Oblique	104 (92.85%)
Horizontal	08 (7.14%)
Above Thyroid Cartilage	106 (94.64%)
Bellow Thyroid Cartilage	06 (5.35%)

Table 5: Width of ligature mark

Width of ligature mark (cm)	No. of Cases
upto -1	14 (12.50%)
1.1-2	56 (50%)
2.1-3	34 (30.35%)
3.1-4	04 (3.57%)
4.1-5	04 (3.57%)

Table 6: Ligature material

Ligature material	No of Cases
Lungi	06 (5.35%)
Sari	10 (8.92%)
Shawl	08 (7.14%)
Nylon rope	12 (10.71%)
Chunni	10 (8.92%)
Joot rope	06 (5.35%)
Gamchha	12 (10.71%)
Absent	48 (42.85%)

Table 7: Associated findings other than ligature mark

Finding→	Injuries other than ligature mark	Cyanosis	Salivary stains	PMS	Petechial hemorrhages
Present	12 (10.71%)	42 (37.5%)	38 (33.92%)	40 (37.71%)	24 (21.42%)
Absent	100 (79.29%)	70 (62.50%)	74 (66.07%)	72 (64.28%)	88 (78.57%)
Total	112 (100%)	112 (100%)	112 (100%)	112 (100%)	112 (100%)

DISCUSSION

In this study, majority of the cases were male subjects (66.07%) and majority (30.35%) were in the age group of 21- 30 years. Similar findings were also observed in the studies by Bhausaheb et al[2], Sharma et al[3] , and Jani and Gupta[4]. Our findings differ from the study done by, Elfawal and Awad[5] (Who observed 30–39 years as the most common age group). Greater fraction of population in India belongs to younger age group as compared to western countries, so is the difference between the two studies.

In our study, in most of the cases (83.92%), single turn of ligature mark was observed around the neck. Similar finding was noted in the study done by Bhausaheb et al[2] (95.04%), Sarangi[6] (96.03%).

In this study, in most of the cases, the mark was incompletely encircling the neck (91.07%). Similar finding was observed in the study done by Sarangi[6] (97.87%).

In our study, the ligature mark was obliquely placed over the neck in most of the cases (92.85%). Similar findings were observed in studies done by Sarnagi[6] (97.87%) and by Sharma et al[3] (98%).

In this study, the ligature mark was mostly (94.64%) high up in the neck above the thyroid cartilage in case of hanging. Similar findings were observed by the Sarangi[6] (97.87%), Sheikh and Agarwal[7] (77%), and Sharma et al[3] (85%).

In this study, the width of the ligature mark in most of the cases (30.35%) was between 2.1- 3cm. Jani and Gupta[4] in their study found different result, who observed maximum cases (39.10%) with width of ligature mark below 1 cm, which showed rope as the most common ligature material. In our study, long, soft cloth was the most common ligature material found, is the reason for greater width of the ligature mark.

In this study, the most common ligature material used was nylon rope, in 12 (10.71%) cases. Collectively, soft ligature material was used most commonly [46 (41.07%) cases]. Similar findings were observed in study done by Naik and Patil[8] (soft material, 53.97%) and Cooke et al[9] (nylon rope, 59%). Our findings differ from those of the study done by Sharma et al[3] (chunni, 30.90%). In this part of the country salwar kameez with chunni and sari, are the common soft cloths used as ligature material, also the shawl is common household cloth. The same is reflected as common ligature materials in our study.

In this study, the associated injuries were present in 10.12% cases. Our findings do not match with those of study done by Samarasekera and Cooke[10] (34.00%).

Salivary stains over angle of mouth and anterior aspect of chest over cloths were observed in 33.92% cases. Our findings similar to those of study done by Shaikh et al[11] (38.37%).

Cyanosis over tip of fingers and over nail beds were observed in 37.50% cases of hanging in our study, which differ from those of study done by Sarangi[6] (98.42%).

Petechial hemorrhages over external body parts were observed in 21.42% cases. Our findings differ from those of study done by Luke[12] (50%). Petechial hemorrhages are common but not a universal finding in cases of asphyxia deaths, and this may account for variable incidence of petechial hemorrhages in most of the studies.

CONCLUSION

Cases of hanging deaths are commonly reported at mortuary Medical College Jabalpur. Mostly the mark of hanging is oblique, incomplete and above thyroid cartilage. Width of ligature mark is between 2.1cm to 3cm as soft cloth is more commonly used as ligature material by the victims of suicide. External injuries other than ligature mark are found in some cases and are not common. Salivary stains over angle of mouth and anterior part of chest petechial hemorrhages and cyanosis are not present in all cases, so these are not universal findings.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Obtained from Institutional Ethical Committee

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Cephalic Index of Southern Kerala Population– An Autopsy Study

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ABSTRACT

Identification denotes determination or establishment of individuality of a person, living or dead. The present study is designed to help in identification of an individual by understanding the variations in cranial dimensions and to establish the cephalic index of the population. The study was conducted on 200 dead bodies (100 males and 100 females) of Southern Kerala region belonging to the districts of Thiruvananthapuram and Kollam. Using the collected data, cephalic index was calculated. The cephalic index of males ranged from 68.85 to 81.01, with mean value of 73.92, whereas in females it varied from 71.43 to 83.63 with mean value of 76.66. The difference in means was found to be statistically significant ($p < 0.001$). The predominant head type in males was dolicocephalic with 64% and in females it was mesocephalic with 79%. Overall mean cephalic index was 75.29

Keywords: *cephalic index, southern Kerala population, Forensic anthropology, race*

INTRODUCTION

Identification denotes determination or establishment of individuality of a person, living or dead. In Forensic Medicine perspective, the need for personal identification arises in mass disasters which can be natural ones like earthquakes, tsunamis, landslides, floods etc., or man-made such as terrorist attacks, bomb blasts, mass murders, and in cases when the body is highly decomposed or deliberately disfigured to conceal the identity of the individual[1,2]. Various data are used for the establishment of identity which include sex, age, race, complexion and features, stature and weight, hair, anthropometry etc. The aim of a Forensic anthropologist is to identify at least the most important parameters i.e. age, sex, race and stature which are also considered as the "Big Fours" so that some idea about the identity of the person can be established[3]. Along with providing social identity, race is an important variable in skeletal biological research. But with intermixing of different ethnic groups in modern population, the issue of identification of race from skeletal remains has become more challenging[4]. Despite its significance and potential practical utility, very little is known concerning the cephalic index for the population of Kerala, a southern state in India. Hence, this study is designed to establish the race of the individual from craniometric measurements by calculating the cephalic index.

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MATERIAL AND METHOD

A descriptive study was carried out in the department after obtaining institutional ethics committee approval. Cases brought for medico legal autopsy who were Natives of Kerala from Thiruvananthapuram and Kollam districts within the age group of 18 – 65 years during the study period constituted the study population. Sample size was 100 males and 100 females satisfying the inclusion criteria. Unknown and unclaimed bodies and cases with head injuries and obvious cranio-facial deformities were excluded. Personal data including place of birth and nativity of parents were recorded. A spreading caliper having an accuracy of 1mm was used to measure skull length and breadth. The maximum cranial

length was measured from Glabella to Opisthocranion and maximum cranial breadth was measured as the maximum width of skull perpendicular to midsagittal plane wherever it is located after reflecting the scalp. Data was entered in the proforma and was tabulated in Microsoft Excel 2010. Statistic variables were expressed in mean, standard deviation, minimum and maximum. Qualitative variables were described in frequency distribution. Correlations between quantitative variables were assessed by Pearson correlation. P value of 0.05 was taken as level of significance. IBM SPSS statistics version 22.0 software was used to analyze the data.

FINDINGS

Mean age of males was 43.39 and that of females was 37.68. Anthropometric measurements, cephalic index and percentage of types of skulls of males and females are described in tables 1, 2 and 3.

Table 1: Anthropometric measurements

	Measurement	Mean	Standard deviation	Median	Minimum	Maximum
Males	Skull breadth (cm)	13.35	0.5118	13.30	12.1	14.5
	Skull length (cm)	18.07	0.4972	18.10	17.1	19.6
Females	Skull breadth (cm)	13.32	0.5001	13.40	12.4	14.6
	Skull length (cm)	17.38	0.5607	17.40	15.8	18.6

Table 2: Cephalic index

Cephalic index	Mean	Std deviation	Min	Max	Median	Mean difference	t	P value
Male	73.92	2.34	68.85	81.01	76.51	-2.75	-8.6	0.00
Female	76.66	2.17	71.43	83.63	76.51			

Table 3: Skull types

Cephalic index	Male (%)	Female (%)
Dolicocephalic, (<74.9)	64	18
Mesocephalic, (75-79.9)	35	79
Brachycephalic, (80-84.9)	1	3

CONCLUSION

The present study is an attempt to bring forth a means to identify the racial characteristics of a person by determining the cephalic index of southern Kerala population. The complete lack of a similar study in the aforesaid population underlines the importance and relevance of the present study. The cephalic index of males ranged from 68.85 to 81.01, with a mean value of 73.92 and standard deviation of 2.34, whereas in females it varied from 71.43 to 83.63 with a mean value of 76.66 and standard deviation of 2.17. The predominant head type in males was dolicocephalic with 64% and in females it was mesocephalic with 79%. The difference in means is statistically significant (t - 8.6; p < 0.001). Overall mean cephalic index was 75.29 with standard deviation 2.64. The finding of a predominantly dolicocephalic type of skull in males is in agreement with researchers Mahesh Kumar et al among males of Bania caste of Haryana[5], Isurani Ilayperuma in Sri Lankan population[6] and Raveendranath V. and Manjunath K. V. among cadavers of South Indian origin in the Department of Anatomy at St. Johns Medical College, Bangalore, Karnataka[7]. Among females, mesocephalic skull type was predominant which is similar to findings of Anitha et al in subjects of North India[8]. These differences in observations among various populations across the world and in India underline the fact that each population group is unique and the sample of population from southern region of Kerala under study is different from these populations in terms of cephalic index and thus in racial characteristics. A comparison of cephalic indices of various populations are given in table: 4

There are lots of variations in cephalic index among people of different region and race. Hence there is a need to conduct more studies among people of different regions and ethnicity so that identification of race becomes more reliable and identity of an individual can easily be established.

Table 4: Comparison of cephalic indices of various populations

Authors	Population	Cephalic index (mean)	Standard deviation
Ilayperuma I, 2011[6]	Sri Lankan (Males)	78.04	6.53
	Sri Lankan (Females)	79.32	6.25
Shah & Jadhav 2004[8]	Gujarat population	80.81	
Anupama et l 2009[5]	Medical students of Punjab	85.53	
Jadhav et al 2011[5]	Gujarat population	80.20	
Anitha et al 2011[9]	North Indian population (Males)	79.14	4.72
	North Indian population (Females)	80.74	3.97
Yagain V. K. et al 2012[10]	Indian students (Male)	77.92	5.2
	Indian students (Female)	80.85	7.71
Mahesh kumar et al 2012[5]	Hariyanvi Baniya (Males)	66.72	7.642
	Hariyanvi Baniya (Females)	72.25	5.035
Sumita Agarwal et al 2013[11]	North India (Males)	79.15	4.06
	North India (Females)	81.66	3.39
Present study	South Kerala (Males)	73.92	2.34
	South Kerala (Females)	76.66	2.17
	Mean cephalic index	75.29	2.64

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Source of funding: Self

Ethical Clearance: Institutional Ethics Committee clearance obtained

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Estimation of Stature From Skull Dimensions of Southern Kerala Population−An Autopsy Study

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ABSTRACT

The present study is aimed to help in identification of an individual by understanding the variations in cranial dimensions and to propose population and gender specific regression equations for stature estimation using the linear dimensions of the cranium. The study was conducted on 200 dead bodies (100 males and 100 females) belonging to Southern Kerala region. Skull breadth, length and skull height were utilised for estimation of stature. All the parameters showed positive correlation with stature with skull height for males having the highest correlation coefficient. Linear regression equation for males and females were derived separately.

Keywords: *Estimation of stature, skull measurements, Southern Kerala population, Forensic Anthropology*

INTRODUCTION

Identification denotes establishment of individuality of a person which could be complete or partial. In Forensic practice, the requirement for personal identification becomes challenging in situations like mass disasters, mass murders, highly decomposed bodies or when body is deliberately disfigured to conceal the identity[1,2]. Various data help in establishing the identity of a person, which include age, sex, complexion, stature, anthropometry etc. Among these, a Forensic anthropologist aims to identify at least age, sex, race and stature so that a partial identification could be made. The cranium, which is the most durable and recognisable part of the human skeleton is the most likely element to survive post-mortem taphonomic changes and can help immensely in determining the above important parameters. This study is designed to propose population and gender specific regression equations for stature estimation using the linear dimensions of the crania of southern Kerala population.

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MATERIAL AND METHOD

A descriptive study was carried out in the department after getting institutional ethics committee approval. Cases brought for autopsy who were natives of Kerala from Thiruvananthapuram and Kollam districts within the age group of 18 – 65 years during the study period constituted the study population. Sample size was 100 males and 100 females satisfying the inclusion criteria. Unknown and unclaimed bodies and cases with head injuries and obvious cranio-facial deformities were excluded. Personal data including place of birth were recorded. A spreading caliper having an accuracy of 1mm was used to measure skull length and breadth. A specially designed Vernier calipers with long jaws having an accuracy of 0.01mm was used to measure skull height. The maximum cranial length was measured from glabella to opisthocranion and maximum skull breadth was measured as maximum width of skull perpendicular to mid-sagittal plane wherever it is located. Skull height was measured from gnathion to vertex. All measurements were taken after reflecting the scalp. Stature of the cadaver was measured from the cranial vertex to the base of heel using a standard measuring scale. Data was entered in the proforma and was tabulated in Microsoft Excel 2010. Statistic variables were expressed in mean, standard deviation, minimum and maximum. Qualitative variables were described in frequency

distribution. Correlations between quantitative variables were assessed by Pearson correlation. Linear regression and multiple linear regressions were used to predict dependent variables. P value of 0.05 was taken as level of significance. IBM SPSS Statistics version 22.0 was used to analyse the data.

FINDINGS

Mean age of males was 43.39 and that of females was 37.68. Anthropometric measurements are described in table 1.

Table 1: Anthropometric measurements

	Measurement	Mean	Standard deviation	Median	Minimum	Maximum
Males	Height (cm)	169.76	5.9707	169.90	153.0	182.1
	Skull breadth (cm)	13.35	0.5118	13.30	12.1	14.5
	Skull length (cm)	18.07	0.4972	18.10	17.1	19.6
	Skull height (cm)	21.03	0.7346	21.10	19.2	22.8
Females	Height (cm)	159.06	6.3974	159.40	143.8	170.5
	Skull breadth (cm)	13.32	0.5001	13.40	12.4	14.6
	Skull length (cm)	17.38	0.5607	17.40	15.8	18.6
	Skull height (cm)	19.69	0.7460	19.60	18.0	21.4

On bivariate analysis, it was found that stature has a strong positive correlation with skull height while skull breadth and length were having weak positive correlation in both males and females and is given in table: 2.

Table 2: Correlation between skull measurements and stature

		Skull breadth	Skull length	Skull height
Males	Pearson Correlation	0.236*	0.316**	0.792**
	p	0.018	0.001	0.000
Females	Pearson Correlation	0.370**	0.514**	0.755**
	p	0.000	0.000	0.000
	N	100	100	100

*correlation is significant at the 0.05 level (2-tailed)

**correlation is significant at the 0.01 level (2-tailed)

Linear regression equations were derived for males and females separately and is given in table 3.

Table 3: Linear regression equations for males and females

	Regression equation	R^2	Standard error of estimate
Males	Y = 6.434 * X1 + 34.452	0.627	3.666
	Y = 3.797 * X2 + 101.44	0.056	5.831
	Y = 2.576 * X3 + 132.962	0.100	5.693
	Y = 32.348 + 6.570 * X1 + 1.070 * X2 – 1.503 * X3	0.638	3.649
Females	Y = 6.476 * X1 + 31.550	0.570	4.215
	Y = 5.862 * X2 + 57.204	0.137	5.974
	Y = 4.729 * X3 + 96.073	0.264	5.516
	Y = 14.999 + 6.033 * X1 + 3.187 * X2 – 2.262 *X3	0.610	4.059

Where Y–stature, X1–skull height, X2–skull length, X3–skull breadth

Combination of variables when used to derive the regression equation resulted in more accurate equation with lower standard error of estimate compared to variables used individually.

CONCLUSION

The study is an attempt to predict the stature from skull dimensions of an individual belonging to southern Kerala population and thus to aid in establishing the identity. There is no similar study in the aforesaid population and this underlines the relevance of present study. Correlation coefficients calculated between stature and skull measurements showed a strong positive correlation with skull height. (r = 0.792 for males and r = 0.755 for females). Skull breadth and length showed a weakly positive correlation. It is in agreement with the findings of Sarangi and associates who measured maximum antero-posterior length, breadth and circumference of skull of autopsied Indian cadavers and found no significant correlation[3] and also with the observations of Introna et al who studied these relations among Italian population[4]. The study by Kanchan Kumar P. Wankhede et al on Central Indian population also revealed a similar result with low positive correlation between stature and skull dimensions[5]. Isurani Ilayperuma also observed a weak positive correlation between skull breadth and stature[6]. The findings of our study are not in agreement with Santhosh Kumar et al who concluded that there is a strong positive correlation between head length and stature in Rajasthani population with r = 0.941 for males and r = 0.85 for females[7].

On linear regression analysis, it was observed that the height of an individual belonging to the study population can be estimated from skull height with reasonable accuracy. When combination of parameters was used, the resultant equation was slightly more accurate. It was also found that other skull parameters like skull length and breadth cannot be used as a reliable means to estimate the stature.

Conflict of Interest: None to declare

Source of Funding: Self

Ethical Clearance: Institutional Ethics Committee clearance obtained

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A Case Report of Sudden Death Due to Rupture of Syphilitic Aneurysm of the Ascending Aorta

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ABSTRACT

Syphilitic aortic aneurysm is a rare occurrence in the antibiotic era, making the diagnose assumption even more infrequent. Though there is availability of modern diagnostic modalities, many of the cases remain unnoticed. Nonetheless, this pathology can appear and should be suspected in patients with aortic aneurysm. We report a case of a 40-year old patient who was brought dead with history of sudden death and, in the following autopsy examination; we noticed a rupture of large aneurysm of intrapericardial portion of ascending aorta leading to cardiac tamponade.

Keywords: *Syphilitic aortic aneurysm, Cardiac tamponade, vasa vasorum*

INTRODUCTION

Sudden death is the sudden or unexpected termination of life of an apparently healthy individual, usually from some natural disease. Sudden death invariably arouses suspicion in younger individuals and the purpose of medico-legal autopsy in sudden death cases is to determine whether violence or poisoning has been in any way responsible for the death[1]. It is a known fact that diseases of the cardiovascular system account for about 45- 50% of sudden deaths and one such condition is the rupture of the aortic aneurysm[1,2].

An aneurysm is a pathological dilatation of the lumen of a vessel. Degeneration of the medial layer of the aortic wall leads to weakening of the wall, resulting in progressive dilatation of the wall, leading to the formation of an aneurysm. Aneurysms which involve the ascending aorta, aortic arch and descending thoracic aorta are termed thoracic aortic aneurysms. The incidence of thoracic aortic aneurysms is estimated to be 5.9 cases per 100,000 person in a year[3]. The incidence of late manifestations of syphilis have declined almost to a rare entity since the era of antibiotics. Before the discovery of penicillin, tertiary syphilis infection was the most common cause of thoracic aortic aneurysm, resulting in 5–10% of cardiovascular deaths.[4]

The primary lesion of cardiovascular syphilis is aortitis, an inflammatory response to the invasion of the aortic wall by the Treponema pallidum that evolves to obliterative endarteritis of the vasa vasorum and results in necrosis of the elastic fibres and connective tissue in the aortic media. The resulting weakening of the aortic wall will progress into the late vascular manifestations of syphilis.[4] Syphilitic aortitis is reported in 70–80% of untreated cases after the primary infection. The ascending aorta is the segment most commonly affected (50%), followed by the arch (35%) and the descending aorta (15%).[4]

Cardiovascular syphilis is a late form of syphilis, which usually manifests in the 4th–5th decade of life, typically 5–40 years after the primary infection. It may become symptomatic with thoracic pain or symptoms of compression of the surrounding structures, but can enlarge asymptomatically until incidental finding in a chest X-ray or a catastrophic and often fatal aneurysmal rupture.[5]

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Case Report: A 40-year old man was found unconscious at 7.00 a.m. at washroom of his house and he was immediately taken to a nearby hospital; however, he was declared brought dead on arrival. As the patient was relatively alright, foul play was suspected. As the foul play was suspected and cause of death was not certified by the casualty medical officer,his body was brought to Dept of Forensic Medicine and Toxicology, VNGMC, Yavatmal for post-mortem examination.

Autopsy Examination: On external examination, except for healed chancre over glans of penis (Figure No 1), no significant external findings were observed on the body. On internal examination, massive haemopericardium (about 700ml. of blood and blood clots in pericardium) along with an external rupture of a saccular aneurysm of the ascending aorta, 10 mm (approx.) in diameter and 1.1 cm at the aortic root was observed. There was also presence of yellowish nodules over the intima of aorta (Figure No 2). All the coronaries were patent. Whole heart and diseased portion of aorta were sent for histopathological examination.

On histo-pathological examination there was presence of lymphoplasmacytic infiltrate around vasa vasorum in tunica media. (Figure No 3) There was also presence of Monckeberg's calcification and foci of necrosis seen. These findings were consistent with syphilitic aortitis. (Figure No 4)

After going through autopsy findings and histopathological report, the cause of death was given as Cardiac tamponade following rupture of syphilitic aortic aneurysm.

Figure 1: Showing healed chancre over glans of penis

Figure 2: Showing presence of yellowish nodules over the intima of aorta

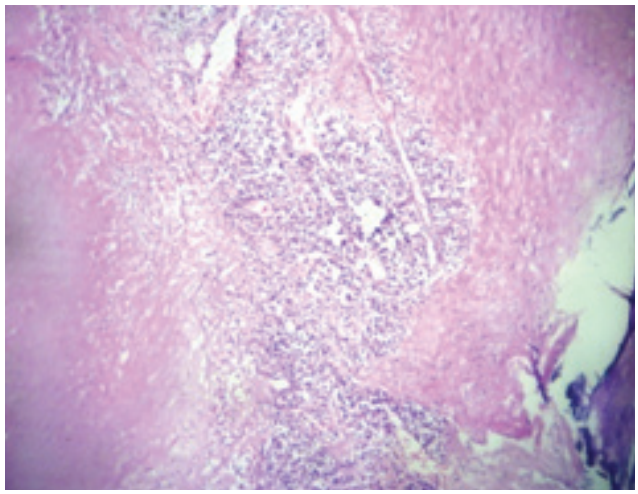

Figure 3: Showing presence of lymphoplasmacytic infiltrate around vasa vasorum in tunica media.

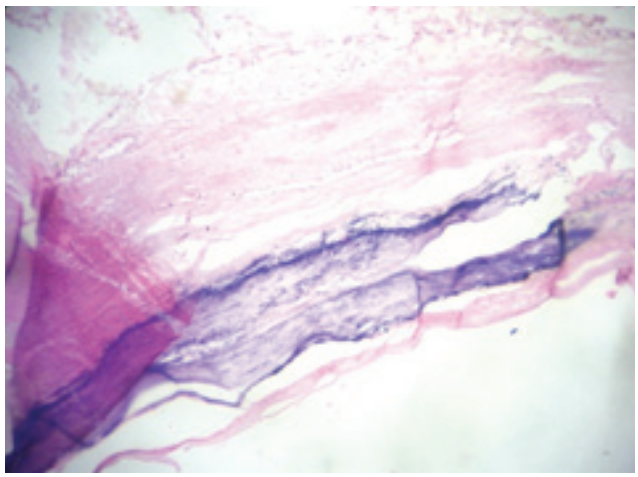

Figure 4: Showing presence of Monckeberg's calcification and foci of necrosis

DISCUSSION

Some of the causes of aortic aneurysms include atherosclerosis, syphilis, trauma, bacterial infection, arteritis, connective tissue disorders, neoplasm, etc.

Aneurysm of the aorta was the most common complication of syphilitic aortitis. The incidence of syphilitic aortitis has certainly declined over the past half century[6]. It has been estimated that cardiovascular syphilis is responsible for 10 to 15 per cent of all heart disease presenting after age 50[4]. These figures are subject to considerable variation depending on the social, economic, racial, and geographic characteristics of the population at risk. In our case patient was 40 years male and was relatively asymptomatic. There have been relatively few surveys of syphilitic heart disease reported in the literature over the past 10 years. Studies of large series of necropsies are worthwhile to detect trends in incidence, changing patterns of lesions, and the influence of therapeutic measures.

The incidence of cardiovascular syphilis has dropped dramatically from 6.93 per cent to 0.76 per cent; the average age at death has increased by almost a decade, and aortic aneurysm has displaced aortic insufficiency as the major complication of syphilitic aortitis.[4]

Presumably these changes reflect the introduction of penicillin therapy and vigorous public health education. The increased proportion of aneurysms is probably related to greater longevity, with the synergistic effect of superimposed atherosclerosis playing an important pathogenetic role, although the factor of hypertension might also have to be considered.

The definitive diagnosis of syphilitic cardioaortitis clinically is difficult to establish[7]. This is particularly true in persons over 50 years of age. The blood serologic tests may be negative or positive with a low titer. A history of a primary syphilitic infection helps in making the diagnosis. There are no specific or pathognomonic electrocardiographic changes in syphilitic heart disease[8]. The abnormalities of the electrocardiogram attributable to syphilis result from left ventricular hypertrophy following aortic insufficiency, or are a consequence of myocardial ischemia due to narrowing of the coronary ostia. These alterations are mimicked by other conditions causing enlargement of the left ventricle, and by atherosclerotic coronary artery disease. However, the chances of having an abnormal tracing in syphilitic heart disease are indeed high. Decreasing incidence, changing patterns of lesions, and reasons for the frequent failure to diagnose syphilitic heart disease are considered. Syphilis still remains a real threat, and, until it is eradicated, it will continue to cause clinical and subclinical cardiovascular disease.

CONCLUSION

As a incidence of syphilis is drastically declined, cause of sudden cardiac death due to rupture of syphilitic aortic aneurysm is very rare in developed country. But in developing country like India Syphilis still remains a real threat, and, until it is eradicated, it will continue to cause clinical and subclinical cardiovascular disease. So routine screening for syphilis is recommended.

Ethical Clearance: Not taken as it is review article.

Source of Funding: Self

Conflict of Interest: Nil

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Five-Year Retrospective Analysis of Profile of Firearm Deaths in Pune Region

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ABSTRACT

A firearm is any weapon which discharges a missile by the expansive force of the gases produced by burning of an explosive substances. According to the World Health Organization, firearms are used in two thirds of all homicide cases and one fifth of suicide cases. India's rates of violence vary greatly and in majority of firearm related injuries illegal, unlicensed weapons are used. The objective of the study is to outline the pattern of firearm injuries and deaths in this area and compare it with the pattern seen in other parts of the world. In the present study, the medicolegal autopsies conducted between January 2012 to December 2016 at B.J. Government Medical College and Sassoon General Hospital, Pune, Maharashtra were analyzed retrospectively. Males were more commonly affected than females; while highest number of deceased belonged to age group of 21 to 40 years. Majority of firearm deaths were homicidal in nature; while Revenge for personal enmity and Land Dispute, Business/political rivalry were the leading circumstances leading to firearm deaths. Firearm injuries were solely present without any other injuries in majority of the cases and lung, heart and brain were common internal organs affected.

Keywords: *Firearm Deaths, Homicidal Deaths, Pune Region.*

INTRODUCTION

A firearm is any weapon which discharges a missile by the expansive force of the gases produced by burning of an explosive substances[1]. Ballistics is the science of mechanics that deals with flight, behaviour and effects of firearm projectiles [2]. Medical experts are not ballistic experts and, therefore confine themselves to the interpretation of injuries upon body and that too in broad generalisation [3]. According to the World Health Organization, firearms are used in two thirds of all homicide cases and one fifth of suicide cases[4]. Besides high death toll firearm injuries cause significant morbidity, long-term physical and psychological disability for individuals, families, communities and societies [5]. The incidences of violent crimes with gunshot injuries have become increasingly more common, reflecting the deterioration of law and order in our society. These are common in the low and middle income countries. In 2000, the rate of violence-related death in low to middle-income countries as a whole was more than twice that in high-income countries, although rates vary between regions and within countries [4]. India's rates of violence vary greatly and in majority of firearm related injuries illegal, unlicensed weapons are used. As at 2006, India was home to roughly 40 million civilian firearms, out of an estimated 650 million civilian owned guns then believed to exist worldwide but only 6.3 million (just over 15 per cent) are licensed[6].

Despite of these dreadful facts, relevant studies, data and information are sorely lacking, particularly in the Maharashtra region of India where incidence and pattern of firearm fatalities have not previously been studied; this study aimed to analyze the demographic as well as post-mortem data of cases of firearm injuries which

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underwent an autopsy in Pune region of Maharashtra. The objective of the study is to outline the pattern of firearm injuries and deaths in this area and compare it with the pattern seen in other parts of the world.

MATERIAL AND METHOD

In the present study, the medicolegal autopsies conducted between January 2012 to December 2016 at B.J. Government Medical College and Sassoon General Hospital, Pune, Maharashtra were analyzed retrospectively. Necessary information for the study was gathered from Police inquest report, hospital treatment records and discussion with the relatives, friends, and neighbours of the victims. The cases were studied to know the prevalence of firearm deaths with respect to age group, sex and manner of firearm deaths as well as that to motives or circumstances leading to such incidents and post-mortem findings.

OBSERVATIONS AND DISCUSSION

Age and sex wise distribution of firearm deaths: During the study period a total of 61 firearm deaths were brought for medicolegal autopsy at B.J. Government Medical College and Sassoon General Hospital, Pune. Males (86.9%) were more commonly affected than females (13.1%); while highest number of deceased i.e. 78.7% belonged to age group of 21 to 40 years (Table 1). These findings are consistent with studies conducted by Toygar et al [7], Kohli A et al [8], Meel B [9] and Sachan R et al[10].

Table 1: Age and sex wise distribution of firearm deaths

Age and Sex	Male	Female	Total deaths
0 to 20 years	2	0	2
21 to 40 years	44	4	48 (78.7%)
More than 40 years	7	4	11
Total deaths	53 (86.9%)	08 (13.1%)	**61**

Manner wise distribution of firearm deaths: In the present study, when analysed for manner of death, majority i.e. 43 (71%) were homicidal deaths followed by 11 (18%) were suicidal deaths, while 7 (11%) were due to accidental firearm discharge (Table 2). Similarly homicidal deaths predominated with same prevalence rate in 2008 NCRB reports [11] i.e.66% and studies conducted by Guileyardo [12] as 65%, by Riddick [13] as 53%; while with higher number of cases in studies conducted by Kellermann [14] as 88% and Sachan R et al[10] as 92%.

Table 2: Manner wise distribution of firearm deaths

Manner of death	No of firearm deaths
Homicidal	43 (71%)
Suicidal	11 (18%)
Accidental	07 (11%)
Total	**61**

Motive/circumstances in firearm deaths: In the present study, when analysed for motive/circumstances in firearm deaths; Revenge for personal enmity was predominate with present in 31.1% of cases followed by Land Dispute, Business/political rivalry in 19.7% of cases. Love Affair, Stress/Depression and Exam failure were present in significant number of cases; while Accidental firearm discharge contributed to 11.5% of cases (Table 3). These findings are consistent with studies conducted by Sachan R et al[10] and Basappa S. Hugar et al[15].

Table 3: Motive/circumstances in firearm deaths

Motive/circumstances	No of firearm deaths
Accidental	07 (11.5%)
Stress/Depression	07 (11.5%)
Exam failure	04 (6.5%)
Land Dispute, Business/ political rivalry	12 (19.7%)
Love Affair	09 (14.8%)
Revenge for Personal enmity	19 (31.1%)
Sudden provocation	03 (4.9%)
Total	**61**

Associated injuries in firearm deaths: In the present study, firearm injuries were solely present without any other injuries in majority i.e. 65.6% of cases followed by chop injuries in 47.5% of cases; while incised injuries and blunt injuries were present in significant number of cases (Table 4). Gupta et al.[16] and Rajeev Kumar [17] found firearm injuries were solely present without any other injuries in higher number of cases than present study i.e. 91.01% and 75% of cases; this disparity can be

attributed to higher sample size and regional variation of crime situation in later two studies.

Table 4: Associated injuries in firearm deaths

Associated injuries	No of firearm deaths (n = 61)
No Other Injuries	40 (65.6%)
Chop Injuries	29 (47.5%)
Incised Injuries	05 (8.2%)
Blunt Injuries	03 (4.9%)

Internal organ affected in firearm deaths: In the present study, lung was most common internal organ affected by firearm injury in 75.4% followed by heart in 50.8% and brain in 31.1% of cases; while liver, spleen, kidneys, intestine and stomach were affected in significant number of cases (Table 5). These findings are consistent with studies conducted by Sachan R et al[10] and Basappa S. Hugar et al[15]; while show partial similarity with studies conducted by Toygar et al [7], Kohli A et al[8] and Mirza CF[18].

Table 5: Internal organ affected in firearm deaths

Internal organ affected	No of firearm deaths (n = 61)
Brain	19 (31.1%)
Lung	46 (75.4%)
Heart	31(50.8%)
Liver	14 (23%)
Spleen	02 (3.3%)
Kidney	04 (6.6%)
Stomach	04(6.6%)
Intestine	02 (3.3%)

CONCLUSION

The present study can be summarized and concluded as; Males were more commonly affected than females; while highest number of deceased belonged to age group of 21 to 40 years. Majority of firearm deaths were homicidal in nature; while Revenge for personal enmity and Land Dispute, Business/political rivalry were the leading circumstances leading to firearm deaths. Firearm injuries were solely present without any other injuries in majority of the cases and lung ,heart and brain were common internal organs affected. The results of this study suggest a strong relationship between particular age group and sex affected, manner of death, region of body affected and circumstances for firearm deaths; while focusing on these, attempts can be made to strategise therapeutic directions, medical and social interventions quite rightly to save life from firearm deaths.

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Ethical Clearance: None

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A Case of Anomalous Evolution of the Thanatological Phenomena

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ABSTRACT

The reported case is worthy of reporting because it shows the difficulties encountered in the medico-legal practice in determining of the death time. The Authors highlight the influence of the environmental factors on the thanatological processes and the importance of studying the climatic and microclimate conditions of the environment where the corpse is found. The thanatological phenomena, detected during the crime scene investigation, placed the death time 48-72 hours before the corpse was discovered, while the investigations of the Judicial Police assessed the murder was committed a week before. The anomalous development of the thanatological phenomena was explained as the consequence of the microclimatic conditions, which significantly slowed down the evolution of post-mortal processes, bringing the time of death to a time antecedent to that established. It can be asserted that the earlier the thanatological data are collected in relation to the time of death, the greater is the likelihood of the death time estimate to be correct, as the influence of the environmental factors is reduced.

Keywords: *postmortem interval, consecutive phenomena, environmental factors, Henssge nomogram, thanatocronology.*

INTRODUCTION

The chronology of the thanatological phenomena has an irregular and never constant pattern due to the variability and multiplicity of influential factors that can be distinguished in "extrinsic factors" to the corpse, such as temperature, humidity, ventilation of places or season, and "intrinsic factors", such as complexion, the cause of death, age or the presence of pathologies. In this report we describe a directly observed case where consecutive thanatological phenomena occurring on a corpse found within a home presented an abnormal chronological trend due to the particular microclimatic conditions that had been created, underlining the difficulties that can be encountered in the legal practice in establishing the time of death.

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Case Report: In February 2013, in late morning, in a Roman coastal location, a corpse of a 65-70 years old male subject was found inside a house. The site inspection started, and before entering inside the house, the outdoor temperature was detected, which was 13.5 °C. The dead body, which was devoid of clothes, was found in a prone position inside the house. Before examining the body, the temperature was measured inside the room where the body laid. It was 15.1 °C. The cadaveric temperature, measured at regular intervals of 30 minutes for two hours by rectal thermometer, was consistently 15.7 °C. The hypostatic spots were of a reddish color, abundantly represented and located in the anterior regions of the body, at the initial phase of absolute fixation, as they were just attenuated by a energetic prolonged massage and no longer migratable to body displacement. The cadaveric rigidity was in process of resolution. Finally,

there was no apparent transformative phenomenology; in particular, there was no putrefactive green spot. The preliminary inspection of the corpse showed numerous injuries of different nature: lacerated and contused wounds of the head, face ecchymosis, skin lesion at the neck due to strangulation and stab, and puncture and stab wounds to the limbs and trunk posteriorly and laterally. The thanatological phenomena observed during the inspection determined that the time of death was about 48 to 72 hours before the corpse discovery. Henssge's nomogram, knowning the rectal temperature (15.7 °C), environmental temperature (15.1 °C) and body weight (80 kg), and considering the corrective factors, confirmed the time of death of estimated during the inspection. However, this information was refuted by the investigations of the Judicial Police. In fact, a video surveillance system near the house where the corpse had been found, filmed the murderer and the victim while returning home with the car of the latter the week before. After a few hours, the murderer left the victim's house with the same car without returning. In the week before the discovery of the corpse, nobody came or left the house. This investigative finding, therefore, allowed the age of death to be fixed a week before the corpse was discovered.

DISCUSSION

The reported case is characterized by an abnormal and singular trend of the thanatological phenomena, which have made the determination of the time of death extremely difficult and complicated. As far as the examination of the time of death is concerned, the following is to be specified. Cadaveric cooling, in standard conditions, occurs in the first 3-4 hours of death with a half-degree decrease in temperature per hour; then in the next 6-10 hours there is a decrease of about one degree per hour and after approximately 14 hours from death, the cadaveric temperature decreases initially three-quarters of degree, then half-degree and finally a quarter degree per hour till it equals the environmental temperature. Temperature leveling occurs on average from 24 to 30 hours. In the aforementioned case, the body temperature (15.7 °C) was in substantial balance with that found inside the room where the body laid (15.1 °C). So the estimate of the time of death, based on the thermal decrease, was to be set beyond thirty hours ago. The hypostatic spots, in standard conditions, generally begin to form after about 30 minutes and become progressively more extended until 10-12 hours after death. Their evolution is characterized by three stages: migratability, relative fixity, and absolute fixity. During the inspection, the corpse had slightly attenuated hypostasis to an energetic long-lasting massage and not modifiable with body displacement, so at an initial absolute fixation stage. The cadaveric stiffness generally begins after about 3-4 hours from death at the level of mimic and masticator muscles. Subsequently, according to Nysten's law, it extends in the skull-caudal direction to all skeletal muscle districts, which will be completely affected after about 7-12 hours. The maximum intensity is reached after about 36-48 hours after death. After that, following the same order of appearance, i.e. in the skull-caudal direction, the stiffness resolution phase begins, which is completed after about 72-80 hours. The cadaveric stiffness in the present case was, at the time of the inspection, in way of resolution. These consecutive thanatological phenomena were associated with the complete absence of transformative phenomena. Therefore, all the thanatological elements available to us, found during the inspection, supported a death time of about 48-72 hours before the discovery of the corpse. The estimate of the post-mortem interval was confirmed by the nomogram of Henssge[1,3]. This was in strong contrast to the results of the Judicial Police investigations, which placed the criminal event occurrence the week before. The explanation of this phenomenon or of such anomalous tendency in the thanatological phenomena suggests that the microclimatic conditions created in the environment where the corpse was located, significantly slowed down the evolution of post-mortal processes. In this sense, it should be emphasized that the chronology of the hypostatic spots is subject to great variability, especially in relation to the period of fixity initiation, which according to some authors[4,5] can also occur hundred or more hours after death. Even cadaveric stiffness is influenced by environmental factors, and in particular by the outside temperature. In a study of corpses kept at a constant temperature of 4°C, the persistence of cadaveric rigidity was observed far beyond the classical limits reported in the literature as it was observed a shift from generalized to partial rigidity between the eleventh and the seventeenth day post mortem[6]. A further study on rigor mortis intensity variations at various environmental temperatures (6, 24

and 37 ° C) on rats showed that, at low temperatures, there is a gradual and substantial increase in muscle rigidity given by the sum of classic rigor mortis and the so-called "cold rigidity"[7]. The action of environmental factors can influence post-mortal transformative processes by favoring an abnormal evolution of the thanatological phenomena.[8]

Under standard conditions, the chromatic phase, the first stage of putrefaction, begins with the appearance of green stain after about 12-18 hours in the summer period and after 1-2 days in winter. This phase, caused by the enzymatic activity of the intestinal tract commensal bacteria, is strongly influenced by the temperature outside of the corpse. In fact, if the ideal temperature for putrefaction is between 21 °C and 38 °C, because it increases bacterial autolysis, temperatures below 10 °C block the putrefactory processes[9,10].

CONCLUSIONS

The presented case is worthy of reporting because it shows the difficulties encountered in the medico-legal practice in determining of the death time. The examined case emphasizes the influence of environmental factors on the thanatological processes and the importance of studying the climatic and microclimate conditions of the environment where the corpse is found. Nevertheless, it should be noted that environmental surveys are not always feasible and microclimatic conditions are often unmanageable and unverifiable. In the case we report, the thanatological phenomena found during the survey, placed the death time 48-72 hours before the corpse was discovered, but the investigations of the Judicial Police showed how the murder was committed a week before. The explanation of the anomalous development of the thanatological phenomena suggests that in the environment where the corpse was located, microclimatic conditions that significantly slowed down the evolution of post-mortal processes were present, bringing the time of death to a time antecedent to that established. It can therefore be asserted that, in general terms, the earlier the thanatological data are collected in relation to the time of death, the greater is the likelihood of the death time estimate to be correct, as the influence of the environmental factors that can change their evolution is reduced.

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Study of Suicide in Central India

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ABSTRACT

'Suicide is characterized as the final common pathway of diverse circumstances, of an interdependent network rather than an isolated cause, a web of circumstances tightening around a single time and space. A prospective study was carried out in the Department of Forensic Medicine Government medical college and hospital, Nagpur from Jan 2013 to Nov 2014. Maximum number of suicide found in males which two times outnumbered the female. Domestic quarrel main cause of suicide followed by psychiatric illness. All the methods of suicide common in young adult (20-40) years of which hanging is most common. Psychiatric illness, 12.67% had consume the alcohol at the time of suicide. home was preferred place of suicide. 7% cases had left the suicide note.

Keywords: *Suicide domestic quarrel, young adults, hanging, suicide note*

INTRODUCTION

'Suicide is characterized as the final common pathway of diverse circumstances, of an interdependent network rather than an isolated cause, a web of circumstances tightening around a single time and space'[1] .The means adopted for committing suicides varies from easily available and less painful such as hanging, poisoning and drowning to more painful means such as self inflicted injuries, burning and shooting etc. In the year 2013 out of total suicide cases, hanging accounted for 39.8%, poisoning 27.9%, self-Immolation 7.4% and drowning 5.7% were the prominent means of committing suicides.[2]

Out of all the suicide in India, Maharashtra accounts for 12.33%, of which 523 suicides occur in study city accounting for 3.1 % of total suicide in Maharashtra and 0.38% of suicide in India. This indicates that Maharashtra has maximum suicidal load all over the India.[2]

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The present study was performed to evaluate the various aspects of suicidal deaths in this region which may help the society to reduce the rate of suicide.

MATERIAL METHOD

A prospective study was carried out in the Department of Forensic Medicine Government medical college and hospital, Nagpur from Jan 2013 to Nov 2014. Various information was collected from inquest papers, autopsy report, information from relative, police, chemical analysis reports and treatment record. The data were analysed and tabulated in Microsoft Excel software packages.

Study conducted to evaluate suicide with respect to sex, causes of suicide, marital status, means adopted for suicide with age, psychiatric illness previous attempt of suicide, alcohol addiction, place of suicide, suicide note.

Inclusion Criteria: All the dead bodies brought to department of forensic medicine for medico- legal autopsy with history of suicidal death.

Exclusion Criteria: Unknown, unclaimed dead bodies.

1. Dead bodies known but no relatives available.
2. Cases where the manner of death is doubtful.
3. Cases where the proper history about all the assessing parameters taken in study could not be elicited from investigating officers and relatives.

RESULT

Table No: 1 Showing Distribution of Suicidal Deaths with Respect To Sex

Sex	Number of cases	% of cases
Male	196	65.34
Female	104	34.66
Total	300	100%

Table 1 Out of 300 cases 196(65.34%) cases were males whereas 104(34.66%) cases were females. This gives a male to female ratio of 1.89:1.

Table No: 2 distributions of Suicidal Deaths with Respect to Cause of Suicide

Causes	Sex				Total	Total %
	Male	%	Female	%		
Domestic quarrel	39	13	32	10.67	71	23.67
Unemployment	25	8.33	2	0.67	27	9
Economic problems	26	8.67	2	0.67	28	9.34
Psychiatric illness	31	10.33	9	3	40	13.33
Failure in love	21	7	15	5	36	12
Exam failure	14	4.66	12	4	26	8.66
Chronic illness	33	11	3	1	36	12
Divorce	5	1.67	13	4.33	18	6
Dowry related	0	0	17	5.66	17	5.66
Total	196	65.33	104	34.67	300	100

It was observed from table 2 that domestic was the main reason of suicide 23.67% cases followed by psychiatric illness 13.33%cases.

Table No. 3: Distributions of Suicidal Deaths with Respect to Marital Status

Marital status	Sex				Total	%
	Male	%	Female	%		
Married	127	43.67	73	23	200	66.67
Unmarried	67	22.33	30	10	97	32.33
Widow/widower	2	0.67	1	0.33	3	1
Total	196	65.33	104	34.67	300	100

Table 3 showed that out of total 300 cases, married individuals contributed for maximum suicide cases 200(66.67%) of cases followed by unmarried 97(32.33%) cases, while 3(0.33%) cases were widow.

Table No. 4: Distribution of Suicidal Deaths With Respect To Age And Method Of Committing Suicide

Method of committing suicide	Age											
	Child (0-12)	%	Ado-lescent (13-19)	%	Young adult (20-40)	%	Adult (41-64)	%	Older (65 or above)	%	Total	%
Hanging	0	0	17	5.67	62	20.66	25	8.33	11	3.66	115	38.34
Poisoning	0	0	7	2.33	60	20	20	6.67	14	4.66	101	33.64
Burning	0	0	3	1	31	10.33	9	3	5	1.66	48	16
Drowning	0	0	6	2	18	6	4	1.33	5	1.67	33	11
Railway cutting	0	0	0	0	1	0.33	1	0.33	0	0	2	0.66

Contd…

Firearm	0	0	0	0	1	0.33	0	0	0	0	1	0.33
Total	0	0	33	11	173	57.65	59	19.66	35	11.65	300	100

Table 4 showed that hanging was the common method of suicide in all age except older victims (above 61 years)

Table No. 5: Distribution of Suicidal Deaths with Respect to Psychiatric Illness and Treatment Taken

Psychiatric Illness		Male		Female		Total	
		cases	%	cases	%	cases	%
Present	Treatment taken	19	6.33	6	2	25	8.33
	Not taken	12	4	3	1	15	5
Absent	165	55	95	31.67	260	86.67	
Total		196	65.33	104	34.67	300	100

Table 5 showed that psychiatric illness was present in 40 (13.33%) cases out of which 25(8.33%) were on regular treatment and 15(5%) cases had not taken any treatment.

Table No. 6: Distribution of Suicidal Deaths with Respect To Previous Attempt of Suicide

History of previous attempt of suicide	Male		Female		Total	
	cases	%	cases	%	Cases	%
Present	21	7	7	2.33	28	9.33
Absent	175	58.33	97	32.33	272	90.67
Total	196	65.33	104	34.67	300	100

Table 6 showed 28(9.33%) cases had history of previous suicidal attempt

Table No. 7: Distribution of Suicidal Deaths with Respect to Place of Suicide

Location	Sex				Total	%
	Male	%	Female	%		
At home	143	47.67	84	28	227	75.67
Outside home	53	17.67	20	6.67	73	24.33
Total	196	65.33	104	34.67	300	100

Table 7 showed that maximum victims preferred their own home as a place of suicide which constitutes 227(75.67%) cases.

Table No. 8: Distribution of Suicidal Deaths with Respect to Suicide Note

Suicide note	Male		Female		Total	
	cases	%	cases	%	Cases	%
Present	10	3.33	11	3.67	21	7
Absent	186	62	93	31	271	93
Total	196	65.33	104	34.67	300	100

Table 8 showed that out of total cases 21(7%) cases had left suicide note.

DISCUSSION

The present study consisted of 300 cases that committed suicide and were subjected to autopsy at our institution. The results of the present study were compared with the studies by different workers from other parts of the country and abroad as well.

Sex: In the current study, out of total 300 cases, 65.34% cases were male whereas 34.66% cases were females. The male: female ratio was 1.89:1. This indicates that males outnumbered the females almost two times.

Similar findings were seen between the studies This was in accordance with, , Mohammed Madadin et al[3], Patel V et al[4] , Kinyanda E [5], Murkey Pankaj et al[6] Vikram Palimar et.al[7] , Singh P et.al[8,] Nigam M et., al[9] , Sharma BR et al[10,] Bennett AT et al[11] ,Roberts AP et al[12] and Martinez AP et al[13],Deborah J Poteet [14]

The maximum number of suicide in male attributed to various factor such as, in India males are sole bread earning member while female are subjected to household chores. Also males frequently face financial loss in business, debts, unemployment etc. As males are supposed to earn for the family they have to work in society because of this, there is mental pressure on him so males are more prone for suicide.

The most common factor responsible for suicidal death in females was torture by the in-laws.. She not only has to adjust with her in laws and other relatives, but also mentally, had compromise with her wishes and dreams at every stage after marriage. In addition to this if there is torture by in-laws, she chooses to get rid of all these thorn–pricks by committing suicide.

Causes of suicide: In the present study, maximum suicidal death were due to domestic quarrel which accounts for 23.67% cases followed by psychiatric illness

Our study is in accordance with NCRB data[2], Deborah J Poteet[14], Anne Freuchenetal[15] and Bardale et al [16].

Domestic quarrel and psychiatric illness are the main cause of suicide that is attributed to various factors such as-Family system and family bond that have remained dominant in India. The marriages were arranged and those few who dared to have love affairs/ marriages were faced with stiff opposition. However in recent two decades the family structure changed rapidly and there was setting of large number of nuclear family

Marital status: In our study, Married peoples contributed maximum suicidal death (66.67%) .Our study is in accordance with Sharma BR et.al[10]. Bardale et.al[16], Gururaj G et al. [17] and Family system and family bond have remained dominant in India. The marriages were arranged ones and those who dare to have love affairs were face with stiff social opposition. Married have to face more responsibilities, financial problem and other domestic problem leading them to end their life. In married males' marital disharmony, family problems and financial burdens were the main motives behind suicide.

Whereas in married females dowry harassment, dependence on husband, cruelty of in laws, change of social environment after marriage and family conflicts were the main motives. Premenstrual tension was also observed in married women.

Method use and age: In present study hanging was the most common method of suicide in all the age group except in older (above 61 years). Our study is in accordance with, Murkey et al [6], Mohammed Ziyauddin G Saiyed et al [18], Singh K et al[19].

The main reasons for people choosing hanging as the most common method of committing suicide are easy availability of ligature material, simple procedure, immediate, painless and surety of death.

Poisoning was second common method of committing suicide after hanging due to the fact that it is easily available and no strict legislation for acquiring poison.

Psychiatric illness and treatment: In present study history of psychiatric illness was present in 13.33% cases out of which 8.33% were on regular treatment and 5% cases had not taken any treatment,

The findings in the present study is in accordance with Jeff Lee C et al[20] There is accumulating evidences indicating that subject with mental illness contribute inexplicably to overall incidence of suicide and that the occurrence and severity of some affective disorders such as depression and mania contribute to increase suicidal tendencies.

Previous attempt of suicide: In present study 9.33% cases of suicide had previous suicidal attempt.

The finding in the present study is in accordance with Jeff Lee C et al[20],

Tanna JA et al[21] and It is a myth that once a person has made a failed suicide attempt that person is unlikely to make another. The fact is that persons who have made an unsuccessful attempt may be at higher risk of attempting it again. A history of past suicide attempts is one of most powerful relevant predictor of eventual suicide.

Place of suicide: In present study, maximum suicide victims preferred suicide at their own home. The present study is in accordance with Bardale et al[16].

A person committing suicide seeks a secured place to commit suicide. For a person home remains the most secured place because in place like home, materials required for committing suicide such as the ligature material, match box, kerosene, insecticide are easily available. Hence, home is the place where the maximum number of suicides was committed.

Suicide note: In present study, Out of 300 cases of suicidal deaths 7% cases had left suicide note. Our study in accordance with, Mohammed Madadinet al[3] and Tanna JA et al[21] Aauer Med[24] This may be attributed to the fact that suicide is done due to a sudden impulse and this may be causative factor for less percentage of suicide notes being written.

SUMMARY AND CONCLUSIONS

The current study concluded that. Males constitute 65.34% cases whereas 34.66% cases were females. Males nearly two times outnumbered the females. Majority of suicidal deaths were due to domestic quarrel accounting (23.67%) cases followed by psychiatric illness (13.33%) cases. Majority were married. All the methods of suicides were common in young adult (20-40) years of which hanging (20.66%) cases and poisoning (20%) cases almost contributed equally. Psychiatric illness was present in (13.33%) cases out of which (8.33%) cases were on regular treatment and (5%) cases had not taken any treatment. Previous attempt of suicide were present in (9.33%) cases.

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"Study of The Pattern of Deaths Due to Suicidal Poisoning" at RIMS Kadapa, AP

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ABSTRACT

Suicidal poisoning deaths is nowadays an increasing burden of mortality to the society. The present study contains 122cases of suicidal poisoning deaths out of a total of 294(41.49%) suicidal death autopsies conducted during 2 yrs in Rajiv Gandhi Institute of Medical Sciences, Kadapa District, Andhra Pradesh. The study includes 77 males (63.11%) and 45 females (36.88%). The ratio of male and female was 1.71:1. Maximum number of deaths 43 (35.24%) noted in the age group of 21-30 years. Married persons (67.21%) outnumbered to unmarried persons (32.78%) .The most common poison used was agricultural Poison (53.27%). victims were more from rural area (67.21%) when compared to urban area (32.78%). Suicide cases were more in Illiterate and low educated people when compared to higher educated people . Most of the incidents (45) occurred at working place of the victim. The overall mortality was 14.3 % out of total acute poisoning cases reported to hospital. Married males and females in young age group with rural background belonging to low socio economic status and male adults with agricultural occupation and chronic alcoholism are more prone to suicidal poisoning

Keywords: *suicide, poisoning, pesticides, mortality, death*

INTRODUCTION

The causes, pattern, and result of poisoning in a region or particular community depends on a various factors such as their profession, literacy, easy availability of poison, the stress of the environment, and the quality of emergency medical care.[1] Exact number of the incidences can be higher, because most of the poisoning cases actually go unreported. The problem is getting worse and Poisoning cases are increasing day-by-day due to the changes in the life style and social behavior.

The causes of poisoning can be civilian, accidental, industrial, and deliberate.[2] Fatality rates of 20% are common and the World Health Organization has estimated that more than 200 000 people die each year from pesticide poisoning only.[3] Recently, it has been reported that the number of intoxications with pesticides only estimated at some 3 million per year, and the number of deaths and casualties some 300 000 per year worldwide.[4]

Poison-associated morbidity/mortality varies from place to place and will changes over a period, due to use of new chemicals. The mortality rate of poisonings is often related to delay in diagnosis or an improper management. Swift diagnosis and standard treatment are often life saving. Hence, the knowledge of general pattern of poisoning in a region would definitely help in early diagnosis and management of poisoning, that in turn will result in reduction of morbidity and mortality. This study was undertaken to give such type of information.

MATERIALS AND METHOD

The present study conducted among medico legal autopsies held at Rajiv Gandhi Institute of Medical Sciences, Kadapa District, Andhra Pradesh, in 2012 and 2013, which includes 122 cases of deaths due to suicidal poisoning out of total 294 suicidal deaths. Information of age, gender, socio-economic condition and poisons/agents were collected

from the panchanama. The nature of involved poison and the method of poisoning were determined from the autopsy findings, circumstantial evidence, reliable history provided by the accompanying relatives.

RESULT

The present study contains 122(41.49%) cases of suicidal poisoning deaths out of a total of 294 suicidal death autopsies during 1st January 2012 to 31st December 2013 (Figure-1). The study included 77 males (63.11%) and 45 females (36.88%) (Table-1). The ratio of male and female was 1.71:1. In the age and sex wise distribution of cases, the age group of 21-30 years included the maximum number of deaths 43 (35.24%) , in that 27 males (62.79 %) and 16 females (37.2%) followed by the age 31- 40 years, which included16 males (57.14%) and 12 females (42.85%) (Table-1). The maximum number of deaths was among the married persons (67.21%) as compared to unmarried persons (32.78%) (Table- 2).The most common poison used in our study was agricultural Poison (53.27%) followed by hair dye (super vasmol)(24.59%), (Table-3). Economic problems (33.60%) and family conflicts(19.67%) followed by chronic disease and drug abuse were the major predisposing factors (Table-4). In our study 40 cases (32.78%) were from urban background and 82 cases (67.21%) were from rural area (Table-5).Suicide cases are more in Illiterate and low education people when compared to higher education people (Table-6). Most of the incidents (55.73%) occurred at residence of the victim (Table-7). Among the suicidal cases, 6% had a history of previous suicidal attempt, 14% had a history of addiction and 1% had a history of psychological disease. The overall mortality was 14.3 % out of all cases reported to hospital.

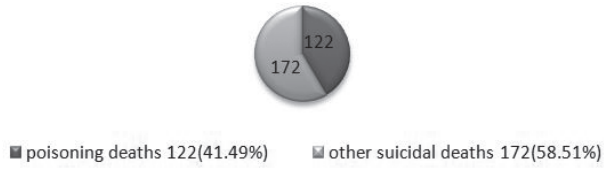

Figure 1: Ratio of suicidal poisoning cases to total cases of suicides

Table 1: Age and Sex wise distribution of cases

Age	Male (%)	Female (%)	Percentage
1-10	00	00	00
11-20	09(60%)	06(40%)	15(12.29%)
21-30	27(62.79%)	16(37.2%)	43(35.24%)
31-40	16(57.14%)	12(42.85%)	28(22.95%)
41-50	14(73.68%)	05(26.31%)	19(15.57%)
51-60	06(46.15%)	07(53.84%)	13(10.65%)
61-70	04(100%)	00(00.00%)	04(3.27%)
>70	01(00.00%)	00(00.00%)	01 (0.81%)
Total	**77(63.11%)**	**45(36.88%)**	**122(100%)**

Table 2: Marital status of the cases

	Male(%)	Female(%)	Total(%)
Married	48(58.53%)	34(41.46%)	82 (67.21%)
Unmarried	29(72.5%)	11(27.5%)	40 (32.78%)
total	77(63.11%)	45(36.88%)	122(100%)

Table 3: Type of poison

Type	Male	Female	Total (%)
Agricultural (pesticides)	52 (80%)	13 (20%)	65 (53.27%)
Phenol	00(00%)	02 (100%)	02 (1.63%)
Drugs (Sedative-hypnotics, Analgesics, Muscle relaxants)	02 (22.22%)	07 (77.77%)	09 (7.37%)
Hair dye (super vasmol)	11(36.66%)	19 (63.33%)	30 (24.59%)

Contd…

Rat poison	06 (66.66%)	03 (33.33%)	09 (7.37%)
Corrosives	02 (100%)	00(00%)	02 (1.63%)
Un known	04 (80%)	01 (20%)	05 (4.09%)
Total	77(63.11%)	45 (36.88%)	122 (100%)

Table 4: Predisposing factor for suicidal poisoning

Predisposing factor	Male (%)	Female (%)	Total(%)
Economic hardship	33(80.5%)	08(19.5%)	41(33.60%)
Chronic disease & painful abdomen	05(23.80%)	16(76.19%)	21(17.21%)
Family conflicts	17(70.83%)	07(29.16%)	24(19.67%)
Drug abuse	18(100%)	00(00%)	18(14.75%)
HIV positivity	01(100%)	00(00%)	01(0.81%)
Dowry problems	00(00%)	09(100%)	09(7.37%)
Mental disease	00(00%)	01(100%)	01(0.81%)
Not known	03(42.85%)	04(57.14%)	07(5.73%)
Total	77(63.1%)	45(36.9%)	122(100%)

Table 5: Area wise distribution

	Male(%)	Female(%)	Total(%)
Rural	49 (59.75%)	33 (40.24%)	82(67.21%)
Urban	28 (70%)	12(30%)	40(32.78%)
Total	77(63.1%)	45(36.9%)	122(100%)

Table 6: Literacy wise distribution

	Illiterate	Primary education	Secondary education	Graduates and post graduates	Total
Male	19	36	18	04	77 (63.1%)
female	15	22	08	00	45 (36.9%)
total	34 (27.86%)	58 (47.54%)	26 (21.31%)	04 (3.27%)	122 (100%)

Table 7: Place of occurrence

Place of occurrence	Male	Female	Total
Home	32(47.05%)	36(52.94%)	68(55.73%)
Work place(agriculture field, industry)	45(83.33%)	09(16.66%)	54(44.26%)
TOTAL	77(63.1%)	45(36.9%)	122(100%)

DISCUSSION

Mortality and morbidity in poisoning depends on various factors like nature of poison, dose consumed, level of medical facilities available and time interval between intake of poison and treatment started at hospital. Results shows that mortality rate was 14.3%, out of all patients reported to hospital during 2 years with acute poisoning. The study outnumbered with 77 males (63.11%) and 45 females (36.88%) .The ratio of

male and female was **1.71:1**. These findings are contrary with study of Arabinda N.Chowdhury *et al*.[5] consistent with study conducted by Shreemanta kumar et al [6] and Amita Srivastaa et al [7] Shahin Shadnia *et al*[8].

In the age and sex wise distribution, 21-30 years age group has the maximum number of deaths 43cases (35.24%) , in that 27 males (62.79%) and 16 females (37.2%) followed by the age 31-40 years , 28 cases which included16 males (57.14 %) and 12 females (42.85%). These findings are consistent with study by Amita Srivastaa et al[7] and Arabinda N.Chowdhury *et al*[5] Shahin Shadnia *et al*[8] Shreemanta kumar *et al*[6]. Economic problems and family disputes are the major causes for suicidal attempts(65%). Similar findings noted in study by Arabinda N.Chowdhury *et al* [5].The maximum number of deaths was among the married persons (67.21%) as compared to unmarried persons (32.78%) , consistent with Shreemanta kumar *et al*[6].

The most common poison used in our study was agricultural Poison (53.27%) followed by hair dye(super vasmol)(24.59%), pesticides were major cause of death in study of Shreemanta kumar *et al* [6] and Arabinda N.Chowdhury *et al*. [5] contrary with study conducted by Amita Srivastaa *et al* [7] also Shahin Shadnia *et al* [8] .In our study 40 cases (32.78%) were from urban background and 82 cases (67.21%) were from rural area , consistent with Shreemanta kumar *et al* [6]. Suicide cases are more in Illiterate and low education people when compared to higher education people. Similar findings observed with Shreemanta kumar *et al* [6] . Most of the incidents (55.73%) occurred at residence of the victim. Among the suicidal cases, 6% had a history of previous suicidal attempt, 14% had a history of drug abuse (chronic alcoholism). Similar with study by Shahin Shadnia1 *et al*[8].

Restricting the availability of toxic pesticides will reduce the number of deaths from poisoning. Reduction in self-harm deaths has occurred in the UK and India after replacement of barbiturates with benzodiazepines as usual sedative prescription[9] [10] .It has been established that consistent exposure to pesticides produces physical, psychological and neurobehavioral effects such as anxiety, depression, and cognitive impairment.[11] [12]. It should be noted that rapid diagnosis and management of suicidal poisoning is critical in the outcome of patients and delay in effective management may open a key role.[13]

CONCLUSION

The growing number of poisoning/toxicological cases among these suicidal poisonings compels us to pay more attention to setting up of interdisciplinary-based prevention as well as running effective toxicological centers. All physicians should recommend psychiatric care for people suffering from mental problems or depression. In case of agricultural poisons government should take a vital role and take strict actions ike Subsidize the costs of pesticides which are less toxic to humans, Prohibit sales of the pesticides most lethal to humans after ingestion. Public education regarding the dangers of pesticide ingestion. Integrated Pest Management should be done where we are reducing the use of pesticides in agricultural practice .we should engage a village head like sarpanch/police personnel/schoolteacher to hold the stocks of a locality's pesticides. Must ensure all villages should have first aid kits for quick management of pesticide as well as household poisoning ,Improve speed of transfer to hospital and all hospitals equipped with adequate supplies of antidotes and modern facilities. Education is the panacea for all.

Conflict of Interest: Nil particular

Source of Funding: Self

Ethical Clearance: Institutional Ethical Committee, Rajiv Gandhi Institute Of Medical Sciences, Kadapa.

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Radiological Age Estimation from the Fusion of Medial Epiphysis of Right Clavicle

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ABSTRACT

Clavicle bone display longest period of growth related activity thus it is frequently used in estimating age and sex of individuals. Primary centres appear around 6 weeks of intrauterine life which fuses during 2nd decade of life and sometimes even extends to late 20's. That's why this bone is important in estimating age in individuals over 18 years of age as by this time majority of skeletal epiphysis got fused. In present study 169 cases including males and females of age group 16-26 years are taken up for the radiological estimation of age from fusion of medial epiphysis of Right clavicle bone. X-Ray antero-posterior view of sterno-clavicular area is taken and stage of appearance and fusion is studied.

Keywords: *Radiological age, X-Ray, Fusion, Epiphysis, Clavicle.*

INTRODUCTION

Identification of a person dead or alive is of utmost interest of Forensic experts. Estimation and approximation of age is one of the important parameter of fixing the complete or partial individuality of person. Various experts including Pathologists, Physicians, dentists, Anatomist and Anthropologist contribute a lot for this.[1, 2]

Forensic Age Estimation constitutes a field of expertise in forensic medicine which aims at defining as accurately as possible the chronological age of individuals.[3,4] Although numerous age estimation techniques have been developed in the fields of Forensic Anthropology and Forensic Odontology, but there is still no consensus on what method should be applied when the age of presumed minor is to be estimated.[3,5] The two main anatomic aspects, which are traditionally examined, are teeth[6-9] and the hand-wrist bones [10,11] but their applicability in the forensic field is relatively limited particularly for the purpose of assessing the 18th year of age. Because they are either fully developed for the hand-wrist bones and as regards teeth, only the third molars are still developing which has variability. Therefore to confirm the dental evaluation, skeletal parameters are also considered.[3, 4, 8]

Various bones and their time of ossification are frequently used for estimation of age of an individual. Clavicle is one of them used for estimation of age & sex of an individual because out of all the long bones in the human skeleton, clavicle displays the longest period of growth-related activity, rendering it useful for the estimation of age in the earlier years. Determination of the stage of ossification of the medial clavicular epiphysis plays a crucial part in Forensic age estimation when evaluating living subjects over 18 years of age.[11-18] In most of the bones during growth, the epiphyses unite to the diaphyses between 11 and 20 years of age & in females fusion commences a couple of years earlier than males. The only exception is the clavicle, in which fusion occurs during the second decade and traces of its union sometimes extend into the late 20's.[19]

Clavicle: *Clavicle* is a modified long bone having received its name from the Latin: *clavicula* ("little key"). Like all long bones, it has two ends. The lateral end articulates with the acromion process of scapula and the medial end articulates with the sternum and first costal cartilage. The clavicle is subcutaneous throughout its length and can easily be seen in all subjects. The lateral

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end of bone is formed by intramembranous ossification while medially it is formed by endochondral ossification. The bone is formed via two ossification centres, one medial and one lateral, which fuses later on. [5, 13, 15] The clavicle is the first fetal bone to undergo primary ossification, and its medial epiphysis is the last to fuse[19], thus making it important in age estimation. Clavicle has two primary ossification centres which appear by the 6th week of intrauterine life and fuse together about one week later.[18, 21] The ossification of centres which lies at either end gives clavicle a unique s-shape by 8-9 prenatal weeks. The bone attains its adult form by 11 prenatal weeks.[21] Growth slows after birth until the growth spurt between 5 and 7 years, and then slows again until the pubertal growth spurt.[18] Medial epiphyseal ossification begins at the onset of puberty but medial epiphysis does not fuse to shaft completely until some 10 years after its initial appearance.[19, 20]

AIMS AND OBJECTIVE

Aim of this study was Radiological age estimation from the fusion of medial epiphysis of clavicles using digital X-Ray Radiography.

MATERIAL AND METHOD

The study was conducted in the Emergency Wing of Department of Forensic Medicine, Government Medical College, Amritsar along with Radiodiagnosis Department of Guru Nanak Dev Hospital, Amritsar. The cases in the age group of 16-26 years coming in for medicolegal purpose, those for treatment investigation purpose in Radiology Department as well as Medical students were studied for the estimation of age from the fusion of medial epiphysis of Right Clavicle.

Exclusion criteria: Those cases who were very sick, not in this age group and those who did not consented were not included in the study.

During the study 169 cases including males (99) and females (70) of age group 16-26 years were studied in groups of 16-18, 18-20, 20-22, 22-24, and 24-26 years after taking informed consent. Digital X-Ray antero-posterior view was taken in standing position focusing sternoclavicular ends of clavicle on Right side along with manubrium sterni. A 4- phase scoring method was used. Stage 1- epiphysis do not appear, Stage 2- epiphysis appear but no fusion, Stage 3- Partial fusion, Stage 4- complete fusion.

RESULTS

Appearance of ossification centers (Stage 1) was observed at age 16 years which extends up to 17 years with mean age 16.11 +_ 0.33 years. Stage 2 first observed at age 16 years and extends up to 21 years with mean age 17.64+_ 1.39 years. Partial fusion (stage 3) first observed at age 18 years which extends up to 24 years with mean age 20.24 +_ 1.58 years. Complete fusion (stage 4) first observed at 21 years and beyond with range 21-26 years with mean age 23.41 +_ 1.57 years. In males stage 1 appeared at 16 years, stage 2 at 17 years, stage 3 at 18 years extending up to 24 years and stage 4 at 21 years and by 26 years all were fused. In females stage 1 first observed at 16 years, stage 2 at 16 years extending up to 21 years, stage 3 at 19 years extending up to 21 years and stage 4 at 21 years and by 26 years all were fused. In present study fusion of medial epiphysis of right side of clavicle was studied and the following was the outcome.

Table 1 showing total number of cases studied in different age groups with stage of fusion of medial end of clavicle of Right side

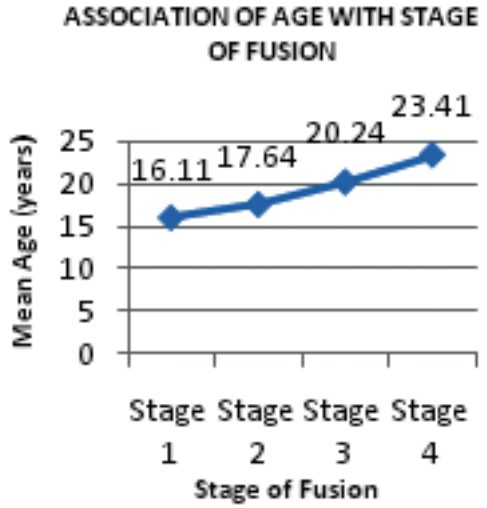
S. No.	Age Group(In Years)	Stage of Fusion (Right)				Total No. of Cases
		Stage 1	Stage 2	Stage 3	Stage 4	
1.	16-18	9	21	4	0	34
2.	18-20	0	5	30	0	35
3.	20-22	0	2	16	21	39
4.	22-24	0	0	8	27	35
5.	24-26	0	0	0	26	26
Total No. of Cases		**9**	**28**	**58**	**76**	**169**
$x^2 = 275.031$; df = 30; $p < 0.001$; Highly significant						

Table 2 showing sex wise distribution of different stages of fusion of medial end of clavicle of Right side.

Age Group (Years)	Stage of Fusion In Males				Total Males	Stage of Fusion In Females				Total Females	Total Cases
	Stage 1	Stage 2	Stage 3	Stage4		Stage 1	Stage 2	Stage 3	Stage 4		
16-18	7	9	4	0	20	2	12	0	0	14	34
18-20	0	2	18	0	20	0	3	12	0	15	35
20-22	0	1	9	10	20	0	1	7	11	19	39
22-24	0	0	8	12	20	0	0	0	15	15	35
24-26	0	0	0	19	19	0	0	0	7	7	26
Total No. of Cases	7	12	39	41	99	2	16	19	33	70	169
	x2 = 108.019; df = 12; p < 0.001; Highly significant					**x2 = 92.901; df = 12; p < 0.001; Highly significant**					

Table 3: showing stage of fusion with mean age

Stage of Fusion	N	Age (In Years) Mean ± SD	Range (In years)	Significance
Stage 1	9	16.11 ± 0.33	16–17	**F value = 145.21; p < 0.001; Highly Significant**
Stage 2	28	17.64 ± 1.39	16–21	
Stage 3	58	20.24 ± 1.58	18–24	
Stage 4	74	23.41 ± 1.57	21–26	
Total	169	20.98 ± 2.85	16–26	



Graph 1: Showing association of age with stage of fusion

DISCUSSION

In the present study, in the age group of 16-18 years- Out of 31 cases, 9 were at the stage 1 of fusion, 20 were at the 2nd stage and 2 in 3rd stage of fusion. In the age group 18-20 years- out of a total of 37 cases, 5 cases were at the stage 2 and 32 at stage 3 of fusion. In age group 20-22 years- out of 40 cases, 3 were at stage 2, 16 at stage 3 and 21 were at stage 4 of fusion. In the age group 22-24 years- out of 37 cases studied, 8 were at stage 3 and 29 were at stage 4 of fusion. In the age group of 24-26 years- out of 26 cases all were at the stage 4 of fusion. Appearance of ossification centres was first observed at age 16 extends to 17 years, partial fusion first observed at age 18 years in males which extends to 24 and 19 years in females extending to 21 years, complete fusion first observed at 21 years and beyond in both sexes and by 26 years all were fused.

The observations are comparative with the study conducted by Singh Pardeep et al. by using X-Ray examination in which epiphyseal union in males was at 22-23 years and earliest occurred at 20 years and females show union at 22-23 years of age and earliest union at 20 years and one month.[22]

The observations of the present study are well in accordance with the study conducted by Schulz, Muhler et al. (2005) using CT scan to determine fusion by using 5 phase scoring system. In which stage 2 was first noted at age 15 years in both sexes, earliest union of stage 3 was noted at age 17 years , 16 years and complete fusion was at age 22 years and 21 years in males and females respectively. In the present study stage 3 was observed at 18 years and 19 years and complete fusion was observed at age 21 years in males and females respectively.[23]

The observations of the present study are comparative with the study conducted by McKern TW, Stewart TD (1957) on Korean war dead by using 5 phase scoring system. In which union begins at age 18 years, possibly at age 17 and majority fuses by age 25 years.

They found unattached epiphysis upto age 22 years and complete fusion was not evident prior to 23 years.[14]

The observations of the present study are comparative with the study conducted by OWINGS WEBB, M.SUCHEY et al (1985) at fusion of anterior iliac spine and medial clavicle in American population using 4 phase scoring system. In which they observed that age range for non-union with separate epiphysis was 16 years through 21 years, partial fusion extends from 16 to 33 years and complete fusion begins at age 20 and complete fusion in total sample at age 34 years.[15]

The observations of the present study are in line with the study by Kreitner et al (1998) in which appearance of ossification centres occurred between ages 11 and 22 years, partial fusion ranges from 16 to 26 years and complete fusion was first noted at age 22 years and by 27 years all were found fused.[20]

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Conflict of Interest: None

Ethical Clearance: Approved from ethical committee of Govt. Medical College, Amritsar.

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Study of Patterns Injuries in Cases of Vehicular Accidents in Jamnagar Region of Gujarat.

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ABSTRACT

Background: Road traffic accident are by far the most common mode of death worldwide. With the increase in number of vehicles with economic development in India accompanied with congested roads, poor road infrastructure & general disregard for the safety measures result in high rate of vehicular accidents.

Material & Method: Out of all cases coming to Autopsy of M.P. Shah Medical College, Jamnagar, Cases of Road Traffic Accidents were taken in study for the period of one year. Basic Information was obtained from police papers, inquiry accompanying police personnel & relatives. Detailed routine post-mortem examination was conducted. The data so collected was than analysed and compared with previous similar studies.

Results: In superficial injuries, Abrasions were mostly found on Limbs, Contusions mostly found on Head & Face. Most of the cases Skeletal Injuries were seen on Skull Bones with Face Bones & Mandible. Injury to Chest region is more common in patients with three or four-wheeler accidents. Head injury is the leading cause of death in vehicular accidents.

Conclusion: Many deaths in injury due to vehicular accidents can be prevented from increasing the awareness to the road-safety measures like Wearing Helmet while riding the two-wheelers, not over-loading the vehicles & wearing the seat-belts.

Keywords: *Vehicular Accident*

INTRODUCTION

India with its growing economy has become world's leading consumers, with all the other objects Vehicles two wheelers, three wheelers and Four wheelers have come in great demand. So, there is a drastic increase in the number of vehicles on the road. But the proportionate betterment of road infrastructure not occur due to various reasons. And there is a general disregard and lack of awareness for the safety measures, both on road and off the road. These factors combine to result in a high incidence of vehicular accident and high death rate following injury in vehicular accident.

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So, Trauma from vehicular accident is a very common case in autopsy room in India. There are numerous previous researches in the field of road traffic accidents, but region-specific problems also exist. So, the current study was undertaken at M.P. Shah Medical College, Jamnagar to evaluate the factors responsible for vehicular accident and what measures can be taken to counter the responsible factors.

AIMS & OBJECTIVES

1. To study the pattern of injuries in road traffic accidents in the Saurashtra Region.
2. To compare patterns in Superficial Injuries, Skeletal Injuries, Visceral injuries & Cause of death in vehicular accident with the work of other workers who have studied before, in other regions of India.

MATERIAL & METHOD

For present study 812 autopsy cases conducted at the Department of Forensic Medicine, M.P. Shah Medical College, Jamnagar, from 1-09-2003 to 31-08-2004 were included and looked for road traffic accident. Summarily the present study comprises of 60 cases of road traffic accident of different types.

General particulars of cases were collected from concerned police officer, relatives of the deceased, attendants and in few cases from hospital indoor cases papers. Specific information regarding mode of event, vehicle involved etc. were collected for every road traffic accident. Detailed and complete external examination of bodies were done, including clothes, presence of ornaments, wearing of helmet or not and its condition and other belongings.

The details of cases showing road traffic accident were entered in predesigned proforma. Master chart of cases of road traffic accident was prepared. The significant details were further grouped and tabulated for obtaining observations. A comparison was made between the observations of available literatures and present study.

RESULTS

Table 1: Superficial injuries in Vehicular accidents & region of body involved

Region involved	Superficial Injuries			
	Contusions	Abrasions	Lacerations	Crush Injuries
Head & Face	15 (25%)	27 (45%)	30 (50%)	08 (13.33%)
Neck	01 (1.66%)	04 (6.66%)	07 (11.66%)	04 (6.66%)
Abdomen	05 (8.33%)	14 (23.33%)	05 (8.33%)	03 (5.00%)
Chest	12 (20.00%)	23 (38.33%)	03 (5.00%)	04 (6.66%)
Pelvis	04 (6.66%)	07 (11.66%)	05 (8.33%)	03 (5.00%)
Upper Limbs	13 (21.66%)	29 (48.33%)	03 (5.00%)	02 (3.33%)
Lower Limbs	07 (11.66%)	30 (50.00%)	09 (15.00%)	3.33%)

*Figures show total number of cases & in bracket percentage of total cases.

1. **Distribution of cases according to Type of Superficial Injuries (Table 1):** In the present study contusion were observed maximally over the region of head and face in 15 cases (25%) followed by upper limbs in 13 cases – 21.66% and chest in 12 cases (20%). Abrasions were observed maximally in the regions of upper limbs and lower limbs in 30 cases (50%) followed by head and face in 27 cases (50%) followed by lower limbs in 9 cases (15%). The incidence of crush injuries with multiple superficial involvements were observed maximally over the region of head and face in 8 cases (13.33%) followed by neck and chest region equally in 4 cases (6.66%).

Table 2: Bone involvement & type of vehicle

		Pedestrain	Bicyclist	Two wheelers	Three & four wheeler (Light & Heavy)	
					Driver	Occupant
Skull	S	69.5%	79.6%	67.9%	76.9%	57.6%
	P	50%	100%	58.3%	36.7%	28.6%
Spinal Injury	S	17.7%	5.4%	15.0%	7.6%	6.6%
	P	16.87%	-	8.3%	-	-
Calvicles & ribs	S	31.9%	33.5%	22.6%	23%	40.6%
	P	22.2%	25%	58.3%	27.3%	28.6%
Pelvis	S	14.4%	12.5%	3.7%	-	3.3%
	P	16.8%	-	8.3%	18.2%	-

Contd…

Upper Limbs	S	15.2%	5.4%	9.4%	7.6%	11.8%
	P	11.1%	-	41.7%	18.2%	21.4%
Lower Limbs	S	16.7%	12.5%	20.7%	23%	22%
	P	22.2%	25%	33.3%	36.4%	21.4%

*Skull - includes Facial Bones and Mandible * S – Salgado Study, P – Present Study
*all figures are in percentage.

2. **Distribution of case according to Skeletal Injuries and Type of Victim (Table 2):** Study shows maximum numbers of skeletal injuries involving skull in pedestrians in 9 cases (50%) followed by motorcyclist in 7 cases (58.33%). Injuries to clavicles and ribs were maximally observed by motorcyclist in 7 cases (58.33%) followed by pedestrian and occupants of four wheelers equally in 4 cases (28.57%). Injuries to the region of pelvis were observed maximally in pedestrians in 3 cases (60.67%). Injuries to upper limbs were observed maximally in 5 cases of motorcyclist (41.66%) followed by occupants of three and four wheelers. Injuries to lower limbs were observed almost equally in 4 cases (22.22%) each in pedestrians, (22.22%) motorcyclists (33.33%) and drivers (36.36%) of three and four wheelers.

Table 3: Organ involvement & type of vehicle

		Pedestrain	**Bicyclist**	**Two wheelers**	**Three & Four-wheeler (Light & Heavy)**	
					Drivers	**Passenger**
Brain	S	71.3%	78.1%	79.2%	69.2%	67.7%
	P	79%	100%	91.7%	54.6%	71.4%
Lungs	S	22.6%	20.3%	32.0%	7.6%	11.8%
	P	16.08%	25%	50%	27.3%	35.7%
Heart	S	2.6%	3.9%	5.6%	7.6%	3.3%
	P	-	-	8.3%	-	7.1%
Liver	S	16.7%	3.9%	9.4%	30.7%	5.0%
	P	21.1%	-	16.7%	9.1%	7.1%
Kidneys	S	5.2%	5.4%	5.6%	0.0	5.0%
	P	5.3%	-	-	27.3%	-
Spleen	S	5.9%	6.2%	5.6%	-	-
	P	10.5%	-	-	27.3%	-
Major Vessels	S	1.8%	-	3.7%	-	-
	P	-	-	3.3%	-	-

* all figures are in percentage.

3. **Distribution of case according to Visceral Injuries and Type of Victim (Table 3):** Present study shows higher incidence of injuries to liver and spleen equally in 4 cases (6.66%) of pedestrians. Observation shows involvement of all 4 cases driving bicycle with injuries to brain. Motorcyclist showed maximum injuries to brain in 11 cases (91.67%) followed by injuries to lungs in 6 cases (50%) and major vessels (including aorta) in 4 cases (6.66%).

   Drivers of three and four wheeler vehicles showed maximum incidence of brain injury in 6 (54.55%) cases followed by involvement of Lungs, Liver, Spleen, major vessels equally in 3 cases (27.27%). Occupants of the three and four wheeler vehicles showed maximum injuries to brain as in 10 cases (17.4%) followed by injuries to lungs in 5 cases (35.7%).

Table 4: Comparison between different studies with current study for cause of death

Study / Cause of death	Salgado	Lau	Biswas	Ghangale	Pensuriya	Present Study
Head injury	69.6%	41.8%	47.3%	35.5%	52%	53.3%
Shock and haemorrhage due to multiple injuries	12%	49%	41.8%	46.6%	21%	16.7%
Chest injury (with or without head injury)	6.7%	2.1%	0%	11.1%	5%	15.0%
Abdominal injury (with or without head injury)	5.5%	2.6%	0%	0%	10%	13.3%
Sepsis	2.7%	0%	5.5%	1.1%	0%	-
Open limb / Spinal injuries	2.9%	2.9%	0%	5.5%	0%	-
Others (including chest & abdominal injury)	0.6%	1.1%	5.5%	0%	12%	1.7%

* all figures are in percentage.

4. **Distribution according to the Cause of Death (Table 4):** Table 4 shows incidence head injury as a single and most prominent cause of death in 32 cases (53.33%) followed by death due to shock and haemorrhage on account of poly trauma in 10 cases 16.66%. Further almost as close incidence of chest injury (with our without head injury) and abdominal injury (with or without head injury) is observed in 9 cases (15%) and 8 cases (13.33%) respectively.

DISCUSSION

Total 60 cases of road traffic accident were observed during the period of one year (01-09-03 to 31-08-04) in which total 812 medicolegal autopsies were conducted.

Distribution of Superficial Injuries: As shown in Table–1 in the distribution of cases according to region of the body involved and type of superficial injuries, contusions were observed maximally over the region of head and face in 25% cases, followed by upper limb in 21.66% cases. Abrasions were observed maximally in the region of upper limb and lower limb in 50% of cases followed by head and face in 45% cases.

Lacerations were observed maximally over head in 50% case followed by lower limbs in 15% cases. It can be explained due to the fact that superficial injuries are more commonly observed in exposed parts of body and also, body defense mechanism involves different regions showing higher incidence in the regions of head, face, upper and lower limbs. The incidence of crush injuries was observed maximally over head and face in 13.33% of cases followed by neck and chest region in 6.66% of cases.

Similar observation of multiple crush injuries involved head and face observed by others can be explained since it is frequently involved body part as a result of the impact of heavy vehicles.[6]

Comparison of Distribution of Skeletal Injuries and Type of Victims: Table – 2 shows comparison of distribution of skeletal injuries in different category of victims between study done by Salgado[1] and present study. Moderate to significant variation was observed in skeletal injuries of different regions.

Among pedestrians' injuries to skill and ribs were significant and predominant. This same pattern is observed in other categories of victims as well. In the present study two-wheeler occupants showed more than double incidence than by Salgado[1]. Higher incidence of skeletal injuries to skull and ribs is explained because primary impact is usually in region of the chest while the secondary impact and secondary injuries are invariably on the head.

Skull injuries were predominant in both studies which indicate that irrespective of other injuries present over different regions, head injury was a major cause responsible for death.

Spinal injuries observed similarly in both studies. In the present study it is also observed in two wheelers

occupant in 8.3% of cases. It can be explained due to the result of secondary injuries being inflicted after impact. Salgado observed that spinal injuries in the pedal cyclist, motorcyclist, drivers and occupant of a vehicle were not significant but in the present study similar spinal injuries are observed in 8.3% cases due to secondary injuries.

Salgado[1] observed lower incidence of spinal injury in drivers and occupants of the vehicle due to headrest preventing this injury. Similarly no cases of spinal injuries are observed in present study also in this category.

Salgado[1] observed injuries to pelvis amongst pedestrian and bicyclist with relatively higher incidence. Similar observation revealed in pedestrians, but no cases were observed in bicyclist. Present study observed injuries to pelvis in 18.2% cases in drivers of three and four wheelers. In pedestrian, it can be explained due to the fact that after primary impact, it is produced by vehicle to being run over in most of the instances.

Injuries to upper and lower limbs were having relatively higher incidence in almost all type of victims than observed Salgado[1]. Injuries to upper limbs showed significant higher incidence in the present study, because incidence of vehicular turn over observed maximally in the two-wheeler drivers and occupants.

Injuries to lower limbs observed predominantly, in both studies in all category of victims. This can be explained by the fact the in pedestrians, pedal cyclist, and motor cyclist primary impact with heavy vehicle, especially bumper was the cause of most these vehicles in both studies. These can be explained by forward movement following a head on collision, results in lower limbs striking the dash board or front seat in case of an occupant resulting in injuries. All type of skeletal injuries was present in pedestrians in both studies due to the fact that all of the body parts have access to vehicle resulting in combination of primary impact secondary impact and secondary injuries.

Comparison of Distribution of Visceral Injury and Type of Victim: Table–3 shows comparison of distribution of visceral injuries among different categories of victims, as expected from the skeletal injuries as shown in table. Study is done by Salgado[1] and present study. Relatively higher incidence of brain injuries observed in all categories except in drivers of light four wheelers. Present study shows brain injuries in all victims riding bicycle. Significant higher incidence of injuries to lungs were observed in four wheeler drivers and occupants, while no cases showed heart injuries to drivers in the present study.

No cases of injuries to kidneys and spleen were observed by Salgado[1], but the present study showed remarkably higher incidence of injuries to spleen and kidneys which have consistent findings as shown in table with skeletal injuries to pelvis and lower limbs in the drivers of the four wheelers.

All visceral injuries showed consistency with the skeletal injuries observed in different category of victims as the possible explanation of the production of injuries given before. In case of pedestrain and occupant of the vehicle, in spite of less incidence of external injuries, incidence of brain injury was higher and proved fatal in present study.

Comparison of The Cause of Death: Table–4 shows comparison of causes of death in cases of road traffic accident by different workers with the present study. All studies including present study shows head injury as a major cause of death involving around 50% of cases out of total fatalities (varying in range 41% to 70%) Lau[2], Biswas[3] and Ghangale[4] observed nearly 40% of cases having multiple injuries as a second major cause of death, while other including present study, observed multiple injuries, chest injuries and abdominal injuries as a cause of death with relative variation in between were also second major cause of death.

The higher incidence of head injury as a cause of death can be explained by the fact that most of the cranio-cerebral injuries were not the result of primary impact but due to secondary impact or secondary injuries or both. Multiple injuries involve all major body region with failure of many organs system causing death. Specific injuries to chest and abdominal organ can be explained by visceral injuries to major organs with trauma like lung, liver, kidney, spleen and major vessels invariably amenable to shock and haemorrhage resulting in immediate death.

CONCLUSIONS

- Among pedestrians incidence of skeletal injuries to skull and ribs were higher. Drivers of two wheelers

also showed higher incidence of injuries to skull and ribs.

- Among the cases showing injuries to skull and ribs, it is observed that injuries were mostly produced due to secondary impact or secondary injuries.
- Higher incidence of pelvic injuries was observed among pedestrians. Among these injuries it was observed that they were produced by vehicular runover after primary impact.
- Higher incidence of skeletal injuries to lower limbs were observed in drivers and occupants of four wheelers. It was also observed that they are mostly produced in a head on collision with the impact of steering wheel, dash board or front seat in case of an occupant.
- Higher incidence of brain injuries was observed in all categories of victim of road traffic accident.
- All cases of riders of bicycle were having brain injuries, along with crush injuries to head.
- Higher incidence of injuries to lungs, spleen and kidney was observed in drivers and occupants of four-wheeler which corresponds with higher incidence of skeletal injuries to pelvic and chest cavity observed in the above mentioned group.
- Incidence of brain injuries in the absence of external injuries was observed higher in the present study.
- Head injury as a cause of death was observed in majority cases of road traffic accident followed by multiple injuries as the second major cause of death.
- It was further observed that cranio-cerebral injuries were not the result of primary impact but due to secondary impact or secondary injuries or both. Multiple injuries involved all major visceral cavities with consistent findings between external injuries and related internal injuries causing failure of many organ systems resulting in immediate death.

Source of Funding: Nil

Conflict of Interest: None

Written Informed Consent: Not Required

Ethical Committee Clearance: No ethical issues involved

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Study of Co-relation between Hand length, Hand Breadth & Arm Span to Height

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ABSTRACT

Background: Stature being an important factor in identity, needs to be researched in depth. Height is a factor that is very reliable since it does not change over few days or weeks in adults like weight. To predict height in decomposed remains of a dead body where a Hand is recovered we need to see correlation of height to Hand length and derive a regression equation.

Material & Method: So, current study was undertaken at GMERS Medical College, Junagadh. Total 244 students were enrolled in study as per inclusion criteria. Their Height, Weight and other parameters were measured as per standard guidelines. The data so collected was digitized and analysed.

Statastical Analysis: Systat 13 software license version was used to derive correlation coefficient between Height to hand length, hand breadth and arm span. And Regression coefficient was used to derive formula of height from hand length, hand breadth & arm span

Results: Our study showed Male students have higher mean height than female students. Correlation between Height and arm span length was highest, followed by hand length and hand breadth.

Conclusion: There is strong positive correlation between height and hand length, hand breadth and arm span. So, Height can be predicted with some confidence if armspan, hand length or hand breadth is available.

Keywords: *Hand length, Hand breadth, Height, Co-relation*

INTRODUCTION

Height is an important factor of identification. It helps Autopsy surgeon to give a very reliable factor of identification since Height is better variable than weight of individual because height does not change erratically as weight can. In autopsies many times cases come to forensic departments where only limbs are sent for Post-mortem examination or where only remains of a decomposed dead bodies are sent for Post-mortem examination. In these cases, it becomes very important to predict the height of the individual to give direction to the police.

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So, the current study was undertaken at GMERS Medical College, Junagadh, where students of 1st and 2nd MBBS were enrolled in the study. Their Height, Weight, Hand length, Hand Breadth and Arm span were recorded to find out co-relation between these parameters and also to achieve a regression analysis equation of deriving height from Hand length, Hand breadth and arm-span.

AIMS & OBJECTIVES

1. To find out co-relation between Hand length, Hand breadth & arm-span to Height.
2. To derive a regression analysis formula for Height from Hand length, Hand breadth & arm-span.

MATERIAL & METHOD

For present study students of 1st and 2nd MBBS were enrolled based on inclusion and exclusion criteria.

Inclusion criteria:

1. Students willing to give written informed consent.
2. Students should not have any skeletal deformity.

Exclusion criteria:

Students not having inclusion criteria were excluded from study.

The students so selected were given information sheet, displaying the objectives, methods of the study and regarding the anonymity of their names for the study. They were given ample time to read, understand and ask any questions arising from the information sheet. They were explained that they can refuse to take part in the study, and there is no reward for joining the study.

Total 244 students gave consent for the study. Their Height was recorded in centimetres on standard Height measuring stand. Their Arm span was recorded in centimetres on 200cm long tape role. For Hand length left hand was placed on calibrated cardboard and length was measured from tip of middle finger or the longest finger to the centre point of inter styloid line. Hand breadth were measured at level of metacarpophalangeal joint with Biotech sliding calliper.

Results so collected were digitized in excel sheet and were analysed using Systat 13 software license version to derive co-relation co-efficient and regression analysis.

RESULTS

For total 244 subjects enrolled in the study, their Mean Age was 18.9 Years, Eldest being 23 years old and youngest being 17 years old. Total 46% were Females and 54 % Males.

Table no. 1 shows the analysis of the observations, for 128 Male students their mean Height was 165.40 cms with Standard deviation of 7.03. For Female students, their mean Height was 151.08 cms with standard deviation of 5.47. Mean Hand length for males was 18.52 cms, for females it was 18.25 cms. Mean hand breadth for males was 8.81 cms and for females it was 7.53 cms. Mean arm-span for males was 178.49 cms and for females it was 160.51 cms.

Table 1: Sex-wise Observations of Height, weight, hand length, hand breadth & armspan

		Height	Weight	Hand length	Hand Breadth	Arm-span
Males (total 128)	Mean	165.4	61.74	18.52	8.81	178.49
	SD	7.03	1.41	0.79	4.76	7.6
	Min	150	9.1	16.3	7.5	156
	Max	189	100.5	20.5	62.1	196
Females (total 116)	Mean	151.08	51.68	18.25	7.53	160.51
	SD	5.47	9.75	14.24	0.41	6.6
	Min	137	36	15.1	6.1	140
	Max	164	88.9	170.0	8.8	175

Table no. 2 shows Mean Mean $\pm$ SD and Correlation coefficient (r) for Hand-length, hand-breadth and arm span to height. Now here when value of correlation coefficient is near to 1 it means there is strong positive correlation. So, Correlation of Height and Armspan length has the best correlation followed by Hand length and then Hand breadth. Which means as Armspan increases the Height of the subject increases in more corresponding values compared to increase in Hand length and Hand breadth.

Table 2: Correlation coefficient & Mean ± SD for Height to Hand length, hand breadth and Armspan

Parameter	Mean $\pm$ SD	Correlation coefficient (r) for Height
Hand length	17.55 ± 1.14	0.801
Hand Breadth	7.90 ± 0.60	0.715
Arm Span Length	168.30 ± 11.08	0.920

Table no. 3 shows Regression equation to predict height based on Hand length, Hand breadth and Arm-span. Based on this formula, we can derive height of the individual if we have Hand length, hand breadth or arm span.

Table 3: Regression equations for deriving Height from Hand length, Hand Breadth & Armspan

	Regression Equation
Hand length	Height = 44.664 + (6.199) Hand Length
Hand Breadth	Height = 73.997 + (10.44) Hand Breadth
Arm Span Length	Height = 33.351 + (0.731) Arm span Length

DISCUSSION

In our study, for 128 Male students their mean Height was 165.40 cms with Standard deviation of 7.03. For Female students, their mean Height was 151.08 with standard deviation of 5.47. Mean Hand length for males was 18.52, for females it was 18.25. Mean hand breadth for males was 8.81 and for females it was 7.53. Mean arm-span for males was 178.49 and for females it was 160.51, strongest positive correlation of height was found with Arm span length (0.902), followed by Hand Length (0.801) and Hand Breadth(0.715).

The results of current studies were compared with earlier study. Most of the previous studies have shown results matching with the current study, barring a few were contrast results were noted.

A study by Mohanty *et al* on 505 healthy women of 20-29 years shows significant correlation between arm span and height of individual [(1)]. In study of Patel PN et al, Arm span showed the highest correlation with stature (r=0.908) followed by Hand length, followed by foot length. Hand Breadth showed the lowest degree of correlation (r=0.467) [(2)]. A study by Chikhalkar B. G. *et al* on 300 medical students (153 females and 147 males) in age group of 19-23 years shows significant correlation between stature and Hand length r=0.5902), hand width (r=0.6004) [(3)].

In study by Isurani et al Regression equation for stature estimation was derived as follows :

For male: Height = 103.732 + 3.493 (hand length). For females: Height = 93.689 + 3.625 (hand length). For both male and female (combined): Height = 60.807 + 5.637 (hand length) [(4)]. In our study, this is slightly different – Height = 44.664 + (6.199) Hand Length.

In Isurani et al the correlation coefficient was 0.58 for males and 0.59 for females which means not so good correlation of height to hand length when compared to our study where correlation coefficient for hand length to height is found 0.801 – which shows high correlation of hand length to height.

In Bhatnagar DP et al & Saxena AK et al also the correlation between Hand length to height was not so good when compared to our study [(5)] [(6)]. Agnihotri AK et al studied the correlation of height with both right & left hand and for both the sexes separately [(7)], he found more significant correlation of height with the Left-hand length.

Source of Funding: Nil

Conflict of Interest: None

Written Informed Consent: Taken

Ethical Committee Clearance: No ethical issues involved, Presented before IRB

CONCLUSIONS

- There is a strong positive correlation of Height to arm span, hand length and hand breadth.
- So, from hand length and hand breadth we can predict height of individual with fair confidence.
- However, further studies are required for sex specific correlations and correlation of right and left hand to see if handedness has any effect on the correlation of height to hand length.

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Rights and Responsibilities of the Patient in Health Care System

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ABSTRACT

Patient rights have come into the limelight ever since the Nuremberg trials post-World War II. Afterwards, great strides were taken to ensure there is an international consensus regarding human rights. Due to lack of education and awareness, many patients are still being wronged and cheated of their basic rights. Patients can demand better services and facilities, only when they have an understanding of their rights. The purpose of the study was to assess patients' awareness of their rights and responsibilities in association with health care. This study was a cross-sectional analysis. The research sample consisted of 400 individuals who have attended hospitals earlier for treatment purpose, including males and females of varied educational backgrounds. The data was gathered through questionnaires and analyzed by descriptive and analytical statistics. In this study, results indicated the awareness was not universal. Amongst the rights that were evaluated, individuals were most aware of their right to receive treatment in a safe and hygienic hospital environment. On the other hand there was minimal awareness of the right to access their medical records as well as the right to be informed about their disease and its progression. The study revealed a trend showing increased awareness with higher levels of education. Measures should be taken by the government as well as organizations to improve awareness levels in the lesser educated population. This will consequently improve the quality of health services. In addition, hospital development committees should take extra care during the implementation of these rights.

Keywords: *Rights and Responsibilities of the Patient, Health care system.*

INTRODUCTION

Health care, as a basic human right, was first enumerated in article 25 of the Universal Declaration of Human Rights 1948[6]. Patient care is a calling for attention and scrutiny as a human rights issue. A vast and severe range of human rights violations occur in the patient care context that violate patients' rights.

The Patient's Bill of Rights has been popularized in the USA by the American Hospital Association[5] and all these rights should apply to all patients, all over the world.

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Indian Constitution does not expressly recognize the fundamental right to health. However, Article 21 of the Constitution of India guarantees a fundamental right to life & personal liberty[7]. The expression "life" in this article means a life with human dignity & not mere survival or animal existence.

WMA Declaration of Lisbon[8] on the Rights of the Patient was also adopted by the 34th World Medical Assembly, Lisbon, Portugal in the year 1981 and amended by the 47th WMA General Assembly, Bali, Indonesia in September 1995. The Declaration represents some of the principal rights of the patient that the medical profession endorses and promotes. The main principle is to provide the right to medical care of good quality.

Patients' rights are varying in different countries and in different jurisdictions, often depending upon prevailing cultural and social norms. In India there is little awareness on the rights and responsibilities of the patients even amongst the educated community, therefore blatant violation of patient's rights is a routine

occurrence in this country. Patients in India are so used to being at the receiving end of medical care that they sometimes forget that they do have some rights and silently bear the sufferings without exercising their basic rights. Patients can demand services from the doctors when they know their legitimate rights.

A patient has the following fundamental rights:

1. World Medical Association Declaration of Helsinki[9] guidelines state that every patient has a right to be treated with reasonable care, skill and dignity without any discrimination**.** In addition, the International Convention on the Elimination of the Racial Discrimination, which was adopted in 1965 and entered into effect in 1969 emphasized the eradication of "racial discrimination in all its forms and to guarantee the right of everyone in regard to public health, medical care, social security without distinction as to race, color, or national or origin to equality before the law."
2. It is a fundamental right of a patient to choose his own doctor. Patients also have a right to refuse treatment. Declaration of Helsinki Article 22, states "the patient should be informed of the right to abstain from participation or to withdraw consent at any time without reprisal". While this is a right that may leave the patient at a disadvantage in case of serious conditions,
3. Confidentiality is a fundamental right in modern health care, in which the doctor cannot divulge details of the patient's condition to anyone. This right is supported by the Declaration of Helsinki, which states that sufficient precaution should be undertaken to protect the confidentiality of the patient's information by hospital authorities as well as healthcare personnel.
4. Patients have the right to be treated with privacy without access to third party at the time of examination. The World Health Organization's Genomic Resource Center of Patients' Rights[4] specifies that there is an international consensus about a patient's right to privacy and maintenance of integrity.
5. The Johns Hopkins Patient Bill of Rights[10] mentions the right to be discharged from a hospital, even against medical advice. It also specifies that patients have the right to be involved in planning their discharge.
6. The American Association of Physicians' Patient Bill of Rights[5] mentions the right of patients to be informed of full costs of any treatment procedure, including the extent of insurance coverage, and other deductibles.
7. Right to access to all available health services of the hospital. Article 3 of the European Charter of Human Rights[3] (ECHR) mentions that all individuals have the right to access information about their disease condition: "Every individual has the right to access to all kind of information regarding their state of health, the health services and how to use them, and all that scientific research and technological innovation makes available." The very next Article in the same charter states that the provision of this information is required prior to any procedure or treatment plan. In addition, Medical Council of India's Code of Medical Ethics[1] Chapter 2.3 ensures the right of the patient to be informed about his or her disease condition and prognosis by the doctor.
8. The right to take a second opinion**,** according to the Medical Council of India Code of Ethics Regulations[1] 2002, chapter 3.4.2, whenever a discrepancy arises between the patient and the physician, the patient has the right to consult another physician for opinion.
9. According to Article 9 ECHR, patients have a right to be treated in a safe environment, free from malpractice, errors, and poor facilities.
10. The World Health Organization Genomic Centre[4] mentions that there are four types of models of patient rights exercised within North America currently, in which the "paternalistic model" explains that the patient is allowed to be a part of the decision-making process with regards to his own treatment.
11. Right to give informed consent before any examination, investigation, and treatment. The ICMR Ethical Guidelines[2] states in its general principles that informed consent should be obtained prior to any treatment or research processes. The World Medical Association Declaration of Helsinki also mentions that "after ensuring that the subject has understood the information, the physician should then obtain the

subject's freely given informed consent preferably in writing."

12. According to the Medical Council of India's Code of Medical Ethics Regulation 2002, Chapter 1.3.2, patients have the right to retrieve Xerox certified copies of their medical records within 72 hours of request from the hospital.
13. Right to complain of grievances: according to Consumer Protection Act[11] of 1986, patients have a right to complain in any event of being wronged to the Consumer Protection Forum. Internationally, this right has also been elaborated in the 13th Article of ECHR.

A patient also has responsibilities when consulting a physician. Some responsibilities include: protection of the hospital environment and respecting the rights of other patients. Patient must cooperate with health providers for proper utilization of the system. Perhaps the most important of the list is to share all relevant information regarding their present and past health history. It is also of assumption that the patient must comply with and pay for the given treatment and rehabilitation procedures. These responsibilities are mentioned in the National Center for Biotechnology Information, US as patient duties as well as Johns Hopkins School of Medicine's Patient Bill of Rights.

AIM AND OBJECTIVE

The main objective of this study is to elucidate the knowledge of the patients of their own basic rights. Most patients seek medical services from the hospitals and clinics without knowing their rights, Patients can demand better services and facilities provided they are aware of their legitimate rights. This study will give information about the extent of knowledge and awareness on patient rights in the society and it will also help to improve the quality of health care in the country,

MATERIALS AND METHOD

A cross sectional study on "Rights and responsibilities of the patient in health care system" was conducted in Hyderabad and Ranga Reddy district area from 1st February 2016 to 31st January 2017. About 400 individuals of adult age group, including both male and female from different educational qualifications were selected from the patients who attended the hospital for treatment. The information was collected in the form of a questionnaire. The questionnaire was prepared based on the rights and responsibilities of the patient prescribed by Medical Council of India rules and regulations and WMA declaration on patient rights.

The questions were formulated in both English and the local Telugu language. The information was obtained from literate and illiterate individuals after taking informed consent. The participants' names were not disclosed in this study.

The following questions were asked in the form of yes or no.

Rights of the patient:

1. Right to be treated with reasonable care, skill and dignity without any discrimination by a health care provider.
2. Right to choose your own doctor freely.
3. Right to confidentiality of information about disease condition and treatment.
4. Right to refuse treatment at any time.
5. Right to get discharged from the hospital at any time, if you are not satisfied with their treatment
6. Right to access all available health services in the hospital.
7. Right to obtain a second opinion, whenever you deem it necessary.
8. Right to be fully informed of the cost of any medical procedure proposed, including extra costs associated with rehabilitation.
9. Right to obtain your case record Xerox copies from your doctor or hospital.
10. Right to be informed about disease and its progress.
11. Right to be examined and treated with privacy and dignity.
12. Right to receive treatment in a safe and hygienic hospital environment.
13. Right to be a part of decision making in any proposed treatment.
14. Right to give informed consent before any examination and procedure

15. Right to complain at consumer protection forum for compensation of any damages caused by the doctor or Hospital.

Responsibilities of the Patient

1. To care for and protect the environment of the hospital
2. To respect the rights of other patients and health providers.
3. To utilize the health care system properly and not to abuse it.
4. To provide relevant and accurate information to health care personnel.
5. To comply with the prescribed treatment and rehabilitation procedures.
6. To pay for the costs of the treatment.

The above details were taken into a data sheet for scientific analysis.

FINDINGS

A cross sectional study on rights and responsibilities of the patients in health care system was conducted in Hyderabad and Ranga Reddy district area of Telangana. The following observations were found:

1. Every patient has a right to be treated with reasonable care, skill and dignity without any discrimination. Our study showed that 83% of illiterates and 96% of literates were aware of this right.
2. It is a fundamental right of a patient to choose his own doctor. Our study revealed that 65% of illiterates and 94% literates were aware of this right. Patients also have a right to refuse treatment at any time after admission into the hospital In our study 80% of literates were aware, where as 64% of illiterates were not aware of this right.
3. Confidentiality is an important ethical clause of human rights organizations throughout the world. Our study showed that 75% of illiterates were unaware, whereas 84% of literates were aware of the right to confidentiality.
4. Privacy of the patients should be maintained during their stay in the hospital especially during clinical examination. Our study showed that 61% of illiterates and 80.3% of literates were aware of their right to privacy.
5. Every patient has the right to get discharged from the hospital at any time after admission if not satisfied with the treatment. Our study shows that 40% of illiterates and 80% of literates were aware of this right.
6. Right to access all available health services in a hospital. Our study shows that 81% of illiterates and 93.6% of literates were aware of this right.
7. Every patient has the right to know the approximate cost of the treatment before commencement. Our study showed that 40% of illiterates and only 12.4% of literates were not aware of their right to know the estimated costs of the treatment.
8. Right to access information about their disease condition. Study revealed only 11% of illiterates and 70% of literates were aware of this right.
9. Right to obtain a second opinion, whenever deemed necessary: 73% of illiterates and 91.3% of literates were aware of this right.
10. Right to be treated in a safe environment, free from malpractice, errors, and poor facilities. Our study showed that 90% of illiterates and 96.6% of literates were aware of this right.
11. The patient is allowed to be a part of the decision-making process with regards to his own treatment. Our study showed that 50% of illiterates were not aware whereas 90% of literates were aware of this right.
12. The physician should obtain voluntarily and freely given informed consent preferably in writing before starting of any procedure. In our study 56% of illiterates and 90% literates were aware of this right.
13. Patient or their relatives can obtain certified copies of the medical records for insurance and other medico legal purposes. Our study showed that 85% of illiterates were unaware, whereas 54% literates were aware of this right.
14. Right to complain of their grievances at consumer forum and ask for compensation in any case of injury or damage caused by treatment: Study revealed that 52% of illiterates and 79% literates were aware of this right.

Responsibilities of the Patient: In addition to their basic rights, patients also have some responsibilities to improve the environmental hygiene and quality of health care. We found the following observations.

1. To care for and protect the environment of the hospital is very much essential for quality of care. 89% illiterates and 99.3% literates are well aware of this responsibility.
2. To respect the rights of other patients and health providers. We found that, 95% illiterates and 99% literates are well aware.
3. To utilize the health care system properly and to not abuse it. We found that 88% illiterates and 97% literates are well aware.
4. To provide relevant and accurate information to health care personnel. Our study reveals that 97% illiterates and 98% literates are well aware.
5. To comply with the prescribed treatment and rehabilitation procedures and to pay for the costs of the treatment. We found that 100% of both literates and illiterates are aware.

CONCLUSION

The awareness on patient's rights and responsibilities among literate individuals is much better when compared with illiterates. Education is an important tool for the enlightenment of individual to acquire knowledge and wisdom. Poor awareness among illiterate community is due to lack of education. The awareness on patient's rights in this study was not satisfactory, similar results were also noticed in other studies conducted within and outside India. Health care organizations should provide proper information at community level. Hospital development committee's must supervise and monitor on patients rights in every hospital. This will consequently improve the quality of health services.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Approved

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Liability for Medical Negligence Under Consumer Protection Act. 1986

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ABSTRACT

In this work it is proposed to critically examine existing legal framework and specifically the response of the judiciary to the interpretation of medical negligence with respect to consumer protection law. There were questions about the applicability of the consumer protection act to the medical professionals. And those questions are determined by the judiciary. The term 'Service' is interpreted and applied to determine the liability of different categories of medical professionals.

Keywords: *Consumer Protection Act, Service, Medical Profession*

INTRODUCTION

Corporatization and commercialization of medical profession has made it like any other business and the medical profession is increasingly being guided by the profit motive rather than that of service. Such a situation gave rise to unethical practices and negligence. When profit motive comes to the force, service to the patients takes place as last row. Today the concept has changed into service for fee coupled with increased the awareness of rights as consumers by the patients. Therefore, if there is a rashness or negligence on the part of the doctor while treating a patient he is being made liable under the Consumer Protection Act, 1986.[1]

MATERIAL AND METHOD

This work is made with the help of literature survey. Methodology included is analytical method. For my sources I depended mainly on primary material specifically court judgments this is because judiciary has a great impact in shaping laws relating to medical negligence in India. Secondary sources I intend to be sort to include books and articles. In this work OSCOLA 4th edition will be used for citations.

Liability For Medical Negligence Under Consumer Protection Act, 1986

The Consumer Protection Act was enacted in December 1986 and came into force on December 24th 1986. It was enacted to protect the consumers from exploitation.

Section 2 (vi) (d) of the Consumer Protection Act provides that –

«Consumer» means any person who—

(i) buys any goods for a consideration which has been paid or promised or partly paid and partly promised, or under any system of deferred payment and includes any user of such goods other than the person who buys such goods for consideration paid or promised or partly paid or partly promised, or under any system of deferred payment when such use is made with the approval of such person, but does not include a person who obtains such goods for resale or for any commercial purpose; or

(ii) hires or avails of any services for a consideration which has been paid or promised or partly paid and partly promised, or under any system of deferred payment and includes any beneficiary of such services other than the person who 'hires or avails of the services for consideration paid or promised, or partly paid and partly promised, or under any system of deferred payment, when such services are availed of with the approval of the first mentioned person **but does not include a person who avails of such services for any commercial purposes**;

Explanation: For the purposes of this clause, "commercial purpose" does not include use by a person of goods bought and used by him and services availed by him exclusively for the purposes of earning his livelihood by means of self-employment.?

The term "Service" under section 2 (1) (o) this is as under:

It means "service of any description which is made available to potential users and includes the provision of facilities in connection with banking, financing, transport, processing, supply of electrical or other energy, board or lodging or both, entertainment, amusement or the purveying a news or other information, but does not include the rendering of any service free of charge or under a contract of personal service."

Corporatization and commercialization of medical profession has made it like any other business and the medical profession is increasingly being guided by the profit motive rather than that of service. Such a situation gave rise to unethical practices and negligence. When profit motive comes to the force, service to the patients takes place as last row. Today the concept has changed into service for fee coupled with increased the awareness of rights as consumers by the patients. Therefore, if there is a rashness or negligence on the part of the doctor while treating a patient he is being made liable under the Consumer Protection Act, 1986[2] Here a question arises whether the service provided by the Doctors and Consumers comes under the ambit of Consumer Protection act?

The first case relating to the application of the Consumer Protection Act is Vasantha P. Nair v. Smt. V.P. Nair[3], in this case it was held that "patient is a 'consumer' and the medical assistance was a 'service' and, therefore, in the event of any deficiency in the performance of medical service the consumer courts can have the jurisdiction. It was further observed that the medical officer's service was not a personal service so as to constitute an exception to the application of the Consumer Protection Act. When the consumer protection was held to be applicable in case of liability of the medical professionals it was argued by the doctors that due to judicial scrutiny doctors may be affected while making treatment.so controversy arose whether the Consumer Protection Act,1986 to be applied to medical professionals or not?

In the case of Indian Medical Association v. V.P. Shantha and Ors[4], the apex court has put an end to this controversy and has held that patients aggrieved by any deficiency in treatment, from both private clinics and Government hospitals, are entitled to seek damages under the Consumer Protection Act, 1986.

It was observed that "The definition of `service' in Section 2(1) (o) of the Act can be split up into three parts - the main part, the inclusionary part and the exclusionary part. The main part is explanatory in nature and defines service to mean service of any description which is made available to the potential users. The inclusionary part expressly includes the provision of facilities in connection with banking, financing, insurance, transport, processing, supply of electrical of other energy, board or lodging or both housing construction, entertainment, amusement or the purveying of news or other information." The exclusionary part excludes rendering of any service free of charge or under a contract of personal service. After pointing out that the said definition is in three parts, the Court has observed that "The main clause itself is very wide. It applies to any service made available to potential users. The words `any ' and `potential' are significant. Both are of wide amplitude. The word `any' dictionary means; one or some or all', In Black's Law Dictionary it is explained thus, "word `any' has a diversity of meaning and may be employed to indicate `all' or `every' as well as `some' or `one' and its meaning in a given statue depends upon the context and the subject- matter of the statute". The use of the word `any' in the context it has been used in clause (o) indicates that it has been used in wider sense extending from one to all. The other word `potential' is again very wide. In Oxford Dictionary it is defined as `capable of coming into being, possibility'. In Black's Law Dictionary it is defined "existing in possibility but not in act. Naturally and probably expected to come into existence at some future time, though not now existing; for example, the future product of grain or trees already planted, or the successive future installments or payments on a contract or engagement already made." In other words, service which is not only extended to actual users but those who are capable of using it are covered in the definition. The clause is thus very wide and extends to any or all actual or potential users."

A few important principles laid down in this case include:

1. Service rendered to a patient by a medical practitioner (except where the doctor renders service free of charge to every patient or under a contract of personal service) by way of consultation, diagnosis and treatment, both medicinal and surgical, would fall within the ambit of "service" as defined in section 2(1) (o) of the C.P. Act.
2. The fact that medical practitioners belong to medical profession and are subject to disciplinary control of the Medical Council of India and, or the State Medical Councils would not exclude the service rendered by them from the ambit of C.P. Act.
3. The service rendered by a doctor was under a contract for personal service rather than a contract of personal service and was not covered by the exclusionary clause of the definition of service contained in the Consumer Protection, Act.
4. A service rendered free of charge to everybody would not be service as defined in the Act.
5. The hospitals and doctors cannot claim it to be a free service if the expenses have been borne by an insurance company under medical care or by one"s employer under the service conditions.

In A.S Mittal v. State of UP, [5] patients who were operated in an eye camp organized by the Govt. of Uttar Pradesh and as a result of such surgery lost their vision. the detailed facts are The Lions Club. Pottery Town at Khurja in Uttar Pradesh arranged and conducted, as part of its social service programme, an "Eye-Camp" intended to extend facilities of expert Ophthalmic surgical services to the residents of the town. The Club invited Dr. R.M. Sahay of the Sahay Hospital, Jaipur and his team of doctors to offer the surgical services. The Camp was arranged in 'Aggarwal Dharamshala' at Novelty Road, Khurja. Dr. R.M. Sahay and his team of doctors and para-medical stiff, Who arrived in Khurja on 21st April, 1986, examined about 122 patients. One hundred and eight patients were operated upon, 88 of them for Cataract which, with the modern advances in Ophthalmic Surgery, is considered a relatively minor and low-risk surgery. Dr. Sahay left Khurja that evening for Moradabad where he was scheduled to conduct similar operations at another "Eye-Camp."But the whole programme at Khurja, however laudable the interactions with which it might have been launched, proved a disastrous medical misadventure for the patients. The operated-eyes of the patients were irreversibly damaged, owing to a post- operative interaction of the Intra Ocular Cavities of the operated eye. It was held by the Supreme Court that though the service rendered free of charge to the patients, but state has paid on behalf of the patients so, in this case the doctors are coming under the purview of Consumer Protection of Act.

In Kishori Lal v. E.S.I Corporation, [6] the appellant was insured with the ESI Corporation and deductions were made from his salary by the employer and deposited with the ESI Corpn. The appellant"s wife was admitted in ESI dispensary at Sonepat for treatment of diabetes, where her condition deteriorated and who later was examined in a private hospital. There it was found that she was wrongly diagnosed at ESI dispensary. The appellant alleging deficiency in service filed a complaint under CPA. The Supreme Court in revision petition held that „services rendered by medical practitioners of hospitals / nursing homes run by ESI Corporation cannot be regarded as service rendered free of charge since sections 39 and 42 of the ESI Act contemplate contributions from both the employer and the employee, which can be deemed to be fee for the service. Thus wife of the complainant was considered to be the consumer under the CPA 1986.

It can be argued that the consumer-service provider relationship between doctor and patient enhances the worsening the relationship. As the application of Consumer Protection act the scope of jurisdiction of court is more widened, as a result there are more chances of filing of false and frivolous cases against doctors to harass them, doctors will play safe while dealing with the patients and it will harm the effective treatment of patients. So it affects the relationship in a whole between doctors and patients.

In the case of Samira Kohli Vs.Dr. Prabha Manchanda and Anr.[7]

The appellant, an unmarried woman aged 44 years, visited the clinic of the first respondent (for short 'the respondent') complaining of prolonged menstrual bleeding for nine days. The respondent examined and advised her to undergo an ultrasound test on the same day. After examining the report, the respondent had a discussion with appellant and advised her to come on the next day for a laparoscopy test under general anesthesia,

for making an affirmative diagnosis. Accordingly,the appellant went to the respondent's clinic with her mother. On admission, the appellant's signatures were taken on (i) admission and discharge card; (ii) consent form for hospital admission and medical treatment; and (iii) consent form for surgery. The Admission Card showed that admission was 'for diagnostic and operative laparoscopy. The consent form for surgery filled by Dr. Lata Rangan (respondent's assistant) described the procedure to be undergone by the appellant as "diagnostic and operative laparoscopy. Laparotomy may be needed". Thereafter, appellant was put under general anesthesia and subjected to a laparoscopic examination. When the appellant was still unconscious, Dr. Lata Rengen, who was assisting the respondent, came out of the Operation Theatre and took the consent of appellant's mother, who was waiting outside, for performing hysterectomy under general anesthesia. Thereafter, the Respondent performed a abdominal hysterectomy (removal of uterus) and bilateral salpingo-oopherectomy (removal of ovaries and fallopian tubes). The appellant left the respondent's clinic without settling the bill. It was held that "In view of our finding that there was no consent by the appellant for performing hysterectomy and salpingo-oopherectomy, performance of such surgery was an unauthorized invasion and interference with appellant's body which amounted to a tortuous act of assault and battery and therefore a deficiency in service. But as noticed above, there are several mitigating circumstances."

CONCLUSION

However the doctors and medical professionals can be liable under the consumer protection law. The service provided by the medical professionals and doctors came under the ambit of the consumer protection law. So the service provided by the doctor to the patient connotes the same nature of service which is described in the Consumer Protection Act, 1986. It can be seen that it is more preferable to go to the consumer forum than the civil courts as the consumer forum disposes matter expediously.

Ethical Clearance: Taken and approved by the National Law University Odisha as it is a part of partial fulfilment of Masters of Law Degree i.e LLM.

Source of Funding: Self

Conflict of Interest: Nil

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Profile of Medico-legal Cases Admitted in the Department of Emergency F.H.M.C., Tundla, Uttar Pradesh

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ABSTRACT

Significance of looking into the demographic profile of the medicolegal cases in an area lies in the fact that the strategies may be devised and steps could be taken by health care and law enforcement agencies to control or prevent such cases. Considering the importance of profiling of medico legal cases, this retrospective study was undertaken to analyse the pattern and magnitude of the cases admitted in the casualty section of FHMC, Etmadpur, Agra which is situated on National Highway-2 over a period of three years starting from September 2014 to August 2017. The study showed that the road traffic accidents (61.13%) constituted the most number of medicolegal cases out of a total 247, followed by poisoning (23.08%) and burn (7.29%). Males (81.44%) were most affected and most of the victims were in the age group of 16-30 years (52.23%). Most of the cases reported in the casualty between 08:00 am and 04:00 pm and the summer months (39.27%) witnessed maximum number of cases.

INTRODUCTION

Medical personnel's have to deal with a significant number of medical cases in the emergency section with legal implications associated with them like injury, assault (both physical and sexual), poisoning or deaths due to accidents etc. Such cases are an integral part of medical practice and are termed as medicolegal cases (MLC) which more appropriately can be defined as "a case of injury or illness where the attending doctor, after eliciting history and examining the patient, thinks that some investigation by law enforcement agencies is essential to establish and fix responsibility for the case in accordance with the law of the land" [(1)] [Dogra TD, Rudra A Lyon's].

Profiling of medicolegal cases is an important aspect for the prevention of preventable casualties in future and to study the crime rate in an area [(2,3)]. The present endeavor aims to study the frequency and pattern of such cases to help the administrators, health care officials, law enforcement agencies and social scientists devise strategies to tackle with and minimize the menace in the society. Agra is a big city and one of the top destinations for tourist in India. F H Medical College is situated about 15 Km from Agra city and is on National Highway 2 (NH-2) which connects Agra to Kanpur city another big city in India. Large volume of traffic, including a heavily loaded trucks to cars, bikes, cycles and pedestrian is flowing throughout the day and round the year. This heavy traffic is a constant threat to human morbidity and mortality.

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MATERIAL AND METHOD

Total number of cases presented in the emergency section of the hospital, which needed medicolegal evaluation were included in the study during the period September 2014 to August 2017. All the medicolegal cases registered were evaluated on predesigned pro forma which included various factors such as age, sex, type and time of arrival.

The patients who got their medicolegal work done at some other centre and referred to this centre for further management were not included in the study.

OBSERVATIONS AND RESULTS

Table 1: Causes of Medicolegal cases

Types cases	Cases	Percentage (%)
Injury/violence (assault)	15	6.07
RTA	151	61.13
Burn	18	7.29
Hanging	6	2.43
Poisoning	57	23.08
Total	247	100

During the span of 3 years September 2014 to August 2017 the total number of 247 medico-legal cases presented in the emergency section of the hospital. Road traffic accident (RTAs) was the leading cause of medico-legal cases (151 i.e. 61.13%) followed by 57 poisoning (23.08%) and 18 burn cases (7.29%). Least number of cases, i.e. 6 cases were of hanging (2.43%). (Table 1)

Table 2: Age Distribution

Age (years)	Cases (N)	Percentage (%)
0-15	30	12.15
16-30	129	52.23
31-45	52	21.05
46-60	29	11.74
61-75	7	2.83
Total	247	100

The highest number of the cases were between 16-30 years of age, i.e. 129 cases (52.23%) followed by between 31-45 years of age, i.e. 52 cases (21.05%) and then 0-15 years of age, i.e.30 cases (12.15%). Number of medico-legal cases seen among the age group of 61-75 years were least in number (2.83%). (Table 2)

Table 3: Sex Distribution

Sex	Cases	Percentage (%)
Male	187	81.44
Female	60	18.56
Total	247	100

Males presented more i.e. 187 cases (81.44) in number than females, i.e. 60 cases (18.56%). (Table 3)

Table 4: Arrival at Casualty

Time	Cases	Percentage (%)
08 am -04 pm.	114	46.15
04 pm -12 am.	87	35.22
12 am. -08 am.	46	18.62
Total	247	100

114 cases arrived at the casualty between 08:00 a.m. to 04:00 p.m. (46.15%) followed by 87 cases between 04 p.m. to 12:00 p.m. (35.22%) and 46 cases in between and 12:01 a.m. to 08:00 a.m. (18.62%). (Table 4)

Table 5: Month wise Distribution

Months	Cases	Percentage (%)
January	18	07.29
February	23	09.31
March	39	15.79
April	27	10.93
May	17	06.88
June	14	05.67
July	09	03.64
August	20	08.10
September	15	06.07
October	21	08.50
November	25	10.12
December	19	07.69
Total	247	100

Table 6: Seasonal Distribution

Seasons	Cases	Percentage (%)
Summer(March- June)	97	39.27
Rainy(July-October)	65	26.32
Winter (November-February)	85	34.41
Total	247	100

The month of March witnessed maximum number of cases, i.e. 39 (15.79%) followed by April i.e. 27 cases (10.93%) and then November i.e. 25 cases (10.12%). Minimum number of cases were seen in the months of July i.e. 9 cases (03.64%) over a period of three years. (Table 5). Maximum number of cases presented in the summer season, i.e. 97 cases (39.27%) followed by 85 cases in winter (34.41%) as compared to 65 cases in rainy season (26.32%). (Table 6)

DISCUSSION

Total 247 medicolegal cases were admitted in the emergency section during the period of three years, i.e. from September 2014 to August 2017. Road traffic accidents (RTA) contributed maximum number of cases, i.e. 151 (61.13%) followed by 57 (23.08%) poisoning

cases, 18 (7.29%) cases were of burn and 15 (6.07%) cases of assault. *Trangadia Mahesh M et al [2] and Yatoo GH et al [3]* also reported RTAs to be the most common type of medicolegal cases in their study. Road traffic accidents seems to be the most common type of medicolegal cases in most of the studies conducted in different parts of India[4 & 5].

The location of the medical college by the NH-2 in India and the adjoining area is mostly farming land. Heavy traffic flows through the highway and commonly injured people are farmers living in the nearby area. Most accidents happen during the peak hour of traffic flow, i.e. morning and afternoon time. Mostly pedestrian and bikes get struck by heavy vehicles like trucks, tractors, buses and lorries. Such a high occurrence of RTAs in our study may be explained by the fact that India, in the last few decades, has undergone rapid urbanization, motorization, and industrialization along with proportionately high population growth. So all these factors combined with poor road conditions and an utter disregard for the traffic rules and safety measures have contributed to the menace.

In contrast the cases of poisoning hold second place in the number of occurrences where as physical assault (violence) is the second most common type of MLCs in most other studies [2 - 6]. Even a few studies showed an entirely different trend, like physical assaults being on top [7] at one place, or in an another study it was the poisoning [8] that came out to be the leading cause. As far as high incidence of poisoning cases is concerned, it may be due to the hospital imparting its services to a significant number of patients from surrounding rural areas. Agricultural poisons such as organophosphorus and aluminium phosphide are easily available in the farming sector, most cases reported are suicidal in nature followed by accidental exposure, homicidal incident is rare.

The majority of the victims (81.44%) are males in this study that almost coincides with all the studies [2 - 6]. Males as compared to females are more actively involved in various outdoor activities. Developing countries like India the vehicle driving is mostly done by males and females are mostly the pillions. Males are again involved in hard physical labour and sometimes assaults. This all leads to a cumulative increase in the number of male victims of injuries.

Most productive age groups which is 16-30 years (129 i.e. 52.23%) is having maximum number of injuries and presented medico legally followed by 31-45 years of age (52 i.e. 21.05%). These figures are in agreement with most of the studies. [2, 3, 7, 9-11] this again shows that 16 to 45 years of age group is more physically active outdoor and are susceptible to more injuries and form more medicolegal cases than the rest of the population.

Most of the cases in the emergency section arrived in the morning and afternoon i.e. between 08:00 a.m. to 04:00 p.m. (46.15%) followed by evening time, i.e. 04:00 p.m. to 12:00 a.m. (35.22%) which is consistent with other studies [2,9]. The daytime hours, i.e. from 08:00 a.m. to 04:00 p.m. has the maximum activity of the day on the roads, in the markets, or at workplaces etc. and that explains the maximum admission of MLCs during day timings.

Summer season (March to June) witnessed maximum number of cases (39.27%) followed by winter season, i.e. from November to February (34.41%) in this study. This finding coincides with the study conducted by Mir M Sarwar et al [6] and Siddharth timsinha et al [12]. Probably summer season is comparatively more active period of the year, as apart from industrial activity, farming activity also increases as there is a wheat harvesting season and a rice sowing season.

CONCLUSIONS & RECOMMENDATIONS

The present study reinforces the findings of previous studies where RTA and poisoning cases continued to top of the list of medicolegal cases. Males and younger age individuals are more commonly affected. The study provides an insight into the problem, valuable data and information for health care individuals, law enforcement agencies, social workers and NGOs working to devise strategies to address the problem.

The exposure to medicolegal cases in casualties of tertiary care centres is a daily routine, around the clock availability of Forensic experts is a must. In fact, establishment of the medicolegal unit in all the emergency section or trauma units is a necessity of the hour. The doctors handling medicolegal cases need to be efficient and trained.

Improvement of roads and traffic control system and proper education of the masses regarding public safety are the few domains needed to be addressed systematically and strategically by drafting effective policies and their implementation by government and non-government organizations.

- There is no conflict of interest among authors and funding source involved.
- This paper has got all ethical clearance from the existing body of the college.

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Profile of Various Thermal Injury Deaths Across the Three Genders in North Maharashtra

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ABSTRACT

Thermal (heat) burns occur when some or all of the cells in the skin or other tissues are destroyed by: hot liquids (scalds) hot solids (contact burns) or flames (flame burns). In India, over 1,00,0000 people are moderately or severely burnt every year. The incidence and circumstances of death due to thermal injuries differ significantly amid the three genders including the third sex of transgender. Present study analyses profiles of different thermal injury deaths during the entire one year period of 2016 at North Maharashtra's only Govt. Medical College. Data obtained from medico-legal autopsy reports, inquests, panchanamas, hospital treatment records of the dead, etc. Out of the 136 thermal injury death victims observed in the year, female predominance clearly noted with 98 (72.05%) deaths, followed by 37 (27.20%) male and one (00.73%) transgender deaths. We observed most numbers of dead across various parameters, such as 109 (81.36%) victims been married, 83 (61.03%) cases had septicemia as cause of death, 86 (63.23%) deaths were accidental in manner, 116 (85.29%) cases sustained flame type of thermal injury among whom 76 (55.88%) incidences involved kerosene as an inflammable material, 69 (50.73%) victims survived for 3–7 days after sustaining thermal injuries; and in 73 (53.67%) cases, including the transgender, dying declarations were recorded. Deaths of the recently recognized third gender, transgender, is still under reported and scarcely studied till the date.

Keywords: *Thermal, Injury, Female, Transgender, Survival, Dying declaration.*

INTRODUCTION

Burns are a global public health problem, accounting for an estimated 1,80,000 deaths annually. In India, over 1,00,0000 people are moderately or severely burnt every year.[1] Thermal (heat) burns occur when some or all of the cells in the skin or other tissues are destroyed by: hot liquids (scalds) hot solids (contact burns), or flames (flame burns).[1] Injuries caused by friction, lightning, electricity, ultra-violet or infra-red light rays, X-rays and corrosive chemical substances are all classified as thermals for medico-legal purposes.[2] The incidence and circumstances of death due to thermal injuries differ significantly amid the three genders including the third sex of transgender. Besides, the epidemiology and etiological factors of burn injury deaths vary in different communities and at different regions. This study analyses these multiple factors of the thermal injury deaths among all the three genders in North Maharashtra region for the very first time.

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MATERIAL AND METHOD

SBH Govt. Medical College, Dhule is the only Govt. Medical College among all the four districts of North Maharashtra region which provides tertiary medical care across all the medical specialties. It caters most of the referral cases from these districts. During the entire one year period of 2016, total 1181 medico legal autopsies were carried out by the teaching faculties of Department of Forensic Medicine and Toxicology of the Govt. Medical College. Out of the 1181 autopsies conducted during this one year period, different types of thermal injury deaths constituted 136 cases making them one

of the major causes of unnatural deaths. Retrospective analysis of all these unnatural thermal injury deaths of the one year duration across all three genders is made in this study.

Data of cause of death and type of thermal injury sustained is sorted from the autopsy reports. Data related to age, marital status, manner of death, inflammable substances involved in the thermal injury incidences and whether dying declarations taken is obtained from the respective cases' police inquest, panchnama and other available record, if any. Dying declaration recording status also confirmed from their clinical records. Information of whether brought dead or hospital admitted with duration of survival after sustaining thermal injuries is obtained from the clinical records of the victims.

OBSERVATIONS AND RESULTS

Out of the 1181 autopsies conducted at the medical college in year 2016, total 136 (11.51%) deaths were due to various types of thermal injuries, recorded in all the three genders. The multifactorial profiles of these thermal injury deaths is analyzed and presented in tabular forms below.

Table 1: Age and sex wise distribution of all thermal injury deaths

Age Group	Females	Males	Transgender	Total
1 – 10 Years	04	02	00	06 (04.41%)
11–20 Years	11	01	00	12 (08.82%)
21–31 Years	30	04	00	34 (25.00%)
31–40 Years	30	12	00	42 (30.88%)
41–50 Years	11	08	01	20 (14.70%)
51–60 Years	05	06	00	11 (08.08%)
61–70 Years	07	03	00	10 (07.35%)
71–80 Years	00	01	00	01 (00.73%)
Total	98 (72.05%)	37 (27.20%)	01 (00.73%)	136

Maximum of thermal injury deaths 42 (30.88%) observed in the age group of 31 to 40 years, also reflected in male and female genders. The youngest victim was only 09 years old boy who suffered accidental firecracker burns. The oldest victim was a male having age of 71 years who suffered accidental burns over his right lower limb due to hot bike silencer. The oldest victim survived for four days after sustaining the thermal injuries.

Females were the predominant victims, 98 in number constituting 72.05% cases in all the thermal injury deaths in comparison to the 37 male victims comprising 27.20% of the dead. The only transgender victim was of 45 years old contributing 00.07% of all the deaths.

Table 2: Marital status of the dead

Marital Status	Females	Males	Transgender	Total
Married	79	30	00	109 (81.36%)
Unmarried	14	06	01	21 (15.44%)
Widowed	05	01	00	06 (04.41%)

Most of the thermal injuries death victims were married 109 out of the 136 (81.36%). 21 dead (15.44%) were unmarried. Only 6 out of the 136 (04.41%) were widowed.

Table 3: Cause and manner of death among the dead

Cause of death	Females	Males	Transgender	Total
Hypovolemic Shock	37	16	00	53 (38.97%)
Septicemia shock	61	21	01	83 (61.03%)

Contd…

Manner of death				
Accident	66	19	01	86 (63.23%)
Suicide	20	16	00	36 (26.47%)
Homicide	04	01	00	05 (03.67%)
Not known	08	01	00	09 (06.61%)

61.03% deaths were due to septicemia while remaining 38.97% deaths were due to hypovolemic shock due to sustaining thermal injuries. Majority, 86 out of the 136 (63.23%) thermal injuries deaths, were accidental in nature. Suicide and homicide manners were reported in 36 and 5 cases respectively. In 9 cases, exact manner of death could not be known.

Table 4: Types of thermal injuries and the accused inflammable materials

Types of thermal injuries	The accused inflammable materials	Females	Males	Transgender	Total
Flame burns	Kerosene	52	23	01	76 (55.88%)
	Gas	11	03	00	14 (10.29%)
	Chulha & Shekoti	17	02	00	19 (13.97%)
	Petrol & Diesel	00	03	00	03 (01.47%)
	Firecracker burns	01	01	00	02 (01.47%)
	Miscellaneous	01	01	00	02 (01.47%)
Scald Burns	Hot water	02	01	00	03 (02.20%)
Electric Burns	Electric current burns	01	01	00	02 (01.47%)
Not known		13	02	00	15 (11.02%)

Flame burns due to dry heat produced by different inflammable substances is the most common observed type of thermal injuries with 116 victims out of the 136 (85.29%). 76 cases (55.88%) involved kerosene as an inflammable material, most of these reported as accidental incidences of kerosene stove blasts and wearing cloths caught getting fire while cooking; few cases reported as suicides by self-pouring of kerosene and less commonly informed as homicide burns. 19 death incidences involved chulha and shekoti which include dried branches of trees and grass etc. Burns involving shekoti had one female and two male victims. 14 cases had incidences with liquid petroleum gas, mostly informed as accidental cases while working with LPG gas burners at kitchens.

Three incidences involving petrol-diesel include one case of accidental diesel tank blast, one case of suicidal self-petrol pouring, and third case was of homicide involved petrol pouring and ignition by others. Fall of hot water causing scald type of thermal injuries observed in three cases. One miscellaneous material flame burn case of female sustained thermal injuries due to fall of edible oil lamp on her cloths while doing *Pooja*. Another miscellaneous material flame burn case of male sustained bike silencer contact burns. In 15 thermal injury deaths, exact nature of the culprit inflammable material could not be known.

Table 5: Duration of survival of the victims after sustaining thermal injuries

Duration of survival	Females	Males	Transgender	Total
Brought dead	08	01	00	09 (06.61%)
Within 24 hours	16	11	00	27 (19.85%)
1-2 days	06	02	00	08 (05.88%)
3-7 days	46	22	01	69 (50.73%)

Contd…

8-10 days	11	01	00	12 (08.82%)
11-20 days	08	00	00	08 (05.88%)
21-30 days	01	00	00	01 (00.07%)
31-40 days	01	00	00	01 (00.07%)
41-100 days	01	00	00	01 (00.07%)

Maximum number of victims 69 (50.73%) survived for 3–7 days after sustaining thermal injuries. Nine victims (06.61%) brought dead and 27 (19.85%) succumbed to death within 24 hours of infliction of the injuries. The longest survival period of 91 days is observed in a female.

Table 6: Dying declarations taken during the survival period of the dead

Dying declarations	Females	Males	Transgender	Total
Taken	47	25	01	73 (53.67%)
Not taken	44	12	00	56 (41.17%)
Not known	07	00	00	07 (05.14%)

Dying declaration recorded in females in 47 out of the 98 cases (47.95%), in 25 male victims out of the 37 (67.56%) and the single transgender got their dying declaration recorded.

DISCUSSION

The incidence and circumstances of thermal injury deaths vary according to the gender. Kumar V[3] states that the incidence of burnt wives, whether suicidal, homicidal or accidental, has become endemic to Indian society. The reasons for this endemic are manifold like dowry, marital infidelity, sexual jealousy, and oedipal dominance of mother in-law over the grooms, etc.[3] As per the key facts by WHO[1], children and women are usually burned in domestic kitchens, from upset receptacles containing hot liquids or flames, or from cook stove explosions.

Most of the male thermal injury deaths involve different types of accidental circumstances and in very few cases, the circumstances reported as suicidal or homicidal. WHO[1] reveals that men are most likely to be burned in the workplace due to fire, scalds, chemical and electrical burns.

The incidence of reporting of deaths as well as carrying out medico legal autopsies for trans genders is very rare due to the still prevalent social taboos, despite the fact that the gender is recognized as 'third gender' by the honorable Supreme Court of India in 2014. In our study we observed only one transgender victim of thermal injury out of the 136 deaths due to thermal injuries. None of the referenced studies here observed any case of transgender victim. Incidence of dominant predisposition of female gender to thermal injury deaths, 98 out of 136 deaths (72.05%) as observed in this study is also reflected in other studies [4,5,6,7,8].

We observed maximum number of 42 (30.88%) deaths in the age group of 31 – 40 years followed by 34 (25.00%) deaths in the age group of 21 – 30 years and the least number cases, actually the alone case in 71 – 80 years. Mishra PK et al[4] found maximum number of burn injury deaths in between 21-30 years i.e. 43 cases (45.3%), followed by 30 cases (31.6%) in 31-40 years and least number of single case in 61 – 70 years group. Gupta R et al[5] noted maximum number of the victims (59.6%) in age group of 15 to 30 years, with the least number in the age groups of ≥ 45 years and ≤15 years i.e. 5.6 % cases in each group. Pawar V et al[6] found maximum 108 (31.03%) cases in 20 - 29 years age group, followed by 82 (23.56%) deaths in 30 – 39 years age group. They found least 26 (7.47%) deaths in more than 70 years old. Tomar J et al[7] found maximum deaths in 21 – 30 years, followed by 31 – 40 years age group. The minimum deaths of one case each seen in 1-10 and 51-60 years age groups[7]. Other studies[8,9,10] observed maximum number of thermal injury deaths in 21 – 30 years age group.

We observed married victims from both male and female gender as predominant victims of thermal injury deaths. Similar observations noted in the most studies[4,5,7,8,10]. The only transgender victim in our study was unmarried. 83 (61.03%) cases had septicemia as a cause of death in this study which is in line with other studies[5,6,7,8]. Accidents as the most common manner of death found in 86 (63.23%) thermal injury deaths in this study. This observation is also noted in other studies[6,8,9,10].

Flame burn injuries caused 116 (85.29%) deaths of which kerosene was the leading culprit inflammable material in 76 (55.88%) thermal injury deaths in our observations. Studies by Pawar V et al[6], Tomar J et al[7], Harish D et al[8], Chaudhary BL et al[9] and Buchade D et al[10] also pointed out that flame burns was the most common type of thermal injury sustained. Gupta R et al[5], Pawar V et al[6], Tomar J et al[7] and Harish D et al[8] too observed in their respective regions kerosene as the most common inflammable material leading to thermal injury deaths. In our study, chulha and shekoti in which dried tree branches, leaves and grass are ignited as an open fire, caused 19 (13.97%) deaths which are more compared to the deaths by LPG gas burners in our North Maharashtra region. Tomar J et al[7] found clothes caught fire while working on chulha in 8 (6.67%) female cases in Indore region. Harish D et al[8] found anghiti/ chullha as means of burns in 24 (06%) cases in Chandigarh region.

Pawar V et al[6] study found majority of their cases 88.50% of flame burns, 8.04% cases of scalds and 3.44% cases of electric burns; Chaudhary BL et al[9] study found 97.10% cases of flame burn and only 2.89% cases of scalds. Buchade D et al[10] also found flame burns most common, followed by electrical, chemical and scald burns. All these studies observations are in accordance with this study observation of flame burns being most reported followed by scalds and electrical burns.

We noted 69 (50.73%) victims survived for 3-7 days after having thermal injuries and 27 (19.85%) victims died within 24 hours. Mishra PK study[4] found 18 cases out of 95 (18.9%) survived for 5-6 days and equal numbers survived more than 10 days. Tomar J[7] and Harish D[8] reveal 56.81% and 47.6% burn cases respectively that lived for 3-7 days, nearly similar to this study. Chaudhary BL[9] and Buchade D[10] differ regarding the most burn cases' survival duration. As per their studies, 57 (27.53%) cases were spot deaths and 61 cases (25.74%) survived for 12-24 hours respectively.

None of the studies referred here reveal any data regarding dying declarations recorded of the dead before their demise. We found 73 (53.67%) thermal injury death victims from all three genders, including the transgender, had their dying declaration recorded.

CONCLUSION

Deaths due to thermal injuries comprise a very significant portion of all the unnatural deaths almost everywhere in India. Etiologic and epidemiologic factors of thermal injury deaths in the three different genders vary to some extent in different regions based on the regional variations of socioeconomic conditions and the working circumstances. Despite having these variations, most thermal injury deaths comprise female gender across all the regional studies. Male gender involvement comes at a distant second place. Deaths of the third recognized gender, transgender, is still under reported and scarcely studied till the date. Through investigations by the police investigation system with public awareness through media regarding common precautions to be taken at kitchens, working places and while dealing with thermal energy sources causing thermal injuries may help in reducing all these unnatural deaths.

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Determination of Sex From the Human Adult Sternum: An Autopsy Based Study

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ABSTRACT

Determination of sex from the skeletal remains is of immense importance in the field of forensic medicine. Various anthropometric studies conducted in this part of the globe have demonstrated sternum as an important tool for determination of sex when less specific/sex indicative bones are available. This study aims to study, compare and analyze the sterna measurements among both sexes and evaluate the reliability of different parameters to determine sex from an adult sternum. 120 sterna (65 male and 55 female) were collected from the autopsy. After cleaning and drying for three weeks, three readings each were taken and the averages of the results were recorded in millimeters. Metric data was summarized as mean, standard deviations and percentage proportions. Among the five parameters used it was proven that the width of the sternum at the level of 4th rib was the most reliable parameter in determining the sex. The application of Hyrtl's law to the study proved that 40% of male sterna and 98.18% of female sterna obeyed it. The application of Ashley's rule of 149 and 136 revealed that 81.66% of male sterna and 90% of female sterna could be sexed accurately.

Keywords: *Sternum, Anthropometry, Sex determination, Hyrtl's Law, Ashley's rule.*

INTRODUCTION

The scope of forensic medicine expert has increased manifold with rapid industrialization, urbanization and increasing population. Sex determination of unidentified remains encountered in forensic situations is one of the prime tasks of a forensic medicine expert. In cases of mass disasters such as armed conflicts, terrorist massacres, airplane crashes, war related crimes, natural disasters, explosions, etc, when badly decomposed, mutilated or damaged human remains consisting of only a few bones or their fragments are recovered from the site, it becomes crucial to establish the identity, especially the sex of the missing individual. There are multiple parameters which aid in identification such as sex, race, stature, complexion features, hair, deformities, scars, tattoos, etc. Though a number of bones such as skull, pelvis, femur ect have contributed significantly to this endeavor, these sex specific or sex indicative bones are not always found at such scenes. In such situations, forensic experts have to depend on less sexually dimorphic elements of human skeleton such as sternum. The motivation of the current study is to find out which are the reliable parameters which can be considered while sexing a sternum when a sternum is found either single or as a part of the skeletal remains.

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MATERIALS AND METHOD

The sternum of all the cases autopsied was dissected using a standard midline incision excluding the sternum of age less than 18 years, intersex, fractured sternum, deformed sternum and those with diseases. The clavicles were disarticulated from the sternum by incising at acromio-clavicular junction. The sterna margins that articulate with the cartilages of the first seven pairs of ribs were carefully cut at the costo-sternal junctions. After removing the sternum, it is washed, soft tissues scraped, allowed to macerate by immersing in a bucket filled with soap water for two weeks. On the third week, the sternum was placed in the bucket filled with plain

water. After the total of three weeks, the sternum were cleaned and dried at room temperature. While cleaning, repeated careful inspection was done to avoid separation of three segments of the sternum. The parameters like manubrial length, mesosternal length, combined length of manubrial and mesosternum, manubrio-corpus index and width of the sternum at the level of 4th rib were measured by using the Vernier calipers. Three readings each were taken and the averages of the results were recorded in millimeters. All measurements were taken keeping the sternum on a flat surface in anatomical positions. The data was entered in a prestructured proforma. Three readings each were taken and the averages of the results were recorded in millimeters. According to the Hyrtl's law the ratio between the length of the manubrium and that of the mesosternum is more than 1:2 in the case of women, and less in men. For sexing the European sterna Ashley (1956) formulated the "rule," according to which a male sternum exceeded 149 mm in length, where as the female sternum was less than 149 mm.

RESULTS

In the present study, the length of the manubrium of both male and female sexes fall in the range 46-54 for males and 41-48 for females with a mean length of 50.43 for males and 44.29 for females with a standard deviation of 2.03 in males and 2.20 in females. The demarking point is >50.89 for males and <44.34 for females. The calculated range was found to be 44.34-56.52 for males and 37.69-50.89 for females. The limiting point was 47.36 which gives us a regression point of 47.36 with which can say that if the value is >47.36, it is a male and if the value is <47.36 it is a female. Therefore in this study, for the parameter of manubrium length, out of 65 male sterna, 60 male sterna could be sexed correctly accounting to 90.30%. Out of 55 female sterna, 50 could be sexed correctly accounting to 90.90%. For the above parameter, t value is 15.718 and the p value obtained is <0.001, hence the parameter is statistically highly significant.

The length of mesosternum of both male and female sexes fall in the range 84-107 and 64-94 for females with a mean length of 99.27 for males and 80.92 for females with a standard deviation of 6.42 in males and 8.75 in females. The demarking point is >107.17 for males and <80.01 for females. The calculated range was found to be 80.01-118.53 for males and 54.67-107.17 for females. The limiting point was 90.09 which gives us a regression point of 90.09 with which we can say that if the value is >90.09, it is a male and if the value is <90.09 it is a female. Therefore in this study, for the parameter of mesosternum length, out of 65 male sterna, 56 male sterna could be sexed correctly accounting to 86.10%. Out of 55 female sterna, 49 could be sexed correctly accounting to 89%. For the above parameter, t value is 12.878 and the p value obtained is <0.001, hence the parameter is statistically highly significant.

The combined lengths of both the manubrium and mesosternum of both male and female sexes fall in the range 133-158 and 105-145 for females with a mean length of 149.70 for males and 125.21 for females with a standard deviation of 8.05 in males and 10.74 in females. The demarking point is >157.43 for males and <125.55 for females. The calculated range was found to be 125.55-173.85 for males and 92.99-157.43 for females. The limiting point was 137.45 which gives us a regression point of 137.45 with which we can say that if the value is >137.45, it is a male and if the value is <137.45 it is a female. Therefore in this study, for the parameter of combined lengths, out of 65 male sterna, 56 male sterna could be sexed correctly accounting to 86.10%. Out of 55 female sterna, 46 could be sexed correctly accounting to 83.60%. For the above parameter, t value is 13.919 and the p value obtained is <0.001, hence the parameter is statistically highly significant.

The sternal index/manubrio corpus index of both male and female sexes fall in the range 47.95-56.97 and 51.08-65.15 for females with a mean length of 50.91 for males and 55.12 for females with a standard deviation of 2.37 in males and 4.08 in females. The demarking point is <67.36 for males and >43.80 for females. The calculated range was found to be 43.80-58.02 for males and 42.88-67.36 for females. The limiting point was 53.01 which gives us a regression point of 53.01 with which we can say that if the value is <53.01, it is a male and if the value is >53.01 it is a female. Therefore in this study, for the parameter of mesosternum length, out of 65 male sterna, 51 male sterna could be sexed correctly accounting to 78.40%. Out of 55 female sterna, 38 could be sexed correctly accounting to 69.09%. For the above parameter, t value is -8.744 and the p value obtained is <0.001, hence the parameter is statistically highly significant.

The width of sternum at the level of the fourth rib of both male and female sexes fall in the range 44-54 for

males and 42-53 for females with a mean length of 51.47 for males and 45.03 for females with a standard deviation of 1.88 in males and 2.87 in females. The demarking point is >53.64 for males and <45.83 for females. The calculated range was found to be 45.83-57.11 for males and 36.42-53.64 for females. The limiting point was 48.25 which gives us a regression point of 48.25 with which we can say that if the value is >48.25, it is a male and if the value is <48.25 it is a female. Therefore in this study, for the parameter of width of sternum at the level of the fourth rib, out of 65 male sterna, 62 male sterna could be sexed correctly accounting to 95.38%. Out of 55 female sterna, 53 could be sexed correctly accounting to 96.36%. For the above parameter, t value is 14.241 and the p value obtained is <0.001, hence the parameter is statistically highly significant.

DISCUSSION

In our study, out of 65 sterna, 26 male sterna obey Hyrtl's law accounting 40%, and out of 55 female sterna, 54 sterna obey Hyrtl's law accounting to 98.18%. The study correlates with study conducted by *Narayan* et al[1], 81.48% of female sternums obey Hyrtl's law and 34.12% of male sternums obey Hyrtl's law. In our study, the mean manubrium lengths of the male sternums were found to be 50.43mm and for female sternums, it was 44.29mm. The male manubriums ranged from 46mm-54mm and female manubriums ranged from 41-48mm. This study correlates with the study conducted by *Gautham R S* et al[2] which concludes that lengths of male manubriums ranged from 35mm-70mm and the female manubriums ranged from 40mm-61mm.In our study, the mean mesosternal lengths of the male sternums were found to be 99.27mm and for female sternums, it was 80.92mm. The male manubriums ranged from 84mm-107mm and female manubriums ranged from 64-94mm. This study correlates with the study conducted by *Dahiphale* et al[3] which concludes that lengths of male manubriums ranged from 77mm-120mm and the female manubriums ranged from 51mm-88mm. In our study, the mean combined lengths of the male sternums were found to be 149.70mm and for female sternums, it was 125.21mm ranging from 133mm-158mm and female manubriums ranged from 105mm-145mm. This study correlates with the study conducted by *Gautham R S* et al[2] which concludes that lengths of male manubriums was 148mm and the female manubriums was 124.00mm. In our study, the manubrio-corpus index of the male sternums were found to be 50.91 and for female sternums, it was 55.12 ranging from 47.95-56.97 in males and female manubriums ranged from 51.08-65.15. This study correlates with the study conducted by *Atal DK* et al[4] which concludes that manubrio-corpus index of the male sternums was 46.09 and the female manubriums was 56.70mm. In our study, the width of the male sternums at the level of 4th rib were found to be 51.47mm and for female sternums, it was 45.03mm. This study correlates with the study conducted by *Mukhopadhyay PP* et al[5] which concludes that width of the male sternums at the level of 4th rib was 51.47mm and that of females was 45.03.

CONCLUSION

The mean manubrium lengths of the male sternums were found to be 50.43mm and for female sternums, it was 44.29mm. The male manubriums ranged from 46mm-54mm and female manubriums ranged from 41-48mm. With a limiting point of 47.36mm, it was observed that 92.30% of males and 90.90% of females could be sexed correctly. p value was found to be <0.001 and hence statistically highly significant. In our study, the mean mesosternal lengths of the male sternums were found to be 99.27mm and for female sternums, it was 80.92mm. The male manubriums ranged from 84mm-107mm and female manubriums ranged from 64-94mm. With a limiting point of 90.09mm, it was observed that 86.1% of males and 89.0% of females could be sexed correctly. p value was found to be <0.001 and hence statistically highly significant. In our study, the mean combined lengths of the male sternums were found to be 149.70mm and for female sternums, it was 125.21mm ranging from 133mm-158mm and female manubriums ranged from 105mm-145mm. With a limiting point of 137.45mm, it was observed that 86.1% of males and 83.6% of females could be sexed correctly. p value was found to be <0.001 and hence statistically highly significant. In our study, the manubrio-corpus index of the male sternums were found to be 50.91 and for female sternums, it was 55.12 ranging from 47.95-56.97 in males and female manubriums ranged from 51.08-65.15. With a limiting point of 53.01mm, it was observed that 78.4% of males and 69.09% of females could be sexed correctly. p value was found to be <0.001 and hence statistically highly significant. In our study study, the width of the male sternums at the level of 4th rib were found to be 51.47mm and for female sternums,

it was 45.03mm. With a limiting point of 48.25mm, it was observed that 98.38% of males and 96.36% of females could be sexed correctly. p value was found to be <0.001 and hence statistically highly significant. The characteristic feature of this study is the fact that this new parameter (width of the sternum at the level of 4th rib), which was not applied for sexing in many previous studies and yet it happens to be the most reliable of all the other parameters. The application of Hyrtl's law to the study proved that 40% of male sterna and 98.18% of female sterna obeyed it. The application of Ashley's rule of 149 and 136 revealed that 81.66% of male sterna and 90% of female sterna could be sexed accurately.

Ethical Clearance: Taken from Basaveshwara Medical College Committee

Source of Funding: SELF

Conflict of Interest: NIL

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Cardiac Causes of Sudden Natural Death in Adults Autopsied in a Tertiary Level Hospital within a One Year Period– A Cross Sectional Study

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ABSTRACT

Background: *Sudden deaths are mostly natural deaths which occur immediately or within 24 hours of the onset of symptoms which may be totally different from the symptoms which the patient was having so long.* Cardiac disorders constitute the most common causes of sudden natural death and incidence is from 45-50% to 90%. There are only a few published studies available in Kerala state with reference to the causes and associated changes in the heart. In the present study, an attempt is made to describe different cardiac causes of death in cases with history of sudden natural death and the socio demographic profile of these cases.

Aims & Objectives: To study the cardiac causes of death in cases with history of sudden death brought for autopsy and to describe the socio demographic profile of the above cases.

Materials & Method: All cases with history suggestive of sudden and unexpected death brought for autopsy at Govt. Medical College, Thiruvananthapuram during the period of one year from August 2009 to July 2010 were selected for this cross-sectional study.

Results: The maximum number of cases were in the age group of 40 to 60 years (55.8%) and had a male predominance. Majority of the cases (39.5%) were manual labourers. The most common cause of death was occlusive coronary artery disease (76.7%), followed by myocarditis (4.2%), non-atheromatous disease of coronary arteries (3.4%), hypertrophic cardiomyopathy (1.7%), right ventricular fibro fatty dysplasia (1.7%), infective endocarditis (1.7%) and valvular heart disease (0.8%). In 8.3% of cases, no definite opinion as to the cause of death could be furnished.

Conclusion: Further detailed studies are suggested.

Keywords: *sudden cardiac death, Occlusive coronary artery disease, Myocarditis, Hypertrophic cardiomyopathy*

INTRODUCTION

Sudden deaths are mostly natural deaths which occur immediately or within 24 hours of the onset of symptoms which may be totally different from the symptoms which the patient was having so long[1]. Cardiac disorders constitute the most common causes of sudden natural death. According to various studies, incidence is from 45-50% to 90%[2-5]. Death may be caused entirely by such disease, or it may be accelerated by some external influence, such as fright, increased or sudden exertion, or slight degree of violence, which, in normal circumstances, will produce no ill effect. There are only a few published studies available in Kerala state with reference to the causes and associated changes in the heart. In the present study, an attempt is made to describe different cardiac causes of death in cases with history of sudden natural death and the socio demographic profile of these cases.

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OBJECTIVES

1. To study the cardiac causes of death in cases with history of sudden death
2. To describe the socio demographic profile of the deceasedsudden deaths due to cardiac causes

MATERIALS AND METHOD

All cases with history suggestive of sudden and unexpected death brought for autopsy at Govt. Medical College, Thiruvananthapuram during the period of one year from August 2009 to July 2010 were selected for this study, excluding the other causes of death. The present study which included 120 cases was designed as a descriptive, cross-sectional study. Relevant details of the deceased regarding the occupation, income, previous history of the illness, details of the present illness, treatment history etc were obtained from the police and the available close relatives and were entered in the proforma.

Meticulous internal and external examinations were done. The sections from the coronary arteries and the myocardium were stained with Haematoxylin and Eosin and were studied in detail for various pathological changes. Examination findings were recorded in the proforma, coded into the chart and analyzed. The analysis was done using SPSS software.

RESULTS

The mean age was 47 years with a standard deviation of 13 with a male predominance (90%). Regarding the occupation and economic status of the victims, 68.8% of the cases belonged to low income group and among them, 39.5% were manual labourers.

When the duration of terminal symptoms and cause of death is correlated, it was seen that 95.7% of death due to occlusive coronary artery disease occurred within 6 hours of onset of symptoms. In 16.7% of cases, death occurred during severe exertion and in 1.7% at the time of emotional exertion, as in an assault.

In 3.3% of cases with cardiac tamponade due to haemopericardium were caused by rupture of, left ventricular wall as a complication of myocardial infarction and dissecting aneurysm of the ascending aorta.

In a female aged 53 years, infective vegetations were seen in and around aortic valve and vegetations seen in the left atrioventricular junction in a male aged 14 years. In one case, mitral valve cusps were broad, redundant and fused in which death occurred due to mitral stenosis and mitral regurgitation. Bridging of coronary artery was present in 3.8% of cases. Both right and left coronary arteries and their main branches were seen in the myocardium in one case. Bridging was noted in right coronary artery in one case (0.8%) and in left coronary artery and its branches in 2 cases (1.7%). Both right coronary artery and left anterior descending branch showed bridging in one case (0.8%). In one case, bridging of left anterior descending and circumflex arteries were present together. In 10% of cases, coronary artery was hypoplastic. In 6.6% of cases, left coronary artery was hypoplastic. Right coronary artery alone was hypoplastic in one case. Hypoplasia of right and left coronary arteries were present in two (1.7%) cases. In one case, right coronary and left circumflex arteries were hypoplastic. Out of these 12 cases, three died due to ischaemia of the myocardium resulting from the hypoplasia of the vessels. Other causes of death were, hypertrophic cardiomyopathy, myocardial infarction following atheromatous narrowing of the coronary arteries (5 cases), coronary artery thrombosis (one case) and arrhythmogenic fibrofatty dysplasia (one case). No definite opinion regarding the cause of death could be furnished in one case. Right coronary ostium was seen positioned 1cm above the valve cusps in 7.5% of cases and similar finding was observed in left coronary ostia in 0.8% of cases. Both ostia were highly positioned in 1.7% of cases. Associated bridging of the coronary artery was seen in three cases. In majority of the cases (92.5%), both coronary arteries originated from the corresponding aortic sinuses. In 6.7% of the cases, both arteries originated from the right anterior aortic sinus and in one case from the left posterior sinus.

In the right coronary artery, more than 75% narrowing of the lumen was present in 30% of cases. Left main trunk showed more than 75% narrowing in 6 cases (5%). More than 75% narrowing of the left anterior descending artery was present in 54.2% of cases. In the left circumflex artery, significant narrowing was present only in 5% of cases.

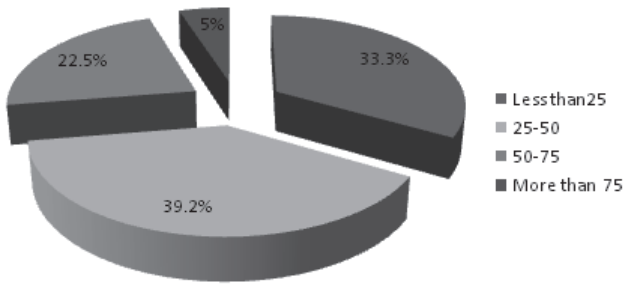

Chart 1: Atheromatous thickening of the left main coronary artery

Table 1: Atheromatous thickening of the left anterior descending artery

Left anterior descending artery	Number	Percentage
Less than 25	22	18.3
25-50	19	15.8
50-75	14	11.7
More than 75	65	54.2
Total	120	100

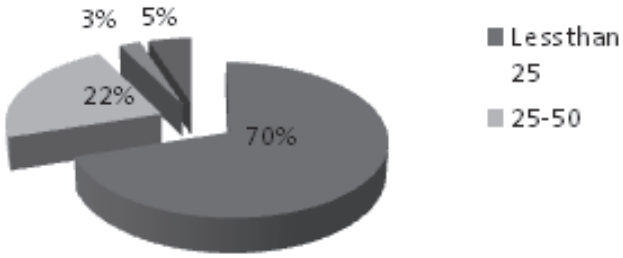

Chart 2: Atheromatous thickening of the left circumflex artery

Table 2: Causes of death

Cause of death	Number	Percentage
Occlusive coronary artery disease	92	76.7
Myocarditis	5	4.2
Non-atheromatous disease of coronary artery	4	3.4
Hypertrophic cardiomyopathy	2	1.7
Right ventricular fibrofatty dysplasia	2	1.7
Ruptured dissecting aneurysm of heart	2	1.7
Infective endocarditis	2	1.7
Valvular heart disease	1	0.8
No definite opinion	10	8.3
Total	120	100

In the present study, the most common cause of death was occlusive coronary artery disease and 90.2% showed microscopic changes of ischaemia in the myocardium. In the remaining cases, positive findings are occlusion of the coronary arteries by subintimal haemorrhage and thrombus. Coronary artery occlusion with thrombus was seen in 16.7% of cases. Most common site of thrombus was in the upper third of left anterior descending artery in 50% of cases. Next common site is the right coronary artery (35%), in its upper half, in 20% of cases and in the lower half, in 15%. In two cases with occlusive coronary artery disease, left ventricle of the heart showed tear near apex, following ischaemic changes of the myocardium. Microscopically, myocardial necrosis, inflammatory cell infiltration with neutrophils and haemorrhages were seen in both cases.

Out of the 120cases, 4.2% died due to myocarditis and were aged between 21 to 35 years. One was female and the rest were males. Presenting illness was fever in 80% of cases and Dengue antibody was positive in 40%. Scattered areas of haemorrhages were seen on the surface of heart in 80% of cases. Microscopically, myocardium showed inflammatory cell infiltration, mainly (lymphocytic), interstitial oedema and congestion in all cases. In 80% of cases necrosis of the muscle fibres and haemorrhagic area in the myocardium were present.

In the present study, 3.4% of cases died due to non atheromatous diseases of coronary arteries and were aged between 20 to 55 years. One case was a female and the remaining three cases were males..In 50% of these cases, the presenting symptom was chest pain and one case was found dead and in the other case, presenting symptom was syncope. In 75% of the cases, death occurred during severe exertion. Coronary artery findings are, bridging of the left anterior descending and circumflex arteries and bridging and hypoplasia of right coronary artery , High take off of right coronary and hypoplastic left coronary artery and bridging of right coronary and hypoplasia of left anterior descending artery. Microscopic changes suggestive of myocardial ischaemia were present in all cases.

Rupture o ascending aorta, just above its root was seen in 1.7% of cases**.** Atherosclerotic plaques with ulceration were seen in the aorta in all the cases.

Fatty infiltrations into the myocardium of both ventricles were seen in two cases. Both were males aged between 40 to 50 years. Myocardium showed fatty infiltration and fibrosis in all cases.

In 1.7% of cases, death was due to infective endocarditis and vegetations were seen at the atrioventricular junctions. Vegetations were seen in the tricuspid valve in one case and left chambers and mitral valve in the other. Associated pneumonia was noted in both cases.

In the present series, no definite finding was observed in 8.3% of cases. All were males aged below 47 years. Among these cases, 60% died within 3 hours of the onset of symptoms and the others were found dead. No significant gross or microscopic findings were seen in these cases.

Ulcerated atheromatous plaques were present in aorta in 60% of cases and in 40% cases, fibrous or atheromatous plaques were seen. Coronary artery showed more than 75% narrowing in 81.4% of cases with ulcerated atheromatous lesions in aorta and in 95.8% of cases with ulcerated atheromatous lesions in aorta, death occurred due to myocardial ischaemia following occlusive coronary artery disease.

DISCUSSION

In the present study an attempt is made to describe the pattern of the cardiac causes of death and the socio demographic profile of the cases brought for autopsy, with history of sudden and unexpected death. Maximum number of victims was in the age group of 40 to 50 years (28.3%) and there was a male predominance. 68.8% of the cases belonged to low income group This may be due to the lack of early detection of heart disease and proper treatment in this group, since autopsy is rarely done in diagnosed and treated cases of natural death, unless otherwise indicated.

The most common cause of death was occlusive coronary artery disease (76.7%), followed by myocarditis (4.2%), non-atheromatous disease of coronary arteries (3.4%), hypertrophic cardiomyopathy (1.7%), right ventricular fibro fatty dysplasia (1.7%), infective endocarditis (1.7%) and valvular heart disease (0.8%). In 8.3% of cases, no definite opinion as to the cause of death could be furnished. Among the 92 cases of occlusive coronary artery disease, maximum number of cases with significant occlusion (>75%) was observed in the left anterior descending artery (54.2%) , followed by right coronary artery (30%), left main coronary artery (5%) and left circumflex artery (5%) which are in accordance with the observations of previous studies[1,3]. The most common site of thrombus was in the proximal third of left anterior descending artery (50%). Among 92 cases of occlusive coronary artery disease, 90.2% showed microscopic changes of ischaemia in the myocardium and 82.3% of the cases showed more than 75% narrowing of the lumen of any one of the coronary arteries. In two cases with occlusive coronary artery disease, left ventricle of the heart showed rupture following ischaemic changes of the myocardium. Both cases were males, aged 48years. As per the previous studies[8,9], it is commonly seen in elderly women.. As per the histology, the rupture of the ventricle had occurred between 3 to 7 days. According to Gradwohl[10] rupture most frequently occurs on the second or third day. Even with survival period of less than 6 hours, microscopic changes were seen in the myocardium. This finding tallies with the study by Knight B[11] where the histological lesions had obvious difference with the age of the lesion as suggested by the history. According to Knight, large proportion of the coronary occlusion may be entirely silent and the ageing of the infarct is very difficult. Dengue was the cause behind 40% cases of myocarditis.

In 75% of the cases of non atheromatous diseases of coronary arteries, death occurred during severe exertion. According to Di mao[12], during exercise or severe exertion, there will be tachycardia which shortens the diastolic perfusion and the compression of the vessel during systole become significant, especially in tunneled coronary artery (bridging). Microscopic changes suggestive of myocardial ischaemia seen in all cases. The site of rupture of dissecting aneurysm of aorta was in its ascending part, just above the root of aorta, which tallies with the previous studies[2,7]. Fatty infiltrations into the myocardium (fibrofatty dysplasia) of both ventricles were seen in two cases and one person died during severe exertion, which tallies with the finding of Burke and Virmani[6]. Coronary arteries were hypoplastic in one case of hypertrophic cardiomyopathy which is a relevant finding as death can occur due to relative myocardial ischaemia following coronary hypoplasia[1]

In the present series, no definite finding was observed in 8.3% of cases. This may be either due to sudden cardiac spasm which produced instantaneous death and so there was no time for the myocardial changes to occur or due to any of the diseases involving the conducting system of the heart which could not be detected by autopsy. Coronary atherosclerosis and smell of alcohol in stomach was present in three cases and heart was flabby in these cases. Death might have occurred suddenly by functional disturbances like arrhythmias which may be superadded by the depressant action of alcohol on heart.

CONCLUSIONS

The maximum number of cases was in the age group of 40 to 60 years and had a male predominance. Majority of the cases were manual labourers. The most common cause of death was occlusive coronary artery disease (76.7%), followed by myocarditis (4.2%), non-atheromatous disease of coronary arteries (3.4%), hypertrophic cardiomyopathy (1.7%), right ventricular fibro fatty dysplasia (1.7%), infective endocarditis (1.7%) and valvular heart disease (0.8%). In 8.3% of cases, no definite opinion as to the cause of death could be furnished.

Further detailed studies along with histochemical examinations are suggested. Due to small sample size, the detailed study of non atheromatous anomalies of the coronary arteries and other cardiac causes of death was not possible and further studies are needed in this aspect.

Conflict of Interest: nil

Source of Funding: self

Ethical Clearance: Ethical clearance for the present study was obtained from the Instituitional Ethical Committee of Govt. Medical College, Thiruvananthapuram.

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Handling of Medicolegal Cases by Doctors in Imphal West

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ABSTRACT

Background: In medical practice, most of the doctors would come across medico-legal cases (MLC). A cross sectional study was conducted over a period of 6 months on doctors posted in different health centres and hospitals of the Imphal West district of Manipur to assess the level of awareness of management of medicolegal cases.

Materials & Methods: The data were collected from consenting participant doctors posted at different health centres of the Imphal West district by interviewers using pretested questionnaires. They were asked certain questions related to the management of medicolegal cases. The awareness status was grouped under three categories like 'aware' (Score >10 points), 'partly aware' (Score >5 to 10 points), 'unaware' (Score 0 to 5 points). The answers were recorded and statistically analysed.

Results: A total of 126 participants took part in this study and on overall assessment of awareness, it was observed that 74.6% of them were partly aware and 7.94% were unaware of the handling of medicolegal cases. Amongst the participants, 19.84% did not know what constitutes a medicolegal case. It was also observed that 61.11% of the participants did not know whether death certificate should be issued or not in these cases. Only 30.95% of the doctors were aware of the samples required to be collected in sexual assault cases, and 54.76% were partly aware of it. Most of the participants (83.33%) were unaware of the maintenance of chain of custody of evidence.

Conclusion: Awareness level and problems faced by doctors in handling medicolegal cases can be established up to some extent from this study. There is a need to educate the doctors to improve the handling of such medicolegal cases, which will be of benefit to all the doctors as well as to the society in general.

Keywords: *Medicolegal cases, doctors, management, awareness*

INTRODUCTION

A doctor's service and knowledge is often required for the administration of law and justice and his/her assistance may be sought by police and law in various circumstances and situations. In medical practice, most of the doctors would come across medico-legal cases (MLC). A medico-legal case is a case of injury/ illness where the attending doctor, after eliciting history and examining the patient, thinks that some investigation by law enforcement agencies is essential to establish and fix responsibility for the case in accordance with the law of the land.[1] It can also be defined as a case of injury or ailment, etc., in which investigations by the law-enforcing agencies are essential to fix the responsibility regarding the causation of the said injury or ailment.[2] The usual impression is that MLC implies lot of disputes, unwanted burden, rough speaking police officials, inordinate hours in the court, unrelenting defense counsels, etc. Because of this fear-factor, they either try to avoid the cases or try to get rid of them as soon as possible.[3] However, a doctor has ethical and legal obligations, and he needs to abide by the laws of the land while discharging his duties.

To assess the awareness of level of handling of medicolegal cases, a few studies have been conducted in the past by some workers. In a previous study on 119

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doctors dealing with medicolegal cases in a tertiary care hospital, 33.89% of the doctors were aware, 31.09% were confused and 24.79% did not know at all about the various procedures of medico-legal case management. [4] They also observed that very few persons were really aware of the importance of evidence preservation in MLC cases (32.77%), importance of identity in MLC (27.73%), criminal abortion cases (22.69%), importance of good medical record (26.89%) and rights of the patients (21.08%). In another study on practicing obstetricians and gynecologists about medico-legal awareness, significant number of practitioners were not aware of important & basic medico-legal procedures, problems, responsibilities and relevant laws, which indicate that this lack of medico-legal awareness needs prompt attention.[5] The present study has been carried out to assess the level of awareness of management of medicolegal cases amongst doctors working in the Imphal West district of Manipur.

MATERIALS & METHOD

After the approval of the local ethics committee, this cross sectional study was conducted over a period of 6 months on doctors posted in different health centres and hospitals of the Imphal West district of Manipur. The data was collected from participant doctors by interviewers from the departments of Forensic Medicine and Community Medicine of a tertiary care teaching Institute at Imphal, using pretested questionnaires. All doctors who were dealing with medicolegal cases in the above establishments and who were willing to participate in the study were included in the study. The interviewers went to different health centres and hospitals in the Imphal West and found out the eligible participant doctors i.e. those who were dealing with medicolegal cases, and recruited them for the study. The participant doctors were briefed about the study and informed consents were obtained from them. Interviews were conducted on the willing doctors at their place of posting by using questionnaires. They were asked certain questions related to the management of medicolegal cases and their answers were recorded. The interviewers read out the questions to the participants in a place in the centre where he/she was comfortable in privacy. The interview took 10 – 15 minutes. If the participant wanted to reschedule the time of interview, it was fixed a later time and date within 10 days. Except for the consent form, only a code number was used. During this study, awareness status was grouped under three categories like 'aware' (Score >10 points), 'partly aware' (Score >5 to 10 points), 'unaware' (Score 0 to 5 points). Data entry was done and the findings were analysed by using Windows based statistical package for social science (SPSS) version 21.0 (Armonk, NY: IBM Corp) applying appropriate statistics.

Table 1: Demographic profile of the participants

SEX	No.	P. C.
Male	82	65%
Female	44	35%
AGE		
25-30	90	71%
31-40	29	23%
>41	07	6%

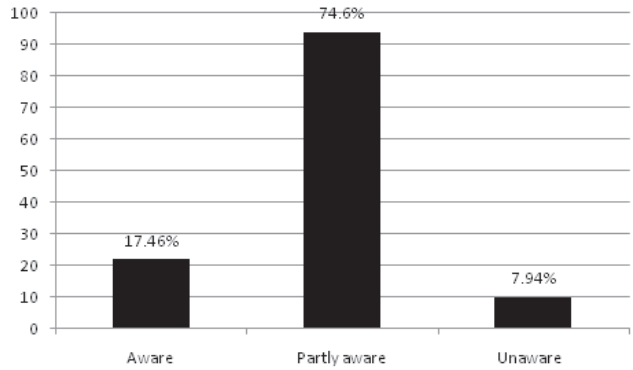

Fig. 1: Overall awareness level amongst participants

Table No. 2: Awareness level of various medicolegal related issues

Questions	Awareness level					
	A		PA		UA	
	No.	%	No.	%	No.	%
What is an MLC?	47	37.30	54	42.86	25	19.84
Should an attending doctor inform the police about the arrival of an MLC	102	80.95	9	7.14	15	11.90

Contd…

How many ID marks are recorded?	103	81.75	9	7.14	14	11.11
Should the police be informed about the discharge\transfer of an MLC from hospital.	81	64.29	0	0	45	35.71
If such a case dies should death certificate be issued?	48	38.09	1	0.79	77	61.11
Who can record dying declaration?	42	33.33	62	49.21	22	17.46
Should only a forensic expert examine a sexual assault case?	96	76.19	0	0	30	23.81
Who should undress a female victim?	85	67.46	0	0	41	32.54
What samples are collected in sexual offence cases?	39	30.95	69	54.76	18	14.29
What is chain of custody of evidence?	21	16.67	0	0	105	83.33
What is POCSO?	12	9.52	0	0	114	90.48
Who should examine a female child victim?	44	34.92	73	57.94	9	7.14
Preservation of MLC record	34	26.98	4	3.17	88	69.84
Awareness of informed consent in MLCs	71	56.34	37	29.37	18	14.29

RESULTS

A total of 126 participants took part in this study from various centres of the Imphal West district. The gender and age of the respondents are summarized in Table 1. The overall awareness level of management of medicolegal cases of the participants is shown in Fig 1, and it is observed that the 74.6% of the participants were partly aware and 7.94% were unaware of the handling of such cases. As shown in Table 2, 19.84% of the participant doctors did not know what constitutes an MLC, and 11.90% did not know whether the police should be informed or not about such a case. Further, 64.29% of the doctors knew whether police should be informed about the discharge or transfer of an MLC from hospital. It is also evident that 61.11% of them did not know whether death certificate should be issued or not in these cases. Only 30.95% of the participants were aware of the samples required to be collected in sexual assault cases and 54.76% were partly aware of it. Most of the participants (83.33%) were unaware of the maintenance of chain of custody of evidence and 90.48% were unaware of the Protection of Children against sexual offences (POCSO) Act.

DISCUSSION

Shortcomings in examination of medicolegal cases, preparation of reports, preservation of evidence, and while giving opinion in courts have exposed doctors' lack of knowledge regarding subject.[6]

In a study by Singh et al.[4], it was observed that 33.89% were aware and 31.09% were partly aware and 24.79% were not unaware of the management of medicolegal cases. Interestingly, in our study, 74.6% of the participants were partly aware and 7.94% were unaware and the remaining 17.46% of the cases were aware of the handling of such cases. In our study, only 37.30% of the participants were aware of the cases which qualify as a medicolegal case, and 42.86% were partly aware of it. This may be also be favourably compared with the findings of Singh et al.[4] who observed that 55.46% doctors were well aware and 41.18% were partly aware of the cases which qualify as medicolegal cases.

According to the Hon'ble Supreme Court, whenever any medico-legal case comes to the hospital, the medical officer on duty should inform the Duty Constable, giving the name, age, sex of the patient and the place of occurrence of the incident and should start the treatment of the patient. It will be the duty of the said Constable to inform the nearest concerned police station or higher police functionaries for further action.[4] In our study, 80.95% of the participants were aware of this and only 11.90% were unaware.

When the dilemma arises as to whether death in a MLC is to be certified or not, it was found in this study that 18.98% were confused about procedure of death certification and 35.45% were not aware of it at all.[5] In our study, 61.11% of the participants were unaware of this situation whereas only 38.09% were aware of the certification of death. In another study by Singh et al.,[4] 26.05% were confused about procedure of death certification and 31.09% were not aware of it at all, which is more or less similar to the findings of Nanandkar and Chavan[5] in their study of assessment of medico legal

awareness of practicing obstetrician and gynecologists. They observed that 18.98% were confused and 35.45% were not aware of it at all.

There is a rise in the cases of violence against woman and child abuse in last few decades. In these cases, in addition to the clinical competence, the law requires the medical professionals to be well versed in understanding and implementing legal provisions. In a study by Nanandkar and Chavan[5] it was observed that 35.45% practitioners were ignorant of the procedure of examination of rape victims. In our study, 30.95% were aware of the samples to be collected in sexual assault cases while 54.76% were partly aware of it. More than 60% were aware of the procedure of sexual examination victims. However, 83.33% were unaware of the maintenance of chain of study of evidence in MLCs.

In our study, 56.34% were aware of informed consent whereas 29.37% were partly aware of it. In a study by Rai et al.,[7] almost 90% of the respondents were aware of informed consent and 61% regarded informed consent with reasonable physician standard model as their choice.

Rao and Hari, [8] observed that the doctors had a very less knowledge about medico-legal records. Another study conducted by Rai et al.[7] in Vadodara among interns and postgraduates also observed similar findings. These observations may be favourably compared with the findings of our study where knowledge about maintenance records was less amongst the doctors.

Considering the awareness level amongst doctors, it is worthwhile to mention here that doctors, regardless of the post graduate specialty they choose, doctors may have to deal with medico-legal cases throughout their career. Hence, they should have sufficient knowledge about medico-legal aspects irrespective of whether they work in private clinics or government hospitals [9,10].

CONCLUSION

Awareness level and problems faced by doctors in handling medicolegal cases can be established up to some extent from this study. There is a need to educate the doctors to improve the handling of such medicolegal cases, which will be of benefit to all the doctors as well as to the society in general. Training programmes may be suggested for proper dealing of medicolegal cases.

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Fatal Road Traffic Accidents: A Study of Autopsied Cases

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ABSTRACT

Background: Human factors remain the leading cause of road traffic accidents. The incidence of death among people on foot is much higher as compared to car occupants or motorcyclists in road traffic accidents. A careful examination of injuries is necessary for reconstruction of the accident. From the nature of the injuries inferences can be drawn regarding relative position of the victim and the vehicle at the time of accident.

Objective of the Study: To understand the trend of road fatalities in and around Moradabad, Uttar Pradesh.

Materials and Methods: After ethical clearance for the study, this autopsy based study was conducted on 74 deaths due to RTA's in Moradabad, Uttar Pradesh over a period of one year. The victim's information and history of circumstances of road traffic fatalities were noted down from the inquest/postmortem reports. Data was tabulated and interpreted using appropriate statistical methods like frequency and percentage.

Results: Majority were males 60 (81.08%), in the age group of 16-45 (58.11%). Pedestrians and bikers comprised main victims (75.67%). Most common external injury was lacerated wound (86.49%), followed by hematoma (44.59%). Most common internal traumatic brain injury was subarachnoid hemorrhage (SAH) 28 (37.83%), followed by hemorrhagic contusion 25 (33.78%). Retroperitoneal hematoma was seen in 16 (21.62%) and solid organ injury in 11 (14.86%) victims. Craniocerebral damage accounted for 48 (64.86%) while hemorrhagic shock accounted for 26 (35.14%) of the deaths.

Conclusion: Establishing modern trauma centers along with well-trained specialists should be the first priority of the Central and State Governments. Social awareness regarding safe driving should be emphasized at all levels.

Keywords: *Road traffic fatalities, medicolegal cases, Autopsy*

INTRODUCTION

Road Traffic Accidents (RTAs) have emerged as a major global public health problem of this century and are now recognized as a veritable neglected pandemic. Accidents occur not only due to ignorance but also due to carelessness, thoughtlessness and over confidence.[1] Worldwide estimation of deaths by road traffic accidents is about 1.25 million each year. Developing countries account for 85% of all road traffic accident mortalities, out of which half of them are situated in the Asia-Pacific region.[2] RTAs are predicted to be the second leading cause of death by 2020 next to ischemic heart disease.[3] Human factors remain the leading cause of road traffic accidents, such as over speeding, carelessness, not obeying traffic laws, under age driving, use of mobile phones and drink and driving, fatigue.[4]

The injury and fatality pattern considerably depends upon the fact that whether the crash victim is an owner of a four wheeler, a motor cyclist, a pedal cyclist or a pedestrian.[5] The incidence of death among people on foot is much higher as compared to car occupants or motorcyclists in road traffic accidents in this region, which are further increasing at an alarming rate.[6]

Majority of the medicolegal autopsies in India are done on the victims involved in vehicular accidents.

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A careful examination of injuries is necessary for the reconstruction of the accident. From the nature of the injuries inferences can be drawn regarding the relative positions of the victim and the vehicle at the time of accident. Moreover in hit and run cases, nature of injuries and collection of trace evidences will help to connect the suspect vehicle with the crime.[7]

The objectives of autopsy on road accident victims are: to establish the identity of the victim; to find out whether the victim died because of trauma or due to some natural sudden cause of death; to search whether the driver had any disease resulting in loss of control of the vehicles; and to reconstruct the accident.[8]

The present study was conducted to understand the trend of road fatalities in and around Moradabad, Uttar Pradesh.

MATERIALS AND METHOD

This autopsy based study was conducted on 74 deaths due to road traffic accidents in Moradabad, Uttar Pradesh over a period of one year from September, 2015 to August, 2016. Ethical clearance for the study was taken from the Institutional Ethics Committee. The victim's information and history of circumstances of road traffic fatalities were noted down from the inquest/ postmortem reports. Pathological injuries, skull fracture patterns, intracranial hemorrhages were noted down in the predesigned proforma. Data, thus collected, was tabulated and interpreted using appropriate statistical methods like frequency and percentage.

RESULTS

In this prospective study, 800 patients of road traffic accidents with multiple injuries were admitted in the Casualty of Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh during the period from September 2015 to August 2016. Out of these, 14 patients left against medical advice, while 56 patients were referred to higher health institutions. From the rest 730 patients, 617 (84.52%) recovered, 28 (3.83%) were discharged on request and 85 (11.64%) patients expired.

Table 1: Age wise distribution of victims

Age group (in years)	Victims (n = 74) No. (%)
≤ 15	4 (5.41)
16–30	20 (27.03)
31–45	23 (31.08)
46–60	18 (24.32)
61–75	6 (8.11)
≥76	3 (4.05)
Total	**74 (100.00)**

Autopsy was performed on 74 mortalities as 11 others were shifted to some other places/mortuaries. Majority were males 60 (81.08%) while 14 (18.92%) were females. Most of the victims 23 (31.08%) were in the age group of 31-45 years, followed by 20 (27.03%) in the age group of 16-30 years, 18 (24.32%) in 46-60 years, 6 (8.11%) in 61-75 years, 4 (5.40%) in ≤15 years and 3 (4.05%) in ≥76 years age group (Table 1).

Table 2: Distribution of type of victims

Type of victim	No. of patients (%)
Pedestrian	31 (41.89)
Rider	16 (21.62)
Passenger	11 (14.87)
Pillion	9 (12.16)
Driver	7 (9.46)
Total	**74 (100.00)**

Pedestrians 31 (41.89%) formed major group of victims, followed by bikers 25 (33.78%). Among bikers 16 (21.62%) were driving the bike, while 9 (12.16%) were pillion riders. Among other victims 11 (14.87%) were passengers and7 (9.46%) drivers of four wheelers (Table 2).

Table 3: Type of injuries

Type of external and internal injury	No. of patients (%)
Multiple abrasions	74 (100.00)
Multiple bruises	74 (100.00)
Laceration	64 (86.49%)
Hematoma	33 (44.59%)
Black eye	7 (9.46%)
Subarachnoid hemorrhage (SAH)	28 (37.83%)
Hemorrhagic contusion	25 (33.78%)
Retroperitoneal hematoma	16 (21.62%)
Solid organ injury	11 (14.86%)

Multiple abrasions and bruises all over the body were observed in all the victims. Most common external injury in autopsied victims was lacerated wound 64 (86.49%), followed by hematoma 33 (44.59%), black eye 7 (9.46%). Most common internal traumatic brain injury was subarachnoid hemorrhage (SAH) 28 (37.83%), followed by hemorrhagic contusion 25 (33.78%). Retroperitoneal hematoma was seen in 16 (21.62%) and solid organ injury in 11 (14.86%) victims (Table 3).

Type 4: Cause of death

Cause of death	No. of patients (%)
Craniocerebral damage	48 (64.86)
Hemorrhagic shock	26 (35.14)
Total	**74 (100.00)**

Craniocerebral damage accounted for 48 (64.86%) while hemorrhagic shock accounted for 26 (35.14%) of the deaths (Table 4).

DISCUSSION

Transportation is the backbone of economic and social development in our country. However, benefits apart, serious consequences in shape of trauma and injuries have become way of life for those who use roads and vehicles in their daily life. In the present study, total RTA fatalities comprised 85 (10.63%) out of 800 accidental patients. Out of these autopsies were conducted on 74 victims, as remaining 11 victims/deceased were shifted to some other places/mortuaries. A total of 60 (81.08%) of the victims were males and 14 (18.92%) females. Majority of victims were in the productive age group of 16-45 years 43 (58.11%). Pedestrians comprised 31 (41.89%) and bikers and pillion riders 25 (37.78%) of the total autopsied victims. Laceration 64 (86.49%) was commonest pattern of external injury, followed by hematoma and abrasion. Hemorrhagic contusion, SAH and SDH constituted the main form of traumatic brain injury leading to death. Retroperitoneal hematoma was seen in 16 (21.62%) and solid organ injury was seen in 11 (14.86%) of the patients. Probable cause of death in 48 (64.86%) of patients was cranio-cerebral damage and in 26 (35.14%) it was hemorrhagic shock.

Khajuria *et al.* found that males constituted 83.14% of RTA victims.[9] Smith, similar to our study, reported that more than one-half of all road traffic deaths occur among age group 15 to 44 years.[10] Similar age distribution RTA deaths have been reported by Jha *et al.*[11] Like our study, Kumar and Kumar[12] also reported that 74% of victims in their study were pedestrians and two-wheelers riders. SAH and SDH were commonest form of traumatic brain injuries in the present study. Head injuries accounted for 69% of deaths and 24% of deaths were due to hemorrhagic shock. Moharamzad *et al.*[13] found that 80.5% of victims were males. Most common cause of death was CNS injury (58.1%). Ahmad *et al.*[14] found that males constituted 64% of RTA victims. Laceration as external injury was present in 90% of cases. SDH and SAH were commonest form of traumatic brain injury (TBI).

This study shows that male gender, age <45 years and head injuries are the most vulnerable parameters accounting for RTA deaths. Nationwide online records should be maintained for all RTA incidents and fatalities so that an effective safety policy and health management for road users can be planned.

CONCLUSION

Road traffic accidents continue to be a speedily rising problem, causing heavy loss of manpower and resources, along with equivalent drain of potential economic growth, so a multi-dimensional approach is the need of the hour to reduce the burden of the RTAs and associated morbidity and mortality. This includes maintaining existing roads, improving road surfaces, removing obstacles, constructing proper signs and widening of the narrow sections of the roads. Hospitals along the highways should be equipped with well experienced surgical team. Trauma centers with integrated facility of surgical, orthopedic, neurosurgical and anesthetic experts with modern investigative procedures like USG and CT scan and facility of blood bank is the best solution to save the lives of RTA victims who are severely injured.

Sensible driving on Indian roads is a need of the hour. The country not only needs strict laws but their implementation is more important for all road users. Establishing modern trauma centers along with well-trained specialists should be the first priority of the Central and State Governments. Social awareness regarding safe driving should be emphasized at all levels. Nationwide online records should be maintained for all RTA incidents and fatalities so that an effective safety policy and health management for road users can be planned.

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Comparison of Two DNA Extraction Methods and Their Utility in Forensic Examination of Bone Samples

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ABSTRACT

The bones frequently present as an important source of DNA available for the identification of mutilated human remains especially in the mass disaster situations. The calcareous nature of bones resists the decomposition making them a preferred source of DNA. This paper deals with he comparative analysis of quality and quantity of DNA extracted by magnetic beads based Prepfiler BTA extraction method and manual organic extraction methods and their utility in forensic examinations of bone samples. The study was carried out on 20 samples and it was found that the quantity of DNA isolated by automated extraction method was in the range of 0.7 to 4.45ng ng/µl and the success rate was 90% as compared to the quantity of DNA isolated through organic extraction method was in the range of 0.01 to 1.36 ng/ µl and success rate was 35%, hence proving that the magnetic bead based automated method of DNA extraction is quite useful in forensic examination.

Keywords: *DNA extraction, organic methods, magnetic beads, bones, human identification etc.*

INTRODUCTION

Identification of the unknown remains is considered as a basic human right[1, 2]. DNA profiling frequently makes a significant contribution to the identification process in forensic caseworks, and is considered primary identifier in the vast majority of cases where the body is highly degraded and it is not possible to identify the body on the basis of facial features. The DNA profiling can provide clues towards phenotypic characteristics viz. eye color, hair color etc.as well as ethnic origin [3- 5]. DNA profiling has witnessed extraordinary changes in the technology in last two decades. The DNA profiles can be generated from highly mutilated and degraded samples. However, the extraction of DNA from the bone is a lengthy and tedious process as compared to other biological materials, due to the calcareous nature. Bone is a mineralized tissue and it contains the 70% inorganic material which interferes with DNA extraction process [6]. Normally, the sternum bone serves as good source for DNA, even after several years after death [7]. In the cases like the mass disasters or unidentified dead bodies, it is important to take the femur or sternum bone for purpose of identification, or if the body is highly decomposed the proper selection of area of bone may enhance the quantity and quantity of DNA. The success rate of DNA amplification is depends on the quality, quantity, and purity of DNA. The DNA extraction from bones can be done on the basis of partial decalcification[8]. In recent years several advanced methods have evolved for DNA extraction and analysis out of which magnetic based automated DNA extraction and manual organic extraction are commonly used in forensic case-work[9].

AIM OF THE STUDY

The aim of this paper is to study the comparative analysis of quality and yield of DNA extraction by Magnetic beads based Prepfiler BTA extraction method and manual organic extraction methods and their utility in forensic casework.

MATERIALS AND METHODS

Sample size: 20 different bone samples were taken from forensic case work exhibits submitted for DNA

profiling. The samples were 1-5 years old and were serially labelled as specimen 1 to 20.

Sample preparation: In order to prevent possible contamination all stages of the work were carried out under sterile conditions, using latex gloves and mouth masks. All steps (bone cutting, surface removing, powdering, extraction and amplification) were carried out in separate places with restricted access. Throughout the experiment, premium quality ultra-micro sterile tips were used for pipetting**.**

In order to compare the two different DNA extraction methods (magnetic based automated DNA extraction and manual organic extraction) for their DNA yield, DNA was extracted from the same amount of bone powder. The bones samples were first cleaned with sand paper and 0.3% hypochlorite. Dried samples were crushed to powdered form by using tissue crusher. Therefore, the bone powder gained (30gm from one specimen) after grinding was divided into two portions for different extraction methods. In this way it was ensured that the same material was used for each extraction method.

Methodology: The powdered material was soaked in 0 .5 M EDTA in a 2µl eppendorf tube for 4 to 5 days for decalcification. Supernatant EDTA was changed daily to remove calcium from the bone powder. EDTA itself is a potent PCR inhibitor; therefore, further washings with saline solution followed by milliQ water were done. The lysate was then utilized as per protocol for the organic extraction using phenol-chloroform. Organic extraction method separates the mixture of molecules based on the differential solubility of the individual molecules in two different types of immiscible liquids. For the second method, same sample of powdered bone in equal amount was taken in fresh lysate tube and freshly made Prep Filer BTA™ lyses solution was added to it. After 5min of vortex, it was incubated in the thermal shaker at 56 °C for approx. 4.30 hours. After incubation, centrifugation of the lysate tube was done for 5 minutes at 12,000 rpm and then clear lysate (without sediments) was transferred to a new sample tube. Afterwards, the automated extraction was done. The samples were taken for isolation by using the Automate Express™ Forensic DNA Extraction System. The instrument allows utilizing PrepFiler BTA™ kit chemistry that is packaged in pre-filled foil sealed cartridges and is special for the DNA from bone[10].

Quantification of DNA: After the extraction process, both the types of samples were quantified using the Quantifiler® Duo kit. The duo Reaction Mix and Primer Mix (12.5 µl and 10.5 µl per sample respectively) were mixed and added to wells plate along with 8 standard samples, as per protocol provided by manufacturer and then 2 µl sample was added to the same well. The plate was sealed with the transparent adhesive film and vortexed thoroughly. The total volume of the PCR reaction system including the sample was 25 µl. For the quantification of the extracted DNA, the instrument Applied Biosystems® 7500 Fast Real-Time PCR System was used. Quantification standards and samples were run as per manufacturer protocols. The Quantifiler® Duo kit contains three types of dye-labeled Taq Man® probes which tell human-specific Ribonuclease RNA and Component H1 gene, human male-specific Sex-determining region Y (SRY) gene, and an internal positive control for purpose of inhibition. The final volume of eluted DNA was 50µl.The kit helped to ascertain the species of origin along with the gender. [11]. STR kits include the primer for amelogenin gene system that allows individualization as well as gender identification. RT-PCR is the best source for such samples where gender of sample is not known and it can be confirmed with the help of Quantifiler® Duo kit[12].

RESULTS

The comparative analysis of the samples from both the methods was done. It was noted that the quantity of DNA isolated from bone sample by automated extraction method was in the range of 0.7 to 4.45ng/µl and the success rate was 90% while the quantity of DNA isolated through organic extraction method was in the range of 0.01 to 1.36 ng/µl and success rate was 35%. The results for individual specimens are recorded in Table-1.

Table 1: Comparison of DNA yield (in ng/µl) by two different extraction methods

Specimen No.	Automated extraction method	Organic Extraction Method
1.	4.35	0.23
2	2.32	1.06
3.	5.09	0.95
4.	2.62	0.20
5.	0	0

Contd…

6.	1.62	0
7.	1.99	0.72
8.	2.04	1.36
9.	0.70	0.98
10.	3.29	0.32
11.	1.07	0
12.	2.67	0
13.	4.02	0.01

Contd…

14.	1.92	0.00
15.	3.09	1.02
16.	0	0
17.	2.32	0.56
18.	1.24	0.59
19.	4.45	1.27
20.	3.46	0.87
Total	48.23	10.14

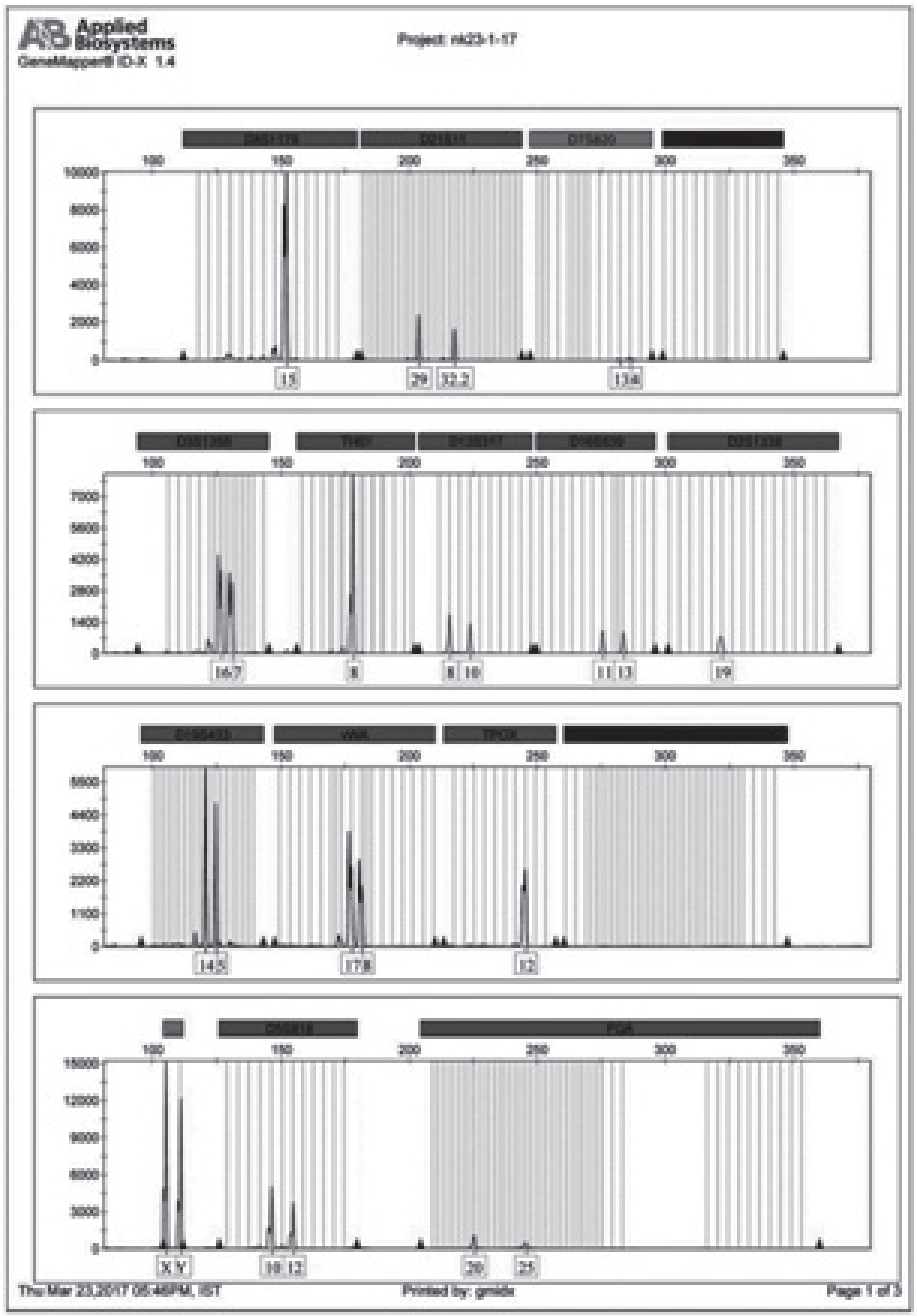

Fig. 1: The profile generated from the DNA extracted using manual method

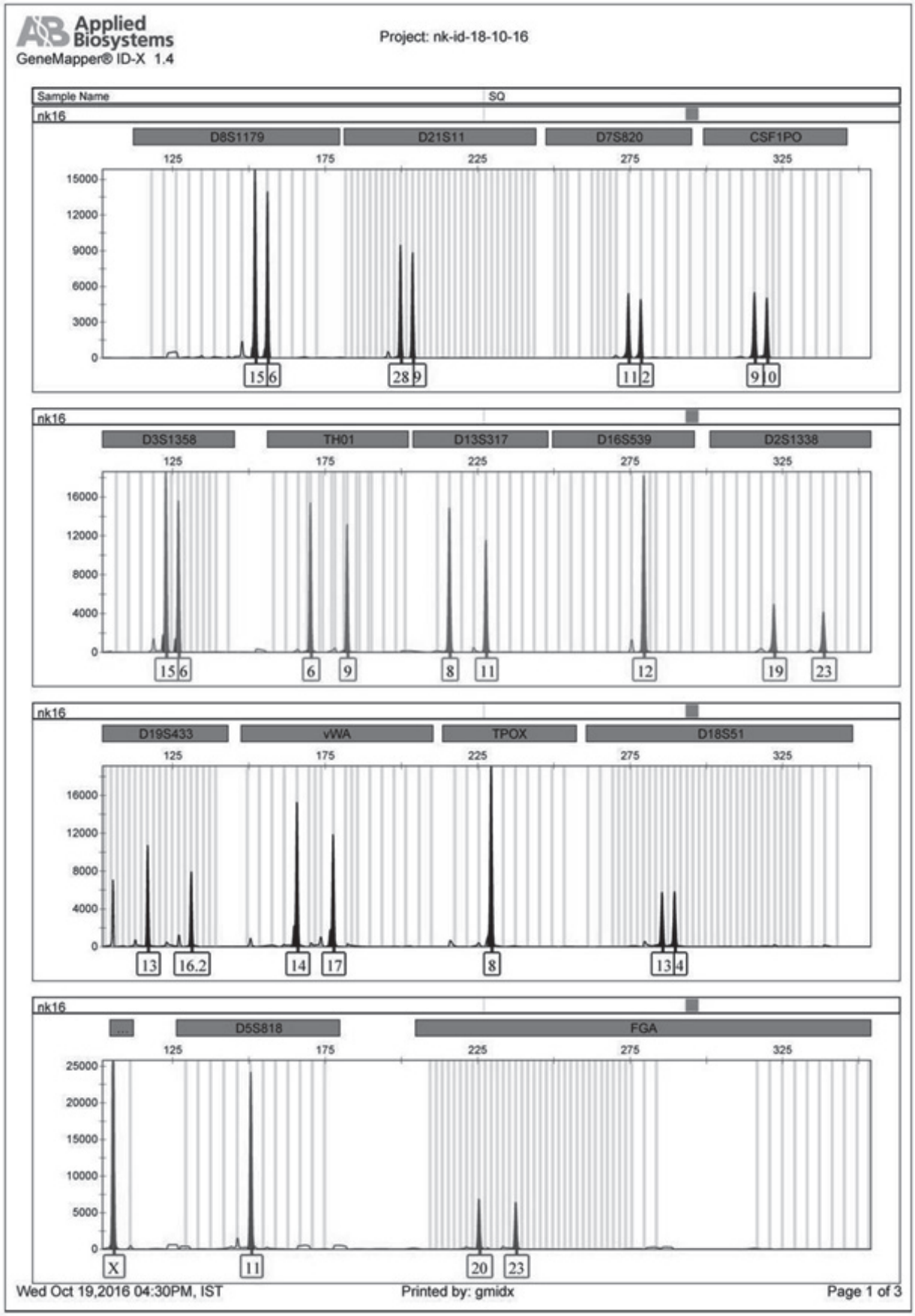

Fig. 2: The profile generated from the DNA extracted using automated method.

There was allele drop in the big size marker in one of the case by automated extraction while 5 cases of allele drop out on big size marker. Alleles on the drop out cases were generated by the use of Mini STR kit along with the complete profile. Fig.1 and Fig.2 shows the examples of profiles generated by DNA extracted using organic extraction method and automated method respectively.

DISCUSSION

The use of non-toxic, genetic kits for DNA extraction from various types of exhibits is explored in the forensic field. The advantages of these new extraction techniques are related to the elimination of PCR inhibitors and the feasibility of performing automated extraction procedures [13]. The purpose of this study using two different techniques for DNA extraction is to know the quantity and inhibitions of amplified DNA and it impact on DNA profile. The automated magnetic bead technique using the PrepFiler® BTA forensic DNA extraction kit in view of quantity of extracted DNA compared to organic extraction technique. It is due to magnetic based especial formulation of extraction kit and this kit is applicable for complicated and critical samples like bones and teeth. The incubation procedure was taken with lyses buffer provided along with the kit, enabling a homogeneous mixture under stable temperature. It allows the contact between the reagent available in the kit and the cells and limiting the effect of PCR inhibitors on the quantity of DNA. The organic extraction method has limitations in most of the case samples to yield appropriate quantity and complete DNA profiling .Bone, taken from the cases is often degraded and contains PCR inhibitor [14]. Both techniques were sufficient to eliminate PCR inhibitors, decreasing the IPC values, indicating the extraction of pure DNA samples. Automatic magnetic bead technique revealed better result, achieving higher amplifications of DNA in most of the bones samples. The magnetic beads are better way to extract the pure DNA and full profile in one attempt instead of using the mini filer kit for the purpose of generating the full profile of 16 loci [15]. Finally, the time required for sample analysis was also considered for the techniques analysis and the magnetic bead based extraction yielded far rapid results, due to the automated design. This technique enabled us the simultaneous analysis of 13 samples in 30 minutes. The organic extraction took 10 to 15 days to isolate the DNA; even then the amplification was not in complete form.

CONCLUSION

From the above results, it was found that automated technique is the better as compared to organic extraction technique in terms of accuracy, sensitivity, rapidity as well as yield of DNA from bone samples in forensic cases. DNA can be extracted without any handling error and inhibition which gives better profiles. In addition, automated extraction method would be of much more use in mass disaster situation where the huge number of degraded or mutilated samples is examined.

Conflict of Interest: None

Source of Funding: Intuitional

Statement of Human and Animal Rights: No human or animal rights were violated since the study was not conducted on live human and animals. The samples used were human remains.

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Awareness of Rights of Patient among Patients Admitted in Tertiary Care Charitable Hospital–A Cross Sectional Study

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ABSTRACT

Patient's rights is an iceberg where minimal has been understood by both the patient and the doctors. Though there are many organisations which have formulated various standards to understand and describe the same, the practical applicability and the knowledge among the beneficiary is still a truffle. This study is undertaken to assess the amount of knowledge and awareness among the patients in a tertiary care centre. Literates fared well indicating they were aware of the patient's rights, and also revealed that they had a right to complain against the doctor in any condition which is an alarming sign. Is the awareness complete? And how far is the gap between the realm and the assumed rights? This study is an attempt to shed light on these questions.

Keywords: *patient rights, ethics.*

INTRODUCTION

WHO formulated rights of patient on the basis of Universal declaration of human rights, particularly on the concept of "the inherent dignity" and the "equal and unalienable rights of all members of the human family".[1] All patients have the right to: respectful care, complete information, informed consent, privacy, confidentiality, information about affiliation, acceptance or refusal of treatment, refusal of experimental treatment, knowledge of hospital regulations, information about medical fees etc.[2]

Since decades globally many organizations have worked together to implement and regulate patient rights. Even now there is outcry that patient's rights are not being taken care and often the blame is put on doctors.

There are at least four models recognized by WHO:[1]

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The paternalistic model, the physician adopts the role of a decision maker and decides what would be good for the patient. In the informative model, the physician acts as an information source, and decision making is in the hands of the patient. The interpretive model has shared decision making; the physician helps the patient to interpret complex medical evidence and its relevance to the patient's illness. The deliberative model is one where both the physician and patient deliberate on the best course of action.

It was noted in few studies that the physicians in India have always held disproportionate power over their patients such that patients are left with little choice. Also the patients are unaware of their rights which synergies effect of the paternalistic model.[3]

Thus we wanted to know the awareness of patient rights among patients.

AIMS AND OBJECTIVES

To assess the awareness of patient's rights among the patients admitted in tertiary care charitable hospital.

Methodology Study design: Cross-sectional survey.

- **Method:** Pre validated questionnaire based interview survey.

- **Sample size:** 100 convenient sampling.
- **Inclusion criteria:** All patients of post- operative care of more than 2 days.
- **Exclusion criteria:** Pediatric patients.
- **Written informed consent:** Taken.
- **Data analysis:** General computing and Chi square tests using SPSS 21

RESULTS AND DISCUSSION

Among 100 patients surveyed 89 patients completed the questionnaire. 11 questions related to consent and decision making, consultation and second opinion, medical record accessibility and confidentiality; and hospital rules and regulation were asked to all the patients.

In our study there were 63(70%) males and 26(30%) females; 22 (25%)were less than 40 years of age and 67 (75%)were more than 40 years of age; and 53 (60%) were belonging to the group with no schooling to less than primary schooling and 23 (40%)were more than primary to degree schooling;

Table 1: Overall scoring of awareness of patient rights among different sexes.

	Male	%	Female	%	Total
Yes	488	70%	198	69%	686
No	205	30%	88	31%	293
Total	693		286		979

Table 2: Awareness of patient rights among different age groups.

	<40 years	%	>40 years	%	Total
Yes	162	67%	524	71%	686
No	80	33%	213	29%	293
Total	242		737		979

Table 3: Awareness of patient rights among different educational strata.

	< primary schooling	%	> primary schooling	%	Total
Yes	394	67%	292	73%	686
No	189	33%	104	27%	293
Total	583		396		979

Among different educational strata, 72% of Illiterates and 92% of literates expressed they understand the term consent and on further enquiring about profound understanding of consent and decision making- majority of the literates were aware of the patient right's. Literates showed significantly more understanding of the information and also exhibiting the behavior of enquiring about their disease and treatment compared to illiterates. Literates were also significantly more aware that consent should be given by self. Similar results were found in a study conducted by Rajesh DR et al[4], who noted higher education showed significantly better understanding of information than illiterates. Contrastingly in our study majority of the patients completely depended upon doctors for the decision making. Similar results were found in a study conducted by Rajesh DR et al[4].

Table 4: Understanding and decision making regarding consent among different educational strata:

Questions regarding Consent and decision making	< primary	%	> primary	%	Significance p value
4.Did you understand the information completely?	Y -38 N-15	72% 28%	Y -33 N-03	92% 08%	p=0.015 <0.05
5.Did you enquire further regarding the disease/ treatment?	Y -21 N-32	40% 60%	Y -28 N-08	78% 22%	p <0.001
6. when not in emergency Can someone (relative) give consent on your behalf?	Y -50 N-03	94% 06%	Y -14 N-22	39% 61%	p<0.001 (for ans.No)
7. Did you completely depend upon doctors to make decision?	Y -44 N-09	83% 17%	Y -32 N-04	89% 11%	Not significant

Regarding consultation and second opinion both literates and illiterates had insufficient knowledge, and majority of them expressed that they were unaware of the facts that it's their right to request for second opinion and also that doctor cannot stop the treatment in the middle. Both group showed no significant difference.

Table 5: Awareness regarding consultation and second opinion among different educational strata

Consultation and second opinion	< primary	%	> primary	%	Significance p value
13. Do you think the same doctor should see you on most of the follow up visits	Y -50 N-03	94% 06%	Y -34 N-02	95% 05%	Not significant
16. Can you request for second opinion	Y -07 N-09 D-37	13% 17% 70%	Y -11 N-04 D-21	30% 10% 60%	---
18. Can the doctor stop to treat you in the middle	Y -08 N-11 D-34	16% 20% 64%	Y -08 N-12 D-16	22% 34% 44%	---

Contrary to the majority 92% of illiterates and 97% of literates who felt that medical records of theirs are important and confidential documents, many expressed that doctor can disclose the information regarding their disease and treatment to the relatives. Literates had significantly more knowledge that they have the right to access medical documents, which is in contrary to the study done by Alphonse[5], where majority were unaware of the same.

Interestingly majority felt that they can file compliant against doctor if they found shortcomings in medical services.

Table 6: Awareness regarding confidentiality and hospital rules among different educational strata

Confidentiality and hospital regulations	< primary	%	> primary	%	Significance p value
21. Do you think medical records are important/ confidential?	Y-49 N-04	92% 08%	Y-35 N-01	97% 03%	Not significant
19. Can you access treatment records?	Y -36 N-17	68% 32%	Y -32 N-04	89% 11%	p<0.001
22. Can the doctor disclose information to relatives other than spouses? (contrary)	Y -34 N-19	64% 36%	Y -28 N-08	77% 33%	Not significant
24. Can you file complaint against the doctor in case of short coming the medical service?	Y -42 N-11	79% 21%	Y -32 N-04	89% 11%	Not significant

11 questions were asked to 89 subjects amounting to a total of 979 characters. 70% male and 69% females told that they were aware of the patient's rights.

Patients < 40 years comprised of 67% and >40 years comprised 71%

There was no much statistical variation among illiterates (67%) and literates (73%) said they were aware of the patient's rights.

With the above data analysis it was found that there was no much difference in the variables and most of the patients were aware of the patient's rights. But on analysing few more questions intended to know the profound understanding and practice of patient rights, data showed that many patients were not aware of basic rights when it came to utilising them.

A total of 71 patients told that they understand the term consent, among them 51 were males (72%) . 80% of the males were aware; 76% of the females were aware. Though majority of the patients were illiterates i.e 43 patients (61%), they understood the term consent.

DISCUSSION

Literates were aware of the patient rights. They exhibited the trait/behaviour of inquiring regarding

their disease and treatment information and also made thoughtful decision about the consent.

Majority of the literate patients also expressed that consent should be given by self.

Regarding consultation and second opinion majority expressed that they don't know whether they can ask/ request for second opinion or can doctor refuse to treat in the middle contrary to their previous statement that they are aware of patient's rights.

Regarding professional secrecy and accessibility to the document literate patients expressed that it's their right to know what is happening with them by accessing the medical records compared to the illiterate ($p<0.001$); also felt that documents are important and confidential but were not aware of the that documents should not be revealed to anyone.

Interestingly majority felt that they can complain against doctor which appears to be dangerous and should be seen by doctors as alarming fact, because patients are not aware of the basic rights but are ready to sue the doctors which many a time is irrelevant.

CONCLUSION

Literates were significantly more aware of patient rights than illiterartes. It was also found that patients of less than 40 years were more aware of patient's rights that more than 40 years, this was because majority of patients under 40 years were literates, but were statistically not significant.

Though majority who expressed that they are aware of the patient rights did not had complete understanding about few basic rights.

What can be done: Unless patients are made aware of their rights and demand for the same, doctors alone should not be blamed for all medical mishappening. In India doctors are overburdened with patient load, and at times may overlook patient rights. To minimize MCI should amend patient's right bill, which is more often indirectly expressed through code of medical ethics - duties of doctor, consumer protection act and consumer guidance society.

Apart from this patient advocacy cells have to be opened in the hospitals.

1. Patients in India are so used to being at the receiving end of medical care that sometimes they forget that they do have rights.
2. Medical profession deserves accolades for its exceptional work, but there are times when they overlook common practices
   - Sheer workload
   - Over time work
3. Patient autonomy is affected by a number of factors
   - severity of the illness
   - socio economic status
   - dependence

   The low patient doctor ratio puts tremendous strain on the existing doctors and restricts the time available for interaction

   Added to this doctors have disproportionate power over patients and classical paternalism is rule than exception.
4. The rights if the patient as a consumer are more important than the rights of general consumer because patient has very little choice in the treatment.[6]

The consumer guidance society of India – 8 specific rights but no provision for refusal of treatment can only ask for second opinion.

Violation of patient's rights is not a cognisable offence in India.

Conflict of Interest: None

Source of Funding: Nil

Ethical Clearance: Taken

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Socio-Demographic Profile of Violent Asphyxial Death Cases in Ajmer, Rajasthan

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ABSTRACT

Violent asphyxial death is very common cause of suicide in the society. Information with respect to socio demographic factors is very much essential to understand the list of causative factors triggering suicidal tendency in humans. The present study was done on the population of Ajmer district of Rajasthan, sample studied were found to be diverse with respect to age, religion, habitat, education level etc and can be consider an ideal population for study of socio demographic factors in relation to violent asphyxia death cases. During the study period 2009-2010 total 105 cases were accounted for violent asphyxial death. High rate of violent asphyxial death were found among peoples; of young age; males; having education above secondary; *Hindu* community; married individuals; socio economic middle class persons and urban residents. Domestic unhappiness and shattered family tension was the most common triggering factor identified in the set of case studied in Ajmer district of Rajasthan.

Keywords: *Violent asphyxia death, socio-demographic, suicidal tendency, Ajmer*

INTRODUCTION

Human's life is factual to reach end, death may be natural (senescence, disease etc) or unnatural (accidental, suicidal, homicidal). Suicidal deaths across world account 2%[2], whereas in India more than one lakh people die of suicide every year [3]. Various methods have been adopted by human to end his own life; most common way for suicide is asphyxia death of which mechanical asphyxia is normally observed[1]. Decision of self to end life by own will is not easy but circumstances around forces, social factors around are very much correlated to adopt suicidal death. Hence to understand suicidal death causes it is very much required to assess socio-demographic profile of death cases. In India various studies have been conducted and it has been found that asphyxia death are very common by hanging [1,4,3] , hanging is high in case of male compared to females; percentage of suicidal death also depends upon many factors viz., status, age, education religion etc. Hence a detailed socio demographic profile of human cases registering suicidal deaths is very much required to be assess from region to region and time to time to understand the social dynamics underneath. In Rajasthan studies are limited on the subject; population in Ajmer district of Rajasthan is diverse with respect to age, religion, habitat, education level etc and can be consider an ideal population for study of socio demographic factors in relation to violent asphyxia death cases. Hence in the present study data was collected for total medico-legal autopsy in Ajmer for 2008, 2009 and 2010. In these three years 30 % cases (776) were of suicide, of which 20 % (158) cases were of hanging. A detailed analysis of socio demographic profiles of 105 cases of violet asphyxia death was done in the study taking into account the period from 2009-2010.

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MATERIAL AND METHOD

The study was conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer for a period of one year i.e. from January 2009 to December 2010. During this period a total number of 105 cases were observed for violent asphyxial death caused by hanging or ligature strangulation. Socio-demographic

data for each case was collected for analysis with respect to age group, education level, religion, socio-economic class, marital status and habitat.

OBSERVATION & RESULT

Out of 105 cases, 100 cases were of hanging (HG) in which 90 cases were dead and 10 cases were alive, dead cases were brought for postmortem examination. Five cases were of ligature strangulation (LS), in which 3 cases were homicidal ligature strangulation, 2 cases were accidental ligature strangulation. Out of 5 cases of ligature strangulation 1 case of accidental ligature strangulation is alive. Highly decomposed and charred burnt bodies were not included in the study. The medico-legal report examination through various police stations of Ajmer was also collected.

Table No. 1: Socio demographic profile of violent asphyxia death caused in Ajmer, Rajasthan

Particulars	Category	No. of cases (Percentage)						
		Male		Female		Sub-Total		Total (%)
		HG	LS	HG	LS	HG	LS	
Age in years	11-20 yr	17 (22.4)	0	4 (16.7)	1 (20)	21 (21)	1 (20)	22 (20.95)
	21-30 yr	32 (42.1)	0	16 (66.7)	2 (40)	48 (48)	2 (40)	50 (47.62)
	31-40 yr	15 (19.7)	0	3 (12.5)	1 (20)	18 (18)	1 (20)	19 (18.10)
	41-50 yr	5 (6.6)	0	1 (4.2)	0	6 (6)	0	6 (5.71)
	51-60 yr	5 (6.6)	0	0	0	5 (5)	0	5 (4.76)
	>60 yr	2 (2.6)	0	0	1 (20)	2 (2)	1 (20)	3 (2.86)
Education	Illiterate	4 (5.3)	0	1 (4.2)	0	4 (4.3)	1 (16.7)	5 (4.8)
	Below Secondary	33 (43.4)	0	7 (29.2)	0	33 (35.9)	0	43 (38.1)
	Above Secondary	30 (39.5)	0	13 (54.2)	3 (60)	43 (46.7)	3 (50)	47 (43.8)
	Graduate	8 (10.5)	0	3 (12.5)	1 (20)	11 (12)	1 (16.7)	12 (11.4)
	Not Known	1 (1.3)	0	0	1 (20)	1 (1.1)	1 (16.7)	2 (1.9)
Religion	Hindu	69 (90.8)	0	22 (91.7)	4 (80)	91 (91)	4 (80)	95 (90.5)
	Muslim	4 (5.3)	0	2 (8.3)	1 (20)	6 (6)	1 (20)	7 (6.7)
	Christian	3 (3.9)	0	0	0	3 (3)	0	3 (2.9)
Socio economic class	Lower	12 (16)	0	1 (4)	0	13 (13)	0	13 (12.4)
	Middle	49 (65.3)	0	17 (68)	3 (60)	66 (66)	3 (60)	69 (65.7)
	Upper	14 (18.7)	0	7 (28)	2 (40)	21 (21)	2 (40)	23 (21.9)
Marital status	Unmarried	27 (36)	0	6 (24)	0	33 (33)	0	33 (31.4)
	Married	48 (64)	0	19 (76)	5 (100)	67 (67)	5 (100)	72 (68.6)
Habitat	Rural	15 (20)	0	4 (16)	2 (40)	19 (19)	2 (40)	21 (20)
	Urban	59 (78.7)	0	21 (84)	3 (60)	80 (80)	3 (60)	83 (79)
	Not known	1 (1.3)	0	0	0	1 (1)	0	1 (1)

Table 2: Manner and reasons of death

Precipitating factor	Number of cases	Percentage
Domestic unhappiness and shattered family relation	23	23 %
Unemployment	18	18 %
Poverty	6	6 %
Failure in examination	5	5 %
Unhappy love affair	18	18 %
Dispute of property (murder)	4	4 %

Contd…

Insanity/ Depression	10	10 %
Despair over torture	4	4 %
Dowry related	9	9 %
Monetary loss in lottery / Shares	0	0 %
Multiple attempts	2	2 %
Unknown / undetermined	1	1 %
Disease/Addiction	4	4 %
Unknown reasons	1	1
TOTAL	100	100 %

In the study table no 1 shows that most common age group affected was 21-30 years i.e., 50 cases (47.62 %) followed by 11-20 yr for 22 cases (20.95 %). Among 50 cases in 21-30 yrs age group, cases of hanging were highest 48 (96%). In this age group, male cases were only of hanging (32 cases; 64 %), whereas, in females both hanging (16 cases; 32 %) and ligature strangulation (2 cases; 4%) were there.

Table 1 denotes educational status of the cases, highest cases of death i.e., 47 (43.8 %) were affected in group educated up to above secondary. Cases of hanging were more (43) than ligature strangulation (3). Whereas, among males; hanging was high in below secondary education level showing 33 cases with 43.4 % occurrence. On the contrary, females of education status above secondary were victimized more with 13 cases (54.2 % among hanging cases) and 3 cases of ligature strangulation.

According to the religion, *Hindu* were victimized more in number (95; 90.5 %) followed by *Muslim* (7; 6.7 %) and *Christian* (3; 2.9%). Among males for hanging, 69 cases were Hindu (90.8 %), likewise in females hanging was also high in frequency for *Hindus* with 22 cases (91.7 %).

Socio economic class study reflected that middle class males and females both were victimized more by hanging{males:49(65.3%); females:17(68%)}.Marital status depicted maximum 72 cases (68.6%) of married persons of which 67 cases were of hanging. Married male cases for hanging were 48 (64 %) whereas in females, 19 cases were married (76%).

Habitat reflected that urban people suffered more with total of 83 cases (79 %), of which 80 cases were of hanging (80%). Among urban males 59 cases were of hanging (78.7 %) and among females 21 cases were of hanging (84 %).

There were 13 triggering factors observed which lead the person to encounter violent asphyxial death. Domestic unhappiness and shattered family tension cases were the highest (23) followed by unemployment (18), unhappy love affair (18), depression (10) and dowry related (9).

DISCUSSION

In the present time of globalization and urbanization with the change in life style, stress is very commonly observed in everyone's life. Suicidal deaths in the society are strongly correlated with mental stress; asphyxia death by hanging is very common suicidal death. Suicide by hanging is common mainly because it is a sure death caused in minimum time with no pain compared to other options. In the present study done over Ajmer, Rajasthan population during 2009-2010, total suicidal cases registered were 749 of which 105 cases (21.29 %) were of violent asphyxia death, of which 100 cases were of hanging (HG); 90 cases were dead and 10 cases were alive; 05 cases of ligature strangulation (LS), in which 3 were of homicidal ligature strangulation, 2 were of accidental ligature strangulation. The number of suicidal cases is increasing day by day in the society, it is very much important to identify the causative factor for its rectification to minimize the incidence of suicidal death in the society.

Present study accounts the socio demographic profile of 105 cases for various factors viz., age, education level, religion, socio-economic class, marital status, and habitat. Age group of 21-30 yrs showed maximum deaths irrespective of gender (50 cases; 47.62 %), males

cases (32 cases; 64 %) were only of hanging whereas in female both hanging (16 cases; 32 %) and ligature strangulation (2 cases; 4 %) was seen. Rate of opting hanging suicidal death is high in the young age group and also in male candidates, past studies also report the same trend by [2, 5, 4]. High rate of death by asphyxia was seen in cases having education above secondary (47 cases; 43.8 %), but in case of male hanging cases were high in below secondary education group (33 cases). Religious background showed that in Hindu's the tendency of suicide is high (95 cases; 90.5 %), where as it was low in Muslims; the ongoing trend of nuclear family in Hindu community may be a strong reason for forcing a person as these suicidal thoughts are very much related when a person is in isolation from family members. A concept of joint family acts in a very positive way to release mental stress occurring in daily life, Muslims are still following the joint family concept in large as compared to Hindus now a days. Cases of hanging were high in middle class socio economic group {males: 49 (65.3 %); females: 17 (68%)}, this clearly shows that middle class is more under stressful environment as the decision of suicide is highly related to mental stress, similar trends are also reported by[4]. Marital status also affects the human life in terms of mental stress, most of the cases of death were married (72 cases; 68.8 %), of which males cases were high (48 cases; 64 %) similar trend was also observed[4]; married life is very stress full and in India, males are highly responsible for all economic needs of the family and social duties, hence stress in and around forces a person to escape from the anxious stage permanently by ending his life. A person's habitat is also of high concern in attempting suicide, urban residents are under more stress environment, and in present study 83 cases (79 %) were from urban areas. Total 13 triggering factors were identified (Table 2) of which domestic unhappiness and family tensions cases were high (23 cases; 21.90 %) followed by unemployment.

CONCLUSION

Asphyxial death studied in Ajmer population over 105 cases showed that high rate of ashyxial death is due to hanging, whereas death due to ligature strangulation was found to be low in the region. The most affected group by asphyxia death as identified by socio-demographic profiles made for Ajmer region can be marked as; age group-21-30 yrs; gender-male; education-above secondary; religion-Hindu; socio economic class-middle; marital status- married; habitat-urban. These all observation made for Ajmer district suggest that there is high metal stress among the people of the region and proper measures should be taken up to reduce the level of increasing stress in humans life either by awareness, education, orientation, counseling etc for common people to adopt stress releasing activities in life.

Conflict of Interest: None

Source of Funding: None (to carry the research fund was spent by authors)

Ethical Clearance: This is my bonafied research work for award of MD Forensic Medicine Degree by Rajasthan University of Health Sciences, Jaipur in May 2011. My thesis has been evaluated and approved by panel of examiners

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Study of Nature of Ligature Material, Knot Type and Pattern of Ligature Mark in Death Cases Caused by Hanging and Compression of Neck in Ajmer District

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ABSTRACT

In humans, one of the major modes of death is asphyxia and type of asphyxia most commonly encountered in medico-legal practice is mechanical asphyxia. Hanging is one of the most common method of suicide in India, other types of hanging are, homicidal hanging judicial hanging, autoerotic hanging. The study was conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer for a period of one year i.e. from January 2009 to December 2010. During this period a total number of 100 cases were observed for violent asphyxial death caused by hanging. In the present investigation hanging cases reported in Ajmer region were studied for ligature material, hanging type and ligature marks. In the study cotton rope is the most common material used (out of 100 cases 52 cases), of which fixed knot pattern was most common. Domestic sites in home like ceiling fans and beam/bar was the common suspension site observed for hanging. Moreover Atypical and complete hanging type were most common being 89 cases and 87 cases respectively

Keywords: *Hanging, ligature material, ligature marks, suspension*

INTRODUCTION

In humans, one of the major modes of death is asphyxia and type of asphyxia most commonly encountered in medico-legal practice is mechanical asphyxia. Among the means of producing mechanical asphyxia, construction round the neck plays a major role. Hanging originated as a method of execution in Persia (now Iran) about 2500 years ago, and since then it is the oldest but most widely used method of execution in the world. Still hanging remains the standard lawful method of execution in many countries. Hanging is one of the most common method of suicide in India, other types of hanging are, homicidal hanging judicial hanging, autoerotic hanging (Camps et al, 1976)[2]. Hanging differs from strangulation in which the neck is constricted irrespective of any effect caused by the weight of the body (Mant, 1984)[5].The various structures damaged in hanging and strangulation include the soft tissue like skin, subcutaneous tissue, fascia, muscle, blood vessels and lymph node and the bony and cartilaginous tissues like the hyoid bone and larynx (Mant,1984)[5]. The ligature mark is a vital piece of evidence, ligature mark depends on the nature and position of the ligature used, and the time of suspension of body after death. If the ligature is soft, and the body cut down from the ligature immediately after death, there may be no mark. Again, the intervention of a thick and long beard or clothes on the neck leads to the formation of a slight mark[3]. Sometimes, the pattern of the ligature material is impressed on the skin and a characteristic diagonal mark of the strands found when the rope is used. The wide band of cloth when used as a ligature on the bare skin may cause a narrow ligature mark, due to tension lines in the stretched cloth[3]. Usually only one mark is found, multiple marks may be present due to multiple turns around the neck or upward displacement after application due to fall[7]**.** The ligature material may consists of a wide variety of objects, some not obviously suitable for the purpose, yet effective in causing death. Cords, wires, ropes and belts are strong

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and relatively thin, so that they tend to cut deeply into the neck if the tension is great[3,7]. In the present investigation hanging cases reported in Ajmer region were studied for ligature material, hanging type and ligature marks. The observations are presented below.

MATERIAL AND METHOD

The study was conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer for a period of one year i.e. from January 2009 to December 2010. During this period a total number of 100 cases were observed for violent asphyxial death caused by hanging. In cases of the body, brought with ligature material, the ligature material were studied for its dimension, pattern, site of knot, type of knot, texture and other characters of the ligature material. The ligature marks were photographed (front view and site of knot). Fixed knot pattern was the most common accounting 87 cases out of 100.

OBSERVATION & RESULT

Table 1: Type of ligature material and type of knot wise distribution of hanging cases

Sr. No.	Type of Material	Hanging			Total	% Cases
		Sliding knot	Fixed knot	Total		
1.	Cotton rope	4	47	51	52	52
2.	Chunni	2	25	27	28	28
3.	Sari	2	6	8	8	8
4.	Nylon rope	-	1	1	7	7
5.	Lungi	-	3	3	3	3
6.	Bed sheet	-	2	2	2	2
7.	Belt	1	-	1	1	1
8.	Niwar	-	1	1	1	1
9.	Plastic rope	-	1	1	1	1
10.	Telephone wire	1	-	1	1	1
	Total	13	87	100	100	

In the study done of 100 cases of hanging, ten type of ligature material were used *viz.,* cotton rope, chunni, sari, nylon rope, lungi, bed sheet, belt, niwar, plastic rope, and telephone wire. After analysis as per Table 1, it was found that cotton rope was very commonly used (52 cases; 52 %). Hanging cases were 51 out of 52 cases and of which fixed knot type was most frequent (47 cases). The second most frequent ligature material used was chunni (28 cases; 28 %), again the fixed knot pattern was commonly used in the 25 cases of chunni. Least used ligature material was belt, niwar, plastic rope and telephone wire with only one case each but all were of hanging.

Table 2: Type of hanging and point of suspension wise distribution of cases

Type of Hanging	Point of Suspension					Total
	Hook	Bar/Beam	Branch of Tree	Fan	Railing	
Typical	1	3	0	7	0	11
Atypical	9	21	1	57	1	89
Total (1)	**10**	**24**	**1**	**64**	**1**	**100**
Complete	8	20	1	57	1	87
Partial	2	4	0	7	0	13
Total (2)	**10**	**24**	**1**	**64**	**1**	**100**

Based on the study on type of hanging and point of suspension (Table 2), it was observed that; out of 100 cases 89 were atypical type of which maximum were suspended on ceiling fan (57), followed by 21 cases suspended on bar/beam. The analysis based on complete and partial hanging type showed that out of 64 cases of suspension on ceiling fan 57 were of complete type, in case of bar/beam suspension maximum 20 were of complete type.

Table 3: Distribution of cases of hanging according to number of turn of ligature mark

Type of hanging	Ligature mark		Total
	Single	Multiple	
Typical	9	2	11
Atypical	85	4	89
Total	94	6	100

Ligature marks were future studied, as per table 3 it was observed that in atypical cases of hanging 85 cases were of single ligature mark were as only 4 cases should multiple ligature turns, whereas in typical hanging cases only 9 cases were of single ligature mark and 2 showed multiple ligature marks.

DISCUSSION

In the present era of urbanization the cases of hanging has increased (Borah and Chaliha), hence the study on the aspects like cause of death, ligature material used and ligature marks is imperative to understand the subject. Therefore, the present study conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer on 100 cases recorded of hanging in Ajmer district from January 2009 to December 2010 are discussed below.

The observation on type of hanging material used for homicidal event showed that cotton rope was the most common material used for hanging (52 cases; 52 %). Similar observations were made by Authors Momin et al (2008)[6], Fimate et al (1993)[4]. However soft material like chunni or dupatta was found in the study by Waghmare et al (2014)[11].

The type of hanging in the cases studied (Table 3) showed that atypical type (89 cases) and complete type (87 cases) was most common. Observation on suspension material showed that ceiling fan was the most common option by the victim (64 cases) followed by bar/beam (24 cases). The findings were similar to that of Ambade et al (2015)[1] they also found hanging in homes on celing fan or beam/bar is most common.

Observation on ligature marks showed that in atypical cases 85 cases showed single ligature mark whereas, 9 cases of typical showed single ligature marks. The finding are similar to that of Sharma et al (2005)[8]

CONCLUSION

Hanging homicidal deaths are very common in the Indian society. In Ajmer district study on hanging cases for the ligature material, hanging type and ligature marks depicted that cotton rope is the most common material used (out of 100 cases 52 cases), of which fixed knot pattern was most common. Domestic sites in home like ceiling fans and beam/bar was the common suspension site observed for hanging. Moreover Atypical and complete hanging type were most common being 89 cases and 87 cases respectively.

Conflict of Interest: None

Source of Funding: None (to carry the research fund was spent by authors)

Ethical Clearance: This is my bonafied research work for award of MD Forensic Medicine Degree by Rajasthan University of Health Sciences, Jaipur in May 2011. My thesis has been evaluated and approved by panel of examiners

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Study on Nature of Ligature Material, Knot Type and Pattern of Ligature Mark in Death Cases Caused by Hanging and Ligature Strangulation in Ajmer District

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ABSTRACT

In humans, one of the major modes of death is asphyxia and type of asphyxia most commonly encountered in medico-legal practice is mechanical asphyxia. Hanging is one of the most common method of suicide in India, other types of hanging are, homicidal hanging judicial hanging, autoerotic hanging. The study was conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer for a period of one year i.e. from January 2009 to December 2010. During this period a total number of 105 cases were observed; of which 100 were of hanging and 05 cases of ligature strangulation. In the present investigation 100 hanging cases reported in Ajmer region were studied for ligature material, hanging type and ligature marks. In the study, cotton rope is the most common material used (out of 100 cases 51 cases), of which fixed knot pattern was most common (47 cases). Domestic sites in home like ceiling fans and beam/ bar was the common suspension site observed for hanging. Moreover Atypical and complete hanging type were most common being 89 cases and 87 cases respectively

Keywords: *Hanging, ligature material, ligature marks, suspension*

INTRODUCTION

In humans, one of the major modes of death is asphyxia and type of asphyxia most commonly encountered in medico-legal practice is mechanical asphyxia. Among the means of producing mechanical asphyxia, constriction round the neck plays a major role. Hanging originated as a method of execution in Persia (now Iran) about 2500 years ago, and since then it is the oldest but most widely used method of execution in the world. Still hanging remains the standard lawful method of execution in many countries. Hanging is one of the most common method of suicide in India, other types of hanging are, homicidal hanging judicial hanging, autoerotic hanging (Camps et al, 1976)[2]. Hanging differs from strangulation in which the neck is constricted irrespective of any effect caused by the weight of the body (Mant, 1984)[5].The various structures damaged in hanging and strangulation include the soft tissue like skin, subcutaneous tissue, fascia, muscle, blood vessels and lymph node and the bony and cartilaginous tissues like the hyoid bone and larynx (Mant,1984)[5]. The ligature mark is a vital piece of evidence; ligature mark depends on the nature and position of the ligature used, and the time of suspension of body after death. If the ligature is soft, and the body cut down from the ligature immediately after death, there may be no mark. Again, the intervention of a thick and long beard or clothes on the neck leads to the formation of a slight mark[3]. Sometimes, the pattern of the ligature material is impressed on the skin and a characteristic diagonal mark of the strands found when the rope is used. The wide band of cloth when used as a ligature on the bare skin may cause a narrow ligature mark, due to tension lines in the stretched cloth[3]. Usually only one mark is found, multiple marks may be present due to multiple turns around the neck or upward displacement after application due to fall[7]**.** The ligature material may consists of a wide variety of objects, some not obviously suitable for the purpose, yet effective in causing death. Cords, wires, ropes and belts are strong

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and relatively thin, so that they tend to cut deeply into the neck if the tension is great[3,7]. In the present investigation hanging cases reported in Ajmer region were studied for ligature material, hanging type and ligature marks. The observations are presented below.

MATERIAL AND METHOD

The study was conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer for a period of one year i.e. from January 2009 to December 2010. During this period a total number of 105 cases were observed for violent asphyxial death, of which 100 cases were of hanging, 05 cases were of ligature strangulation in which 03 cases were of homicidal ligature strangulation and 02 cases were of accidental ligature strangulation. In the present paper observation pertaining to 100 cases of hanging and 05 cases of ligature strangulation are presented and discussed. In cases of the body, brought with ligature material, the ligature material were studied for its dimension, pattern, site of knot, type of knot, texture and other characters of the ligature material. The ligature marks were photographed (front view and site of knot). Fixed knot pattern was the most common accounting 87 cases out of 100 cases of hanging.

OBSERVATION & RESULT

In the study done of 105 cases, 100 cases were of hanging and 05 cases were of ligature strangulation. Ten type of ligature material were used *viz.,* cotton rope, chunni, sari, nylon rope, lungi, bed sheet, belt, niwar, plastic rope, and telephone wire. After analysis as per Table 1, in 52 cases cotton rope was used in which 51 were of hanging and 01 of ligature strangulation. For knot type study, fixed knot type was most frequent observed (in 47 cases). Chunni was the second most frequent ligature material used in 28 cases (28%) of which 27 were of hanging and 01 of ligature strangulation. Least used ligature material was belt, niwar, plastic rope and telephone wire with only one case each but all were of hanging. In all 05 ligature strangulation cases, only slip knot was observed; Among these five cases in 03 cases of homicidal ligature strangulation nylon rope was used, whereas for two cases of accidental ligature strangulation chunni and cotton rope were used.

Based on the study on type of hanging and point of suspension (Table 2; Plate 1), it was observed that; out of 100 cases 89 were atypical type of which maximum were suspended on ceiling fan (57), followed by 21 cases suspended on bar/beam. The analysis based on complete and partial hanging type (Plate 1; table 3) showed that out of 100 cases of suspension, 86 cases were of complete type and 14 were of partial type. Out of 86 cases of complete type, 56 cases were of ceiling fan suspension and 20 cases of bar/beam suspension. Out of 14 partial cases 08 were ceiling fan suspension and 04 were of bar/beam suspension.

Ligature marks were future studied, as per table 4 it was observed that among 100 cases of hanging, single mark was found in 94 (94 %) cases and multiple marks were seen in 06 cases (06 %). In 05 cases of ligature strangulation single mark was observed in 02 cases and multiple in 03 cases.

Table 1: Type of ligature material and type of knot wise distribution of hanging and ligature strangulation cases

Type of Material	Hanging			Ligature strangulation			Total
	Sliding knot	Fixed knot	Total	Sliding knot	Fixed knot	Total knot	
Belt	1 (1.00)	-	1 (1.00)	-	-	-	1 (0.95)
Bed sheet	-	2 (2.00)	2 (2.00)	-	-	-	2 (1.90)
Chunni	2 (2.00)	25 (25.00)	27 (27.00)	1 (20.00)	-	1 (20.00)	28 (26.67)
Cotton rope	4 (4.00)	47 (47.00)	51 (51.00)	1 (20.00)	-	1 (20.00)	52 (49.52)
Lungi	-	3 (3.00)	3 (3.00)	-	-	-	3 (2.86)
Niwar	-	1 (1.00)	1 (1.00)	-	-	-	1 (0.95)
Nylon rope	-	1 (1.00)	1 (1.00)	3 (60.00)	-	3 (60.00)	7 (6.67)
Plastic rope	-	1 (1.00)	1 (1.00)	-	-	-	1 (0.95)

Contd…

Sari	2 (2.00)	6 (6.00)	8 (8.00)	-	-	-	8 (7.62)
Telephone wire	1 (1.00)	-	1 (1.00)	-	-	-	1 (0.95)
Total	13 (13.00)	87 (87.00)	100 (100.00)	5 (100.00)	0	5 (100.00)	105 (100.00)

*Percent in parenthesis

Table 2: Type of hanging and point of suspension wise distribution of cases

Type of Hanging		**Point of Suspension**					**Total**
		Hook	**Bar/Beam**	**Branch of Tree**	**Fan**	**Railing**	
A	Typical	1	3	0	7	0	11
	Atypical	9	21	1	57	1	89
	Total A	**10**	**24**	**1**	**74**	**1**	**100**
B	Complete	8	20	1	57	1	87
	Partial	2	4	0	7	0	13
	Total B	**10**	**24**	**1**	**64**	**1**	**100**

Table 3: Distribution of cases of hanging according to number of turn of ligature mark

Type of hanging	**Ligature mark**		**Total**
	Single	**Multiple**	
Typical	9	2	11
Atypical	85	4	89
Total	**94**	**6**	**100**

Table 4: Distribution of cases of hanging and ligature strangulation according to number of turn of ligature mark

Number of Turns	**Hanging**	**Ligature Strangulation**
	Number and %	Number and %
Single	94 (94 %)	2 (40 %)
Multiple	6 (06 %)	3 (60 %)
Total	100	5

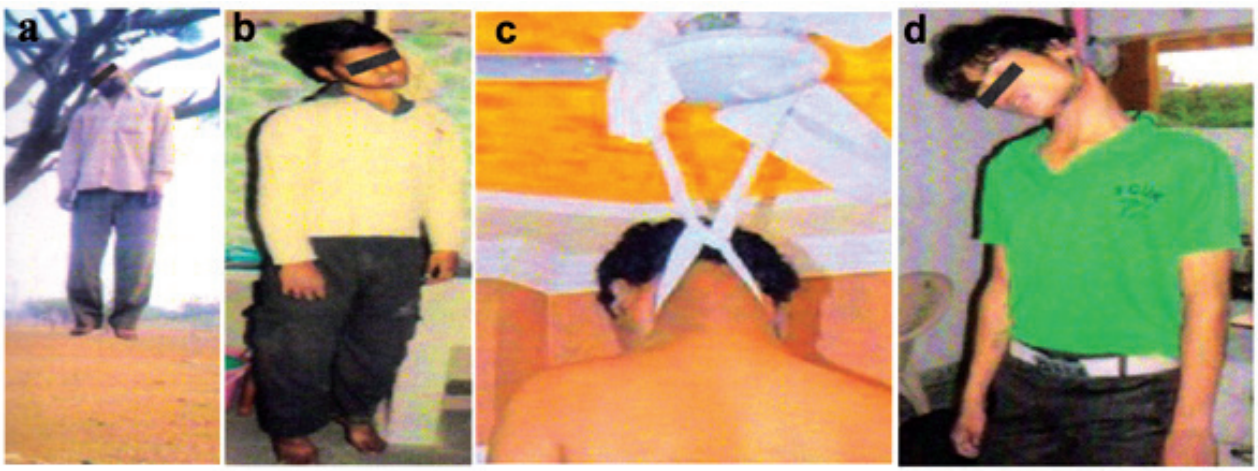

Plate 1: Photos depicting type of hanging observed in the study; a: Complete; b: Partial; c:Typical; d: Atypical

DISCUSSION

In the present era of urbanization the cases of hanging has increased, hence the study on the aspects like cause of death, ligature material used and ligature marks is imperative to understand the subject. Therefore, the present study conducted in the Department of Forensic Medicine & Toxicology at JLN Medical College, Ajmer on 105 cases recorded of hanging and ligature strangulation in Ajmer district from January 2009 to December 2010 are discussed below.

The observation made on type of ligature material used for homicidal event (03 cases) showed that nylon rope was used in all the three cases. Whereas, in suicidal cases cotton rope was the most common material used for hanging (51 cases). Similar observations were made by Momin et al (2008)[6], Fimate et al (1993)[4]. However, soft material like chunni or dupatta was found to be more common in the study done by Waghmare et al (2014)[11].

The type of hanging in the cases studied showed that atypical type (89 cases) and complete type (87 cases) was most common. Observation on point of suspension showed that ceiling fan was the most common option used (64 cases) followed by bar/beam (24 cases). The findings were similar to that of Ambade et al (2015)[1] they also found hanging in homes on ceiling fan or beam/bar is most common.

Observation on ligature marks showed that, out of 100 cases of hanging single mark was most common (94 cases) whereas multiple mark was seen in only 06 cases. Out of 05 ligature strangulation cases, in 03 homicidal cases multiple marks were observed and single mark seen in 02 accidental cases. Single ligature marks was observed in 85 cases of atypical type and 9 cases of typical type. The finding are similar to that of Sharma et al (2005)[8]

CONCLUSION

Suicidal hanging is common in India, and very often homicidal hangings are simulated as suicidal hangings. In our study on Ajmer population, 105 aspyrixal death were recorded for the study period. Out of 105, 100 cases were of hanging and 05 of ligature strangulation of which 03 of homicidal ligature strangulation and 02 accidental ligature strangulation. Study on ligature material showed that in hanging cotton rope was most commonly used followed by chunni. Fixed knot pattern was most common in hanging, slip knot was found in all cases of ligature strangulation. Nylon rope was used in all cases of homicidal cases. Domestic sites in home like ceiling fans and beam/bar was the common suspension point observed for hanging. Among the type of hanging, atypical and complete hanging type were most common observed. Single ligature mark in hanging was commonly found and multiple marks were observed in homicidal ligature strangulation.

Conflict of Interest: None

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Awareness among Doctors of a Medical College in Southern India of Guidelines and Protocols for Medico-Legal Care for Survivors/Victims of Sexual Violence

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ABSTRACT

Sexual assault is a heinous crime. An early and detailed medical examination is of vital importance for the purpose of investigation. Often, due to lack of documentation, maintenance of records and a lack of awareness of medico-legal law among health care professionals, there is secondary victimization of women, compounding the psycho-social impact of the event. Sexual violence is a major cause of psychological and physical harm for children and women. New guidelines for treating rape victims/survivors was drawn up by the Union health ministry, according to which, every hospital has to set up a separate room for the forensic and medical examination of survivors. The Department of Health Research (DHR) with the Indian council of Medical Research (ICMR) and other experts, introduced a set of national guidelines and protocols for sexual assault cases. The present study aim was to find out the awareness about these guideline and protocol and also to identify the gaps which was introduced to overcome the loopholes. The study was questionnaire based. The target population was medical practitioners in different departments. With 23.47% of respondents being partly aware and 36.73% being unaware, it is obvious that there is a training need. As per the guidelines of the MoHFW, GoI, any medical practitioner can examine and treat sexual assault cases. Hence, the suggested training module can be implemented during under graduation training or during internship.

Keywords: *Sexual violence, MoHFW guidelines, awareness among doctors*

INTRODUCTION

Sexual assault is a heinous crime. An early and detailed medical examination is of vital importance for the purpose of investigation. Often, due to lack of documentation, maintenance of records and a lack of awareness of medico-legal law among health care professionals, there is secondary victimization of women, compounding the psycho-social impact of the event. Sexual violence is a major cause of psychological and physical harm for children and women.

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The WHO defines sexual violence as "any sexual act, attempt to obtain a sexual act, unwanted sexual comments/advances and acts to traffic, or otherwise directed, against a person's sexuality, using coercion, threat of harm or physical force, by any person regardless of relationship to the victim, in any setting, including but not limited to home and work (WHO 2003).[1]

Following are the forms of sexual violence[1]:

1. Female genital cutting.
2. Sexual abuse of children.

3. Systematic rape during armed conflict, sexual slavery.
4. Forced prostitution and trafficking for purpose of sexual exploitation.
5. Sexual abuse of people with mental and physical disabilities.
6. Forced abortion
7. Rape by family members
8. Rape by strangers.
9. Child and forced marriage
10. Coerced /forced sex in marriage or living in relationships or dating relationships.
11. Forcibly disrobing and parading naked any person.
12. Inspections for virginity.
13. Unwanted sexual harassment or sexual advances.
14. Denial to use contraception or other measures to protect against STIs.
15. Forced exposure to pornography.

The MoHFW-GoI (Ministry of Health and Family Welfare-Government of India), in March 2014, presented the Guidelines and Protocols for the Medico-legal care of survivors/victims of Sexual Violence. These were developed by the Department of Health Research and the Indian Council of Medical Research(ICMR). These aim to achieve the following[1]:

1. Provide guidance on dealing with persons from groups like: differently abled persons, sex workers, the LGBT community, children, persons facing caste, class or religion based discrimination.
2. Ensure gender sensitivity in the entire procedure by disallowing any mention of past sexual practices through comments on the size of the vaginal introitus, elasticity of the vagina or the anus. Further, it bars comments of built/height-weight/nutrition or gait that perpetuate stereotypes about "victims".
3. Focus on the history by recognizing various forms and dynamics of sexual violence including activities that lead to loss of evidence.
4. Scientific collection and preservation of samples.
5. Standard examination and treatment protocols for dealing with sexual violence cases.

All hospitals must have a Standard Operating Procedure (SOP) for managing sexual assault cases.[1]

1. To provide comprehensive patient care services.
2. Clarity of role/s of each hospital staff for smooth handling of cases.
3. To have a uniform policy for all doctors in the hospital.

The SOP must be printed and provided to all hospital staff. A registered medical practitioner can conduct the physical examination and it is not mandatory for a gynecologist to examine the survivor. In case of a female survivor, a lady doctor is preferred, but the absence or unavailability of a lady doctor should not result in denial or delay of examination and treatment. The police should not be allowed in the examination room with the survivors. Evidence collection, hospital admission or filing of a police complaint are not preconditions for the provision of treatment.

AIM

To assess awareness among doctors, of the MoHFW-GoI (Ministry of Health and Family Welfare-Government of India) March 2014 guidelines and protocols for medico-legal care of survivors of Sexual Violence.

OBJECTIVES

1. To assess awareness among doctors of the new guidelines of medical examination and treatment of sexual assault survivors.
2. To design a training module on the basis of the gaps identified.

METHODOLOGY

Type of study: Cross sectional study

Study tool: Questionnaire based study

Study setting: A medical college in southern India

Duration of study: 6 months

Sampling: Cluster two stage sampling

Sample size: 98

Inclusion criteria: Doctors who examine and treat sexual assault cases.

OBSERVATION AND RESULT

The study was conducted in a tertiary care teaching hospital. The study was conducted among doctors of the departments of forensic medicine, obstetrics and gynecology, psychiatry, surgery, medicine, otorhinolaryngology (ENT), pediatrics and ophthalmology. Doctors who examine and treat sexual assault cases were considered in this study whereas doctors who don't examine and treat sexual assault cases were excluded from this study. Questionnaires were distributed to all 98 doctors out of which 13 refused to participate in the study. After assessing the awareness among doctors, we identified the gaps. We have designed a training module to overcome these gaps.

Table 1: Awareness among respondents of the guidelines and protocols for medico-legal care for survivors/ victims of sexual violence.

Aware (Above 12 correct responses)	Partly aware (8-12 correct responses)	Not Aware (less than 8 correct responses)	No response
26 (26.53%)	23 (23.47%)	36 (36.73%)	13 (13.27%)

Table 2: Awareness among respondents of the guidelines and protocols for the physical examination of sexual assault victims.

Aware	Partly aware	Not aware	No comment
30 (30.61%)	35 (35.72%)	20 (20.40%)	13 (13.26%)

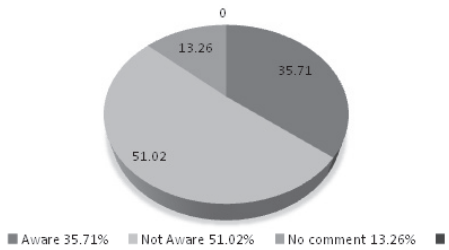

Figure 1: Awareness among respondents of the guidelines and protocols for police investigation and procedure.

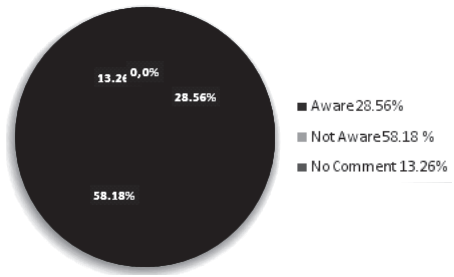

Figure 2: Awareness among respondents of the age of consent in sexual assault victims/survivors.

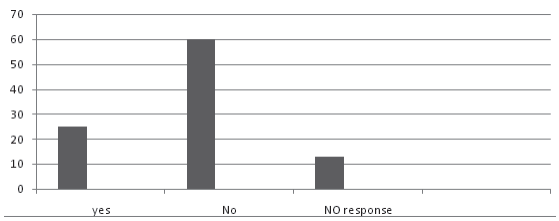

Figure 3: Education or training on sexual assault

25 doctors said that they had received some form of training. 60 doctors said they had not received any training. 13 doctors did not respond.

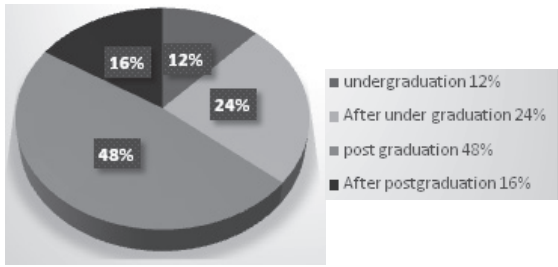

Figure 4: Point of time when they received the training on sexual assault.

48% received the training during their post graduation. 16% received the training after their post graduation. 12% received their training during their under graduation. 24% got their training after under graduation and before post graduation.

DISCUSSION

New guidelines for treating rape victims/survivors was drawn up by the Union health ministry, according to which, every hospital has to set up a separate room for the forensic and medical examination of survivors. The Department of Health Research (DHR) with the Indian council of Medical Research (ICMR) and other experts, introduced a set of national guidelines and protocols for sexual assault cases. A Gender and Health expert group was formed in

2011 by Dr.V.M. Katoch, secretary of ICMR, under the chairmanship of Dr.M.E. Khan, to formulate guidelines and protocols that could be used at all levels of healthcare, from Primary Health Centers (PHCs) to District hospitals. Dr.Indrajit Khandekar, professor in the Clinical forensic medicine unit at the Mahatma Gandhi institute of Medical sciences (MGMS), Wardha, was given the responsibility of drafting the guidelines.

Khandekar concluded that there was no uniformity in examination documentation and opinion writing in sexual assault cases. There was no uniform proforma for the examination of rape survivors. No relevant training was given to doctors[2]. Brahma et al noted the absence of clear guidelines, standard operating protocols and manuals for examination of sexual assault survivors. It noted that rape survivors were treated the same as general patients, with a disregard for the requirement of privacy.[3] Lal et al noted the absence of uniform guidelines for the gathering of medical evidence in rape cases and observed that medical practitioners often focused on aspects that were not relevant to the investigation.[4] Nanandkar et al observed that 39% of Obstetricians and gynecologists in his study were not aware or confused regarding promptness in examination of a survivor of sexual assault. 44% were unaware or unsure of evidence preservation in rape cases.[5] Mc Gregor et al found that documented injury extent had a significant positive association with both filing of charges and conviction. This confirms the value of injury documentation in the forensic examination of sexual assault victims.[6] Tamuli R P et al found that 98.43% of alleged sexual assault survivors were females. 55.76% of cases were in the age group of 11 to 20 years.[7]

Campbell et all concluded that nurses who were provided training in the sexual assault nurse examiner program (SANE) were not only competent in forensic evidence collection but also better at examination.[8] Sande et al in their survey of residency program directors (PDs) concluded that more than half of them did not know how their sexual assault guidelines were formulated. Recommendations from literature were few.[9]

The present study aim was to find out the awareness about these guideline and protocol and also to identify the gaps which was introduced to overcome the loopholes. The study was questionnaire based. The target population was medical practitioners of different departments.

With regard to the overall awareness among respondents of the guidelines and protocols for medico-legal care for survivors/victims of sexual violence, 26(26.53%) were aware, 23(23.47%) were partly aware, 36(36.73%) were not aware and 13(13.27%) had no response. With regard to the awareness among respondents of the guidelines and protocols for the physical examination of sexual assault victims, 30(30.61%) doctors were aware, 35(35.72%) were partly aware, 20(20.40%) were not aware and 13(13.27%) did not respond. With regard to the awareness among respondents of the guidelines and protocols for police investigation and procedure, 49(50%) were not aware, 36(36.73%) were aware and 13(13.27%) did not respond. With regard to the awareness among respondents of the age of consent in sexual assault victims/survivors. 57(58.16%) were not aware, 28(28.57%) were aware and 13(13.27%) did not respond. With regard to education or training on sexual assault, 25(25.51%) had received education or training, 60(61.22%) had not received education or training and 13(13.27%) doctors did not respond. Out of those whao had received education/ training 12(48%) received it during their post graduation, 6(24%) after their under graduation, 3(12%) during under graduation and 4(16%) after their post graduation.

RECOMMENDATIONS

1. With 23.47% of respondents being partly aware and 36.73% being unaware, it is obvious that there is a training need. As per the guidelines of the MoHFW, GoI, any medical practitioner can examine and treat sexual assault cases. Hence, the suggested training module can be implemented during under graduation training or during internship.
2. Hospitals should set up a special room for the examination of sexual violence victims. As per the new guidelines, history taking and examination must be carried out in complete privacy.
3. Periodic training should be made mandatory for all medical practitioners.
4. A comprehensive SOP (standard operating protocol) for management of cases of sexual assault should be provided in all departments which deal with sexual assault cases.

TRAINING MODULE

Module summary: A training program to ensure standardization in the approach to the examination and treatment of sexual assault victims in the hospital.

Objectives

1. To provide comprehensive training to doctors.
2. To help doctors understand better the nature and effects of sexual assault.
3. To help doctors recognize the range of injury patterns in sexual assault.
4. To increase the doctors' awareness of procedures for conducting and reporting on a forensic examination of sexual assault victims.

Presenter's Activities to Support this training

During this training, the presenter will:

1. Use a scenario to explain the guidelines on sexual assault.
2. Conduct a small group exercise.
3. Conduct a group discussion.

Tools and Materials

Handouts

1. Power point slides.
2. Manual for physical examination and treatment of sexual assault survivors.
3. Copy of guidelines on approach to sexual assault victims by MoHFW.

Schedule

Total duration: 4.5 hours with a break for 30 minutes

Module 1

Session	Topic	Components	Duration
1.	Introduction to sexual assault : Department of Forensic medicine	1. Definition 2. Significance of forensic examination in sexual assault victims. 3. Current statistic for the world and for India.	0.5 hours
2.	Examination and treatment of sexual assault victims : Department of Forensic medicine	1. Demographic details, personal history. 2. General physical examination, Oral examination, Local examination, Extra genital examination 3. Evidentiary material.	1.5 hours
3.	Legal proceedings and documentation : Hospital administration.	1. Police intimation procedure 2. Consent taking and documentation for physical examination	0.5 hours
4.	Psychological counseling : Psychiatrist	Post traumatic stress disorder. guilt, low self esteem, depression, suicidal tendency .	0.5 hours

Break: 30 minutes

Module 2

Session	Topic	Components	Duration
5	Small group exercise : Department of forensic medicine	1. Groups of 4 to 6 people answering questions or solving problems. Eg. hypothetical cases. 2. Followed by discussion and expert advice.	1.5 hours

Feedback forms are collected from participants. Printed handout of training sessions to be provided. Training cards to be given to all participants. Documentation to be maintained by HR. Re-test to be conducted after 6 months. If the scores in the re-test are not satisfactory, then retraining is required.

Source of Funding: Nil

Conflict of Interest: Nil

Ethical Clearance: Taken from Manipal University Institutional Ethics Committee.

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Profile of Deaths Due to Poisoning at a Tertiary Care Centre in North Karnataka

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ABSTRACT

The present study evaluated the trends of deaths due to Poisoning in Northern Karnataka region for a period of one year, from January 2014 - December 2014 in the Department of Forensic Medicine and Toxicology at Karnataka Institute of Medical Sciences, Hubballi, Karnataka.

There were a total of 179 cases died due to Poisoning with males (66.5%) and females (33.5%). The highest incidence (56.4%) was seen in victims aged between 21-40 years. 78.2 % were from rural origin and most of the victims were literates and completed High School (41.9%). Majority of victims (59.2%) belonged to upper lower (Class IV) socioeconomic class and majority of the victims were agriculture (47.2%) by occupation. Most common type of poison consumed or used was Organophosphorus compound (78.2%), followed by Carbamates (6.1%) and Organochlorines (3.4%). Suicidal poisoning (95.5%) was most common among the victims.

Keywords: *Poisoning, Insecticides, Pesticides, Suicide, Homicide, Accidental.*

INTRODUCTION

Paracelsus the father of toxicology (1493-1541) wrote "All things are poisons and there is nothing that is harmless, the dose alone decides that something is no poison".[1] Poison is any substance that causes damage or injury to the body and endangers one's life due to its exposure by means of ingestion, inhalation, or contact.[2] Poisoning, self infliction with fire and hanging are the major modes of suicides in India.

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In India according to National Crime Records Bureau 2014, more than one lakh persons (1,31,666) lost their lives by committing suicide. Out of these 26% of the suicides were reported due to poisoning. The highest incidents of 16,307 (12.4%) suicides were reported in Maharashtra followed by 16,122 (12.2%) suicides in Tamil Nadu and 14,310 (10.9%) suicides in West Bengal. In Karnataka 10,945 (8.3%) persons committed suicides during the above mentioned period.[3]

Globally, intentional poisoning is one of the important causes for morbidity and mortality.[4] Various agents such as agrochemicals, drugs or environmental substances are used as poisoning agents.[5] Distress due to failure to achieve, loss in the business, refused in love or failure in romance or conflict with the intimate partner or dear ones, or failure in examination, emotional disturbances and frustration of chronic diseases are the common reasons for intentional poisoning.[6] However, accidental poisoning also is on rise.[7]

As the majority of population in rural parts of India depend on agriculture for their livelihood, farmers stock the pesticides for its repeat use to eliminate the pests and weeds. It is due to the easy availability of pesticides, they are commonly used by the people who are psychologically overwhelmed to end their life in different stressful life situations. Organophosphorous compounds are most commonly used insecticides for suicidal poisoning in southern parts of India. Pattern of poisoning in a region depends on variety of factors like availability and accessibility of poison, socioeconomic status of the population and impact of culture. By knowing the pattern of poisoning cases in a region helps in suggesting proper earliest preventive measures and also in early management of cases.[8]

The present study was conducted with an aim at determining sociodemographic profile and pattern of poisoning reported to Karnataka Institute of Medical Sciences, Hubballi mortuary during the study period. Therefore the findings of this study will be helpful for the government authorities and planning bodies, to plan and execute strategies towards prevention of poisoning.

MATERIALS AND METHOD

The present research was a prospective study covering all cases which were autopsied over a period of 1year (January 2014 to December 2014) in the Department of Forensic Medicine and Toxicology at Karnataka Institute of Medical Sciences, Hubballi, Karnataka which is located at south region of India.

In our study all the cases of unnatural deaths due to suspected poisoning occurred in course of treatment at Karnataka Institute of Medical Sciences, Hubballi and other hospitals in and around Hubballi which were subjected to medico-legal autopsy during the study period were included in this study. Relevant data including age, sex, marital status, religion, type of poison used, was gathered from the relatives of the deceased, autopsy files maintained in the department of Forensic Medicine and Toxicology, Police inquest reports, Forensic Science Laboratory reports and Hospital case records (if available). The manner of death was constructed as suicide or otherwise based on inquest reports of investigating officer.

RESULTS AND DISCUSSION

A total of 1244 medico legal cases were autopsied in the department of Forensic Medicine and Toxicology, Karnataka Institute of Medical Sciences, Hubballi during the study period, out of which 179 cases of deaths due to poisoning was observed constituting 14.39% of total cases.

Table 1: Sex distribution of Poisoning Cases

	Number of Cases	Percentage (%)
Males	119	66.5
Females	60	33.5
Total	179	100

In our study out of 179 cases, 99 were males (constituting 66.5% of total cases), and 60 were females (constituting 33.5% of total cases) with a male to female ratio of 1.65:1. (Table 1). This scenario is similar to the study done by Abubakar S et al, where there were 59.4% males and 40.6% females and the M:F ratio was 1.46:1.[9] Whereas a much higher M:F ratio of 3:1 and 6.1: 1 was observed by Ramesha KH et al[10] in a tertiary care centre in Karnataka and Guntheti BK and Singh UP[11] respectively.

Table 2: Age and Sex distribution of Poisoning Cases

Age group	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
< 10 Years	0	0	0	0	0	0
11-20 Years	3	1.7 %	22	12.3 %	25	14.0 %
21-30 Years	37	20.7 %	17	9.5 %	54	30.2 %
31-40 Years	34	19.0 %	13	7.3 %	47	26.3 %
41-50 Years	20	11.2 %	4	2.2 %	24	13.4 %
51-60 Years	19	10.6 %	2	1.1 %	21	11.7 %
>60 Years	6	3.4 %	2	1.1 %	8	4.5 %
Total	119	66.5 %	60	33.5 %	179	100 %

Overall the majority of poisoning deaths were in the age group of 21-40 years. In males a similar picture is presented, but in females the major age group affected was 11-30 years. (Table 2) There was an increased incidence in this age group, as this age group are the working population of the society, they have to undergo both physically as well as mental stress hence more prone during life.[9]

Table 3: Distribution of cases according to Marital status, Residence and Religion

Sex	Marital Status		Residence		Religion		
	Married	Unmarried	Rural	Urban	Hindu	Muslim	Christian
Male	100 (55.9%)	19 (10.6%)	87 (48.6%)	32 (17.9%)	106 (59.2%)	12 (6.7%)	1 (0.6%)
Female	41 (22.9%)	19 (10.6%)	53 (29.6%)	7 (3.9%)	54 (30.1%)	6 (3.4%)	0 (0%)
Total	141 (78.8%)	38 (21.2%)	140 (78.2%)	39 (21.8%)	160 (89.3%)	18 (10.1%)	1 (0.6%)

Majority of the victims in our study were followers of Hindu religion (89.3%) as compared to followers of Islam religion (10.1%), majority of the victims were married (78.8%) and most of the victims were from rural areas (78.2%). (Table 3). These are consistent with the authors.[12,13] Hindu predominance may be due to the fact that major population is of Hindu religion in our region. Most of the victims were from rural region as majority of the patients to the hospital are from rural area.

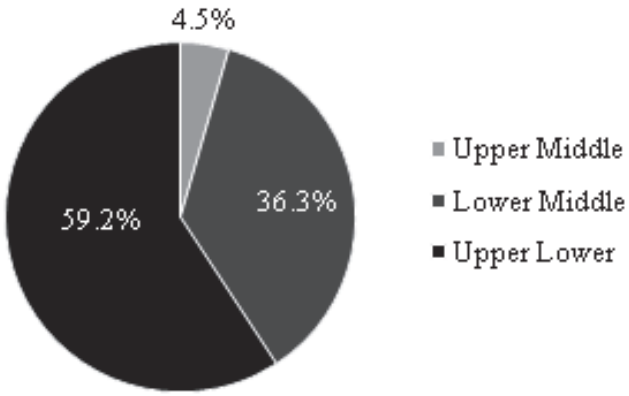

Fig 1: Distribution of cases according to Socio-Economic Status

According to B G Prasad's socioeconomic scale – 2014,[14] in our study highest number of cases (59.2%) belonged to upper lower (Class IV), followed by lower middle (Class III) (36.3%) socioeconomic class. (Fig 1). These are consistent with the authors[15,16] and it is contradictory to the study carried by Kumar S et al in which middle class victims are common followed by lower class.[17] Low socioeconomic group are more vulnerable which may be due to they are under continuous financial stress or other stress (eg: unable to meet the basic demand) during their life.

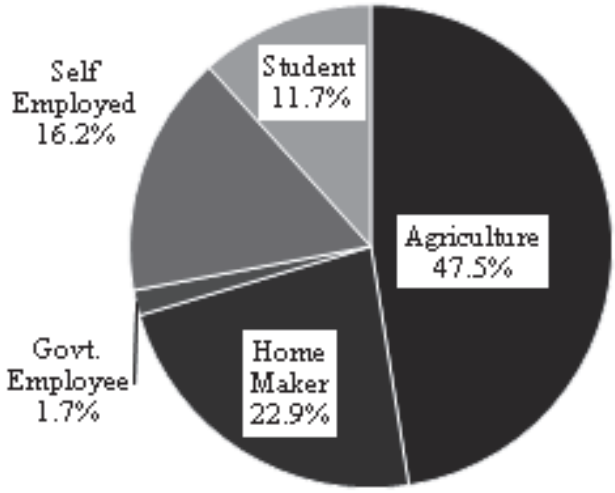

Fig. 2: Distribution of cases according to Education Status

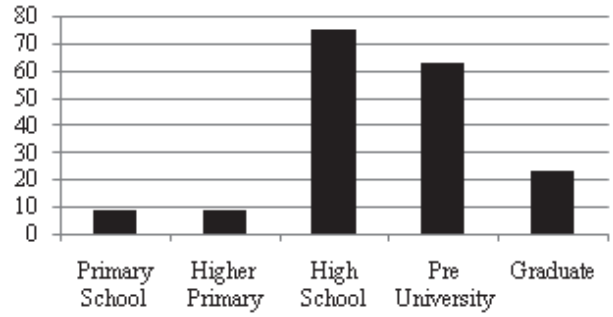

Fig. 3: Distribution of Cases according to Occupation

Most of the victims were literates, of which 9 (5%) discontinued after primary and higher primary education, 75(41.9%) completed High school, 63(35.2%) studied up to pre-university and 23(12.8%) completed their graduation. (Fig 2). Majority of the victims were agriculture (47.5%) by occupation. (Fig 3). Ramanath et al[18] in their study in Karnataka found that farmers 38.4% as majority of the victims followed by Homemakers 21.9% which is consistent with our study.

Table 4: Type of Poison and Sex wise distribution

Type of Poison	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
Organophosphorus compounds	99	55.3 %	41	22.9 %	140	78.2 %
Organochlorine compounds	5	2.8 %	1	0.6 %	6	3.4 %
Carbamate	2	1.1 %	9	5.0 %	11	6.1 %
Alcohol	1	0.6 %	0	0	1	0.6 %
Sedatives	0	0	2	1.1 %	2	1.1 %
Phosphides	3	1.7 %	2	1.1 %	5	2.8 %
Amitraz	1	0.6 %	0	0	1	0.6 %
Cyanide	1	0.6 %	0	0	1	0.6 %
Corrosives (Hcl)	2	1.1 %	1	0.6 %	3	1.7 %
Imidacloprid	1	0.6 %	1	0.6 %	2	1.1 %
Paraquit	2	1.1 %	2	1.1 %	4	2.2 %
Pyrethroids	2	1.1 %	1	0.6 %	3	1.7 %
Total	119	65.5 %	60	33.5 %	179	100 %

Regarding the type of poison consumed or used, overall a large number of cases were due to organophosphorus compounds i.e. 140 cases (78.2%). In males as well as females a large percentage of cases were due to organophosphorus compound consumption 99 cases (55.3%) and 41 cases (22.9%) respectively. The next most common type of poison used was carbamates 11 cases (6.1%) and organochlorine 6 cases (3.4%). (Table 4). These are consistent with Maharani et al, Jaiprakash et al, Jesslin et al [19,20,21] who conducted studies in Southern part of India. Agriculture is the main occupation of the people and Organophosphorus compounds were commonly used pesticides in this locality.

Table 5: Duration of Hospital Stay in Poisoning Cases

Duration of Stay	Number of Cases	Percentage (%)
Brought dead	25	14.0
< 24 hours	64	35.8
2 days	20	11.2
3 days	25	14.0
4 days	8	4.5
> 4 days	37	20.7
Total	179	100

The duration of hospital stay preceding the death in poisoning cases were lesser than 24 hours in 64 cases (35.8 %), while 37 cases (20.7 %) survived more than four days, followed by 25 cases (14.0%) who were brought dead to casualty. (Table 5)

Table 6: Manner of Poisoning and its Sex wise distribution

Manner	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
Accidental	4	2.2 %	4	2.2 %	8	4.5 %
Suicidal	115	64.2 %	56	31.3 %	171	95.5 %
Homicidal	0	0	0	0	0	0
Total	119	66.5 %	60	33.5 %	179	100 %

As regards to the manner of poisoning, an overwhelming number of cases were suicidal in nature 171 cases (95.5%). A small percentage of cases 8 cases (4.5%) were accidental in nature. (Table 6). These are consistent with Maharani et al, Mrinal et al, Kumar et al, Gargi et al. [19,22,23,24]

CONCLUSION

The pattern made known from this study showed a male predominance. Organo-phosphorus compounds were the major culprit in many cases and in most cases the poisoning was intentional. Poisoning was more prevalent in the 21-40 years age group.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Taken

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Profile of Electrocution Fatalities-An Autopsy Study

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ABSTRACT

Background: Electricity has became an essential necessity of modern life. But with its the advantages and convenience come the hazards as well. Electric current is accountable for a significant proportion of injuries and deaths in both domestic as well as occupational settings. The present study was performed with an aim to evaluate the profile and magnitude of electrocution fatalities in Etawah district of uttar Pradesh.

Material and Method: A one year study was conducted on cases that were brought to the mortuary of Etawah district during the period from 1 April 2016 to 31 march 2017. During this time frame a total of 1845 medicolegal autopsies were performed out of which 23 deaths were due to Electrocution.

Observation: electrocution related deaths accounted for 1.24% of total medicolegal autopsies. The study showed preponderance of male victims (95.6%) over female victims and the most vulnerable age group was 31-40 years(26.1%). The highest incidence was observed in summer season from April to June(39%). Majority of the victims (74%) died instantaneously or shortly after the event. Among all the victims 78.2% had electrical contact mark on upper extrimities and 52.2% had exit marks located on the lower extremities. Both entry and exit electric mark were present in 91.3% of the cases while 8.7% cases showed only entry mark as an electrical injury. 39% cases presented with flash burns and 43.5% cases had associated mechanical injuries.

Conclusion: The present study highlights the pattern of electrocution mortalities in Etawah region. We recommend organisation of awareness programs for the residing population to spread education about electrical safety principles specialy the youth need to be educated about the potential risk of electrocution due to inadvertently increasing use of electronic gadgets among them. We also recommend certain precautionary measures against electrocution.

Keywords: *electrocution, contact marks, flash burns, electronic gadgets, electrical installations, clearance distance*

INTRODUCTION

Electricity, from its very invention has removed darkness from the world and has illuminated every sphere of human life. It has now become an essential necessity of modern life but with its advantages and convenience, come the hazards as well. Electric current is accountable for a significant proportion of injuries and deaths in domestic as well as occupational settings. Widespread usage of faulty appliances, damaged cords and extension leads, operating equipments with wet hands, attempting electrical work by oneself are some of the leading causes that result in electric shocks at home.

Meanwhile, electricity has long been recognised as a serious workplace hazard and various employees often fall victim to it. Fortunately these hazards are largely preventable as they are almost always accidental. Presently electrocution deaths are becoming an emerging health problem in our country owing to lack of awareness and poor safety issues. The recent available statistics according to Indian National data reports total number

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of accidental deaths by electrocution in India as 9606 during 2014 and Uttar Pradesh ranked fourth among the top 10 states with total number of 623 such deaths. Numerous studies have been conducted across the country and outside pointing towards the various aspects of electric injury related deaths. Our study is significant as it is of its first kind to evaluate the magnitude of the problem of electrocutions in Etawah district of Uttar Pradesh. It identifies the potential risk factors and also provides recommendations for developing effective safety programs for the residing population to reduce the risk of electrocution.

MATERIAL AND METHOD

A one year study was conducted on cases that were brought to the mortuary of Etawah district during the period from 1 April 2016 to 31 March 2017. During this time frame a total of 1845 medico-legal autopsies were performed out of which 23 deaths were due to Electrocution. We segregated the cases according to age, sex, time period of survival, site of electric contact mark and the associated injuries. We had also tried to study the association of these mortalities with the month of presentation.

OBSERVATIONS

The following observations were made

Table 1: Distribution of cases based on gender

Sex	No. of cases	%
Male	22	95.6
Female	1	4.4
Total	23	100

Table 2: distribution of cases based on Age

Age group	No. of cases	% of cases
<10	2	8.7
11-20	4	17.4
21-30	5	21.7
31-40	6	26.1
41-50	3	13
51-60	3	13
>61	0	0
Total	23	100

Table 3: Distribution based on Month of occurrence

Month	Total cases	% of cases
April 2016	2	39.1
May 2016	3	
June 2016	4	
July 2016	0	30.4
Aug 2016	3	
Sept 2016	4	
Oct 2016	0	21.7
Nov 2016	3	
Dec 2016	2	
Jan2017	0	8.7
Feb 2017	1	
Mar2017	1	

Table 4: Distribution based on Time of survival

Time of survival	No. of cases	%
Instant death	17	73.9
<24 hrs	4	17.4
>24 hrs	2	8.7
Total	23	100

Table 5: Distribution based on site of electrical injuries

Site of injury	Entry mark	Exit mark
Upper limb	18	7
Lower limb	2	12
Chest	3	2
Abdomen	0	0
Head and neck	0	0
Total	23	21

Table 6: distribution of cases based on type of electrical injuries over the body

Type of mark	No.	%
Only entry mark	2	8.7
Only exit mark	0	0
Both entry and exit marks	21	91.3
Burns	9	39
Associated mechanical injuries	10	43.5

DISCUSSION

Even with high utility of electricity in domestic places as well as presence of moderate number of small scale industries in Etawah region, electrocution related

deaths accounted for only 1.24% of total medico-legal autopsies which is slightly lower as compared to studies conducted by various researchers in other parts of India and abroad who have reported 1.9 – 3.3% incidence rates of such deaths[1234]. One of obvious explanation can be long power cuts in this semi-urban area especially in the outskirts of the district.

In our study most of the victims were males (95.6%) which is in concordance with findings of Ghuliani et al[5] who reported 90.9% of electrical fatalities in males while Dandapat et al[6] mentioned all mortalities only in males. We observed the most vulnerable age for electrocution-related deaths was between 21 and 40 years (47.8%), particularly adults between 31 and 40 years (26%). We noted least number of cases in extremes of ages i.e. <10 and >60 years as 2 and nil respectively. The obvious reason for this male preponderance in 20-40 age groups is there relatively higher involvement in electricity dependant activities seemingly associated with ignorance, carelessness and haste. We confronted with 5 cases who were young children and adolescents. Probable reasons for Young children to succumb to these injuries is likelihood of biting of cords, or poking metal objects into electrical outlets while in older children is owing to their inquisitive nature leading to mischievous exploration of electrical equipments or installations.

In our study it is noteworthy that highest incidence of electrocution-related mortality (39%) occurred during summer (April-June) followed by 30.4% in monsoon (July-September) season. This may be attributable to increased utilization of electricity during hot summers to run coolers and air conditioners which further increases probability of electrical injury due to illegal power thefts popularly known as 'katiya' in this area. Moreover increased sweating during summers decreases skin resistance for conduction of electricity thereby increasing the vulnerability. Likewise dampness and humidity of the environment is responsible for the increased incidences during monsoon. Our findings are consistent with Shaha and Joe[7] and Ananda Reddy et al[8] who reported mortalities during summer as 42% and 36% respectively and are lower when compared with Rautji R[9] who mentioned a mortality rate of 74% during summer. While Gupta et al.[10] and Kumar et al[11] have observed highest incidences of fatal electrocution in monsoon seasons.

Of the electrocuted persons, 74% were found dead at the scene of accident, 17.4% were dead in hospital within 24hrs of admission while 8.6% managed to survive for more than 24hrs after receiving treatment and then died later on. These findings are correlated with those reported in Sheikhazadi et al[12] study and but higher in Ragui et al.[13] study.

In our study majority of cases (78.2%) showed electrical contact marks on upper extremities which were specifically noticed on palms and fingers followed by chest in 13% cases whereas exit marks were commonly located on the lower extremities and more so on the soles and toes in 52.2% cases. Many studies on electrocution-related injuries report that entry and exit marks are commonly located over upper and lower extremities[1,13,14]. The obvious reason is that most of the time people handle electrical appliances with bare hands and work without using any insulating materials or footwear.

We have observed both entry and exit electric marks in 91.3% of the cases, while 8.7% cases showed only entry mark as an electrical injury. We also noted 39% cases presented with flash burns and 43.5% cases had associated mechanical injuries among which abrasions was the commonest type followed by contusions. Variable findings were reported by other authors. In a study conducted by Rajesh B et [15] , 44.5% cases showed only entry wounds while in 27.8% both entry and exit wounds were present. While Guntheti BK et al [16] mentioned 40.3% cases with entry wounds, 35.48% cases having both entry and exit wounds and 25.8% cases with flash burns. He also reported nonelectrical injuries in 33% of cases in his study which is consistent with our study.

CONCLUSION

The present study highlights the pattern of electrocution mortalities in Etawah region and depicts a relatively lower incidence of such fatalities in this area which still deserves considerable attention because most of them are almost always accidental and largely preventable. We emphasize on an imperative need for organisation of awareness programs for the residing population to spread education about electrical safety principles. We also recommend certain precautionary measures against electrocution such as early recognition

of warning signs in houses like overloaded circuits, frayed cords or sparks from outlets or switches. Parents and other adults should be alert of possible electrical dangers in the home and need to be more vigilant in case of toddlers and young children. Use of enhanced safety devices like Advanced Circuit Breakers, capable of recognising impending dangers is advocated. Moreover, the rapidly increasing careless use of electronic gadgets is a matter of concern in the present scenario. It has become a status symbol especially among the youth to stay "logged on and plugged in". Thus they need to be educated about the potential risk of electrocution with inadvertent use of these equipments while on charging mode or with substandard or incompatible chargers.

Furthermore, it is a common sight to see power cables lying dangerously close to balcony of the houses in many crowded old dwellings in the interior of Etawah city due to very narrow and haphazard layout of roads. The root cause of this problem is unplanned settlements lacking basic infrastructure that accentuates a critical need of strict enforcement of government housing programs to maintain the required clearance distance between the building and electricity installations so that they remain inaccessible to public. Therefore we conclude that implementation of the proposed initiatives for prevention together with improved housing schemes and systematic management of old informal settlements can certainly help in bringing significant reductions in rates of electrocution mortalities.

Conflict of Interest: None

Source of Funding: Nil

Ethical Clearance: Taken

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An Assessment of the Perceptions in the General Population of Sexual Harassment

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ABSTRACT

Historically,it is not uncommon to see a victim of sexual abuse being blamed for triggering her own harassment.This revolves mostly around the appearance of the victim where the victim is accused of being "provocatively" dressed. Jensen and Gutek suggest that men are more likely to blame the victims of sexual harassment than women.Other researchers have not found significant gender differences in perceptions of sexual harassment.Sexual harassment is not an unusual phenomenon in India.Male harassers are usually older,while female harassers are generally younger.Victims have been of all ages,from neonates to senior citizens. For this cross-sectional study,random sampling was done.A structured questionnaire consisting of questions pertaining to respondents' demographic information like age, gender, location,and education along with whether or not they have experienced sexual harassment in their life was framed.Statements based on chosen constructs along with instructions to rate them on a 5 point scale with 1 being strong disagreement and 5 being strong agreement was distributed to the sample population.Quantitative analysis was done. Primary data was collected from 287 respondents. It appears that the ignorance of the victims is more likely to convey consent,agreement,or approval on the part of the victim. This has important practical implications since it is quite possible that the ignorance may give an impression of rationality to the harassment resulting in recurrence and may not even be taken seriously by a witness.Too often women in India are stuck in a sticky situation of blaming and shaming,from where there is not much hope of redemption.

Keywords: *Sexual harassment, perceptions*

INTRODUCTION

Historically, it is not uncommon to see a victim of sexual abuse being blamed for triggering her own harassment.This revolves mostly around the appearance of the victim where the victim is accused of being "provocatively" dressed. Jensen and Gutek suggest that men are more likely to blame the victims of sexual harassment than women.[1,2] Other researchers have not found significant gender differences in perceptions of sexual harassment.[3] Sexual harassment is not an unusual phenomenon in India[4].Male harassers are usually older,while female harassers are generally younger[5].Victims have been of all ages,from neonates to senior citizens.Women reported experiencing sexual harassment irrespective of how they dressed or how much make-up they used.[6,7] Males who experience sexual harassment generally do so when they are children or adolescents.[8] Shaver's defensive attribution theory says that since females are more likely than males to be sexually harassed,it is expected for males to blame the target more than the harasser.[9]

Harassment can happen anywhere including at educational institutions,workplaces,public places,public transports and homes.

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Leach & Sitaram[10] report adolescent school girls reporting problems with commuting to school by tempos and other transport due to harassment by fellow passengers which in turn made walking the distance seem a better option.Here too,they were forced to travel in groups to minimize the chances of being targeted on the streets.9 out of 10 Canadian women experience sexual harassment in public places.[11]

Female victims tend to be single.Married and widowed women have fewer harassment experiences.[12] In India, single,separated,divorced and widowed women not having the support of a husband,father or siblings beyond a point,could be a possible reason for them being perceived as more vulnerable than married women. Women who concentrate on their appearance are considered to do it for attracting men and are known to possibly arouse compassionate intimacy.This supports Johnson & Workman[13] who reported that their findings were consistent with previous research findings which show that people perceive the "provocative" (revealing) clothing of the victim(i.e.clothes that reveal more skin) to play a key role in "inviting" sexual gestures and believe that it is less likely to provoke the harasser if the victim was wearing "non-provocative" clothes. Johnson & Workman[14] report respondents considering sexual harassment as an expectable and controllable event from which victims can somehow safeguard themselves by not dressing provocatively.[14] It is also a common belief that the application of make-up makes someone more attractive and could "provoke" sexual harassment. Findings that support the connection of cosmetics and sexual harassment has been found by Workman & Johnson[15] where victims said that they were more likely to attract sexual harassment when they wore heavy cosmetics than when they did not.Women dress to look attractive but not to invite unwelcome sexual advances or to be used as sex objects.[16]

METHODOLOGY

Aim

To assess perceptions of sexual harassment.

For this cross-sectional study,random sampling was done.A structured questionnaire consisting of questions pertaining to respondents' demographic information like age, gender, location,and education along with whether or not they have experienced sexual harassment in their life was framed.Statements based on chosen constructs along with instructions to rate them on a 5 point scale with 1 being strong disagreement and 5 being strong agreement was distributed to the sample population. Quantitative analysis was done.Primary data was collected from 287 respondents.

RESULTS

1. Age of respondents

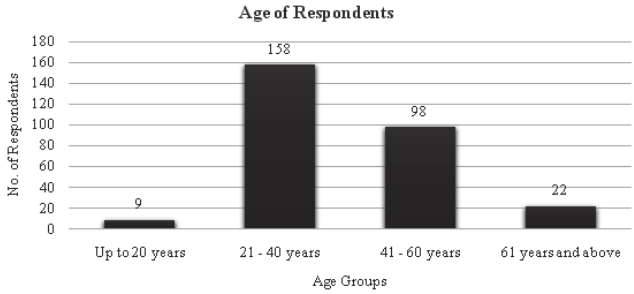

Figure 1

Source: Primary data

The respondents were categorized into four groups based on their age: Below 20 years,21-40 years,41-60 years and 60 years and above. Out of 287 respondents,the highest number of respondents fall under the category of 21-40 years of age(55.1%). The second highest being 41-60 years of age(34.1%) of the responses.

2. **Gender of respondents:** Out of 287 respondents, 55.4% were female and 44.6% were male.

3. Educational qualification of respondents

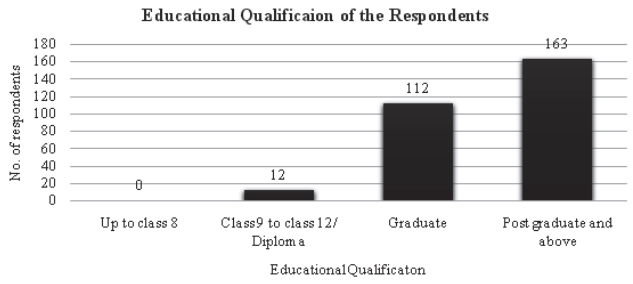

Figure 2

Source: Primary data

4. **Experience of sexual harassment:** 46.3% of respondents had encountered sexual harassment while 53.7% of respondents had not.

In any graphs that follow, the Y-axis represents the number of respondents while the X-axis

represents the range of the Likert scale with 1 = strong disagreement, 2 = disagreement, 3 = neutral, 4 = agreement and 5 = strong agreement.

5. **Gender of the victims:** 188(65.5%) respondents believe that sexual harassment happens only with females(Responses 4 and 5) while 52 (18.2%) felt that it is not restricted to women alone(Responses 1 and 2).47 respondents(16.4%) neither agreed nor disagreed with the statement (Response 3).

6. **Company(A person is seen as a potential victim if s/he is alone.):** The above graph shows that 224(78.1%) of respondents agree with the statement that there is a high chance of becoming a victim of sexual harassment if they are alone and without any company.34(11.8%) of respondents chose to neither agree nor disagree.29(10.1%) respondents disagreed with it.

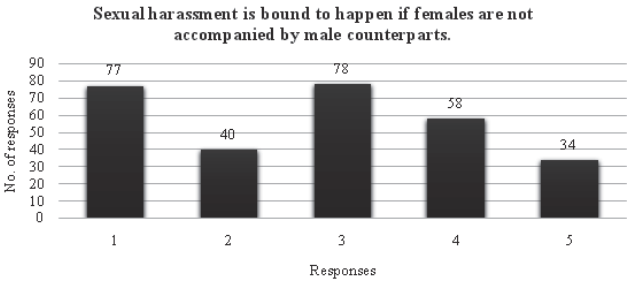

Figure 3

6. **Sexual harassment is bound to happen if females are not accompanied by male counterparts:** Out of 287 respondents, 92(32%) of respondents think that it is necessary for females to be accompanied by male members to avoid sexual harassment while 107(40.7%) respondents disagreed with it. The remaining 78(27.2%) respondents were neutral.

7. **Sexual harassment happens only outside the walls of home:** When asked whether sexual harassment happens only outside home,201(70%) respondents disagreed while 35(12.2%) agreed with it.The remaining 51(17.8%) respondents were neutral.

8. **Sexual harassment happens even inside homes:** 228(73.4%) of respondents agreed that it also happens inside homes.23(8%) of the remaining respondents feel that it doesn't happen inside house and hence disagreed with the statement. Remaining 36(12.5%) respondents chose neither to agree nor disagree.

9. **Sexual harassment is more easy at places like pubs,parks and tourist spots:**

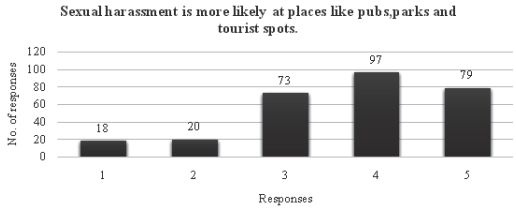

Figure 4

Source: Primary data

176(61.3%) respondents agreed that sexual harassment incidents are more likely when potential victims are found in public places like pubs,parks and tourist spots,while 38(13.3%) of them did not agree with this.The remaining 73(25.4%) respondents chose to be neutral.

10. **Sexual harassment is common in public transport like buses, trains, cabs, etc.:**

Source: Primary data

215(75%) respondents felt that sexual harassment was common in public transport,56(19.5%) respondents neither agreed nor disagreed while 16(16.5%) respondents disagreed with the statement.

11. **Sexual harassment is common in isolated places:**

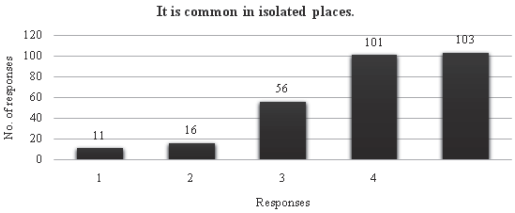

Figure 5

Source: Primary data

204(71.1%) respondents agreed with the statement that said incidents of sexual harassment is common in deserted areas while 27(9.4%) of respondents felt otherwise.56(19.5%) of respondents neither agreed nor disagreed.

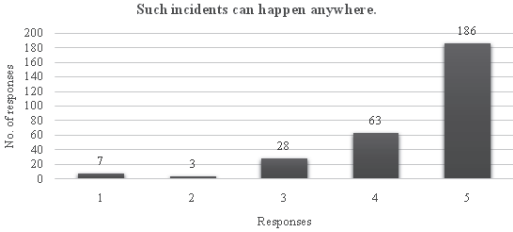

Figure 6

Source: Primary data

10(3.4%) of respondents felt that incidents of sexual harassment do not happen just anywhere.28(9.8%) of respondents were neutral to this statement.249(86.8%) of respondents felt that it can occur anywhere.

12. **Only unmarried, separated, divorced women or widows are sexually harassed:** 26(9%) of respondents felt that only women who are unmarried,separated,divorced or widowed are subjected to sexual harassment.22(7.7%) of respondents were neutral.239(83.3%) of respondents disagreed with the above statement.

13. **Married women are not sexually harassed:** 11(3.8%) of respondents agreed with the statement that married women were not sexually harassed.26(9.1%) of respondents were neutral.250(87.1%) of them disagreed with the above statement.

14. **Only women who wear tight, short or western clothes are subjected to sexual harassment:** 37(12.9%) of respondents agreed with the statement while 148(69%) of respondents disagreed with the statement.52(18.1%) of respondents were neutral to it.

15. **Women who wear ethnic clothes like salwar, saree, hijab or burkha do not experience sexual harassment:** 21(7.3%) respondents chose to agree with the statement that women who wear ethnic clothes do not experience sexual harassment.225(78.4%) respondents disagreed.41(14.3%) respondents were neutral.

16. **Women who wear make-up become victims:** 19(6.6%) felt that only women who wear make-up become victims.227(79.1%) of respondents disagreed.41(14.3%) respondents were neutral.

17. **Women who do not wear make-up are not sexually harassed:** 11(3.8%) respondents agreed that women who do not wear make-up are not sexually harassed. 243(84.7%) of respondents disagreed with this.33(11.5%) respondents were neutral.

18. **People who are intoxicated by tobacco/alcohol/drugs become the victims of sexual harassment:** 115(40.1%) respondents felt that people who are intoxicated by alcohol/tobacco/drugs become victims of sexual harassment.116(40.4%) respondents disagreed.56(19.5%) respondents neither agreed nor disagreed.

19. **Sexual harassment happens only with people who socialize with the opposite gender:** 28(9.8%) of respondents said that sexual harassment is a result of socializing with people of the opposite gender.209(72.8%) respondents disagreed.50(17.4%) of respondents were neutral.

20. **Sexual harassment happens even with people who are not socially active:** 211(73.5%) respondents agreed with the statement that even people who were not sexually active experienced sexual harassment.36(12.6%) respondents disagreed.40(13.9%) were neutral.

21. **Women should be educated to restrain themselves from socializing:** 44(15.3%) respondents agreed that women should be restrained from socializing with men in order to avoid sexual harassment.208(72.5%) respondents did not agree with this.35(12.2%) respondents were neutral.

22. **Sexual harassment happens only after sunset:** 33(11.5%) respondents agreed with the statement that sexual harassment happens only after sunset.183(63.8%) respondents did not agree with this.7(24.7%) respondents were neutral.

23. **Sexual harassment can happen at any time of the day:** 235(81.9%) respondents felt that sexual harassment can happen at any time of the day.16(5.6%) of respondents did not agree with this.36(12.5%) of respondents were neutral.

24. **The incidence of sexual harassment will reduce if the victim and/or the witnesses stand up against it:** 235(81.9%) respondents agreed that the incidence of harassment would reduce if the victim and/or witnesses stood up against it.17(5.9%) respondents disagreed.35(12.2%) were neutral.

25. **The intensity of harassment will increase if the victim and/or the witnesses stand up against it:** 68(23.7%) respondents felt that the intensity of the harassment would increase if victims and/or witnesses opposed it.150(52.3%) disagreed.69(24%) were neutral.

26. **Resistance does not matter to the harasser,s/he will continue to harass:** 95(33.1%) respondents felt that resistance did not matter to the harasser who would continue to harass.94(32.8%) of respondents disagreed.98(34.1%) respondents had neutral views.
27. **Sexual harassment is the fault of the victims and their upbringing:** 45(15.7%) respondents felt that sexual harassment was the fault of the victims and their upbringing.192(66.9%) respondents do not agree with this.50(17.4%) respondents were neutral.

DISCUSSION

The harassers tend to target people like women and children who are vulnerable(i.e. who are drunk,homeless,on drugs etc.)[17].Target intoxication has a significant role: when intoxicated,targets were less certain that harassment had happened. When compared to targets in the sober state,those in the intoxicated state perceived less trauma.[18] In most parts of India,women consuming alcohol and/or socializing with men is considered taboo.The rationale given is that this behavior could lead to kidnappings,sexual harassment and rape, thereby laying the blame for all these at the door of the victim.It is important to know whether or not this really contributes to perceiving an extrovert as a potential and easy target.

Kanekar & Seksaria[19] report that the assertiveness of the victim's response implies a rejection of men's power over women.The gender-related power differential is not equally acceptable to men and women,The more assertive reactions of the victim were perceived as appropriate more by female subjects than by male subjects,especially in the case of physical rather than verbal harassment,physical harassment representing a more blatant form of power abuse by men than verbal harassment.It was also found that if the target and the witnesses respond and decides to consistently report the harassment,observers are more likely to blame the offender.[20] For suitable action to be taken, there should be proper procedure for grievances.[21,22]

It appears that the ignorance of the victims is more likely to convey consent,agreement,or approval on the part of the victim. This has important practical implications since it is quite possible that the ignorance may give an impression of rationality to the harassment resulting in recurrence and may not even be taken seriously by a witness.[4]Too often women in India are stuck in a sticky situation of blaming and shaming,from where there is not much hope of redemption.

Ethical Clearance: Since it was a non interventional questionnaire based study, ethical clearance was not required.

Source of Funding: Self.

Conflict of Interest: Nil.

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Adverse Drug Reaction in Tertiary Care Hospital of Hilly State

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ABSTRACT

Adverse drug reaction is an injury caused by taking a medication. It may occur following a single dose or prolonged administration of a drug or result from the combination of two or more drugs. Recent epidemiological studies estimated that adverse drug reactions are fourth to sixth leading cause of death in the world. Adverse drug reaction monitoring and reporting activity is in its infancy in India. The present study was conducted in Indira Gandhi medical college, Shimla by reporting the adverse drug reactions in the Departments of Radiotherapy, and Department of Skin and Venereal diseases in the year 2015 September to 2015 December.45 cases were reported during the period with adverse drug reactions which affected the various systems. The frequency of adverse drug reaction related to sex, age, and drug with which the reaction occurred was reported, whether the drug was discontinued and whether the patient was taking any other drug was also recorded. The spontaneous reporting of adverse drug reactions to antibiotics, proper documentation and periodic reporting to regional pharmacovigilance center shall be made mandatory to ensure patient safety.

Keywords: *pharmacovigilance, Shimla, adverse drug reaction.*

INTRODUCTION

In unbooked nomenclature adverse drug reaction is an injury caused by taking a drug or other form of medicine that is used to treat or prevent disease. According to world health organization adverse drug reaction can be defined as a response to a drug, which is noxious and unintended, and which occurs at doses normally used in man for the prophylaxis, diagnosis, or therapy of disease, or for the modifications of physiological function[1]. A study of development of a drug is done under various stages.ie at preclinical stages, clinical stages and the postmarketing stages. Adverse drug reaction causes a huge financial loss[2], unnecessary burden of bed occupancy in the hospitals, financial loss to the patient as well as to the attendant .The incidence of adverse drug reactions varies with studies, which show incidences ranging from as low as 0.15 % to as high as 30%[3-7]. Hence it becomes a matter of importance to evaluate the adverse drug reactions so that drug induced mortality and morbidity can be evaluated.

Recent epidemiological studies estimated that adverse drug reactions are fourth to sixth leading cause of death[8]. Adverse drug reaction monitoring and reporting activity is in its infancy in India. India is a developing country with a large drug consuming population. It is the fourth largest producer of pharmaceuticals in the world with more than 6000 licensed drug manufacturers and over 60,000 branded formulations. Thus it is essential that the drug treatment should be safe, efficacious and cost effective. It is also emerging as a clinical hub exposing larger population to newer drug treatments. The ministry of health and family welfare had initiated the national pharmacovigilance program on 1st January 2005 which was further revived in July 2010.[9]. This program is overseen by the central drugs standard control organization, New Delhi. Hence since occurrence of adverse drug reaction due to drugs is a world wide problem and cannot be ignored so it was thought to study the same in a hilly state as a retrospective observational study. The study was conducted in Indira Gandhi medical college, Shimla by reporting the adverse drug reactions in the Departments of Radiotherapy, and department of skin and venereal diseases.

MATERIALS AND METHOD

The entire out door patients coming to radiotherapy and skin department were included in the study in Indira Gandhi Medical College, Shimla.

Study design and procedure: This observational retrospective study was tabulated from year September 2015 to December 2015 to assess the adverse drug reactions from suspected adverse drug reaction reporting form. This form is a voluntary reporting of adverse drug reactions by healthcare professionals and issued by Indian pharmacopoeia commission. The report type is initial or a follow up. The form bears an AMC report number along with world wide unique number. The form bears the patients initials, age of the patient, and sex of the individual along with the weight of the individual. The events of the reactions, drug responsible, past history, concomitant medical product including self medication and herbal remedies with therapy dates are mentioned.

RESULTS

The study sample comprised of 45 adverse drug reactions related to antimicrobials given to the patients. The study showed that the females were 23 in number and males were 22 in number, hence there was not much difference in the gender criterion. The age wise distribution of the total cases revealed that the geriatric patients were more accounted with 14 people in 61-70 years, 13 people in age group of 51-60 years followed by adults total 18 in age group from 31 -50 years. Results revealed that that the gastro intestinal tract were the most affected organ system by adverse drug reactions due to antibiotics i.e. 12 in number and skin had 6 cases and further others 19, cardio vascular system 2 and hematology 2 , central nervous system2 and endocrine system2. The date of recovery was in few days ranging from 1 to 10 days. The outcomes were that the patients recovered in 25 cases, 8 cases were on recovering stage, and the symptoms did not recover and became chronic in 13 cases. In majority cases doses were not changed and in one case drug was with drawn. The cases which had drug reaction were carcinoma cervix 5, carcinoma lung 1, carcinoma gall bladder 8, carcinoma endometrium 1, carcinoma buccal cavity 2, carcinoma breast 4, carcinoma thyroid 1, carcinoma oropharynx 1, and carcinoma of stomach 2, carcinoma esophagus 1.many cases had more than one complaint at a time. The drugs after which the adverse reaction was reported were cisplatin, paclitaxel, intaxel, chepatron, palnox, platinex, celplat.only in one case the reaction occurred after reintroduction and patch test was done. There was no history of concomitant medical product being used and no self medication was being done.

DISCUSSION

Reporting of new adverse drug reactions is to be encouraged but one should not ignore already reported and well known adverse drug reactions because their might be a pattern shift of adverse drug reactions over the time. Clinical trials of new drug therapies provide information about the nature and number of serious adverse events (SAE)[10].Pharmacolvigilance programme of India is a turning point in reporting of adverse drug reactions and establishing the data for critical analysis and opinions so that the spurious drugs, substandard drugs and the drugs with low efficacy can be withdrawn from the market based on this data and patients safety is ensured. In the present study, prescription pattern of oncologists and dermatologists was studied and it was found that they have used single or two drugs in the treatment therapy of different diseases. Our study is also in confirmation with earlier studies showing commonly occurring adverse drug reactions in patients consuming medication. In the earlier studies also the gastrointestinal symptoms were the commonest .Since the study time period was only four months, the number of patients screened was less due to which we could not apply the extensive statistics therefore, further long duration studies covering large population are needed to validate the data.

Financial support and sponsorship: Nil

Conflicts of interest: There are no conflicts of interest.

Ethical clearance not required.

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Retrospective Study on Patterns of Homicidal Death in Western Odisha

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ABSTRACT

The study is undertaken in the department of Forensic Medicine and Toxicology, VIMSAR, Burla of Odisha state to examine the pattern of homicidal death in Western Odisha considering the data from 2013 to 2017 (152 cases). Data on age and sex, period of survivability and causes death of the deceased; motive behind, weapons used and place of occurrence of homicides; and relation between the assailant and victim have been collected from the reported cases of homicidal death after doing autopsy. The bivariate and descriptive statistics has been used for data analysis. As the dominant motive for homicides is wealth, wine and woman, the study attempts to examine the motive of homicides along this line.

The analysis depict that out of 6140 autopsies done during the study period 152 (2.47%) are found as homicide cases. The distribution of deceased across gender shows that 79.6% are male and 20.4% are female. Maximum of 80.3% of homicides was committed during night time, in 57.9 % cases the place of occurrences is at outside from home, 90.4 % cases death was occurred instantly, 58.6 % cases the victim is either a family member or relative, 52 % cases the weapon used is hard and blunt, 51.3 % cases the cause of death is due craniocerebral injuries, 50.7 % cases the motive behind the homicide is wealth followed by women (22.4%). The month wise distribution of homicide cases depicted that maximum number of occurrences have occurred during the month of March and June (each 13 %) followed by February, September and October (each around 11 %).

Keywords: *Homicidal death pattern, Motive, Crime, Western Odisha*

INTRODUCTION

Homicide means 'killing of human being as a result of conduct of other, which may be lawful or unlawful'[1]. This paper deals with only unlawful crime. Homicide is one of the important causes of unnatural death. Killing of individual is the highest level of aggression found in any society that needed to be controlled. The incidence of homicide is increasing day by day and also the pattern is changing because of changing life style, modern need of human beings and easy availability and accessibility to modern weapons. The dominant motive for killing is often associated with wealth, woman and wine. This paper aims to examine the different patterns of homicides broadly classified into –causes (motive) of homicides; demographic characteristics of the deceased; place of occurrence of crime, period of survival and types of weapons used in the crime and seasonal distribution of homicides in the context of Western Odisha. Western Odisha is part of the Indian states named Odisha, where the people often known for peaceful leaving yet homicides death have been recorded frequently in the state, particularly in the western part of the state. Hence the paper attempts to understand the patterns of homicidal death in this region. The paper has the following objectives.

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OBJECTIVES & HYPOTHESIS OF THE PAPER

1. To examine the distribution of homicides cases by their gender and age.
2. To examine the place, time and occurrence of the death

3. To examine the assailant-victim relationship
4. To explore the cause of death and type of weapons used in the homicides.
5. To explore the motive behind the homicides.

Given the above objectives the null hypothesis stated are -(a) homicidal death are not related to wealth, woman and wine; (b) homicidal victim has no significant relationship with the accused and they do not belonged to any specific age group.

MATERIALS AND METHOD

For the present study data has been collected from the department of Forensic Medicine and Toxicology, VIMSAR, Burla. It covered a period of five years, i.e. from 2013 to 2017 (till 25th December 2017). During that time period 6149 autopsies were carried out of which 152 cases are found to be homicidal death. The cases not reported in the medical college, has not been included in this paper. The data were extracted from police forwarding letter, history revealed by the deceased's relative and autopsy findings. A standard medical procedure has been followed to gather the information and to complete the paper permission has been obtained from the Veer Surendra Sai Institutional Research and Ethics Committee (VIREC). The extracted data are been analysed using SPSS statistical package. Simple frequency distribution and cross tabulations were carried on and table has been presented here. The proposed null hypotheses have been refuted through descriptive statistics.

OBSERVATION AND DISCUSSION

During the study period from January 2013 to December 2017, there are total of 6149 medico-legal autopsies cases are conducted of which 152 cases (2.47 percent) are found to be homicidal death. Table-1, depicts -there is no specific trend observed in case of homicide death. The highest number of homicides cases are found in 2015 (48 cases, 3.94 %) followed by 2016 (32 cases, 2.48 %) and by 2013 (28 cases, 2.52 %) compared to the lowest number of same cases is found in 2014 (20 cases, 1.68 %). The female homicides have not only been lower than their male counterpart but it always remained at around one fourth to one fifth of the total homicide cases except in 2014 where it remained at 10 % level.

Table1: Number of Homicides cases over 2013 to 2017

Period	Total Autopsies	Homicide cases			% of Homicides cases
		Male	Female	Total	
2013	1112	23	5 (17.9)	28	2.52
2014	1189	18	2 (10)	20	1.68
2015	1217	36	12 (25)	48	3.94
2016	1291	25	7 (21.9)	32	2.48
2017	1340	19	5 (20.8)	24	1.79
Total	6149	121	31 (20.4)	152	2.47

Source: Department of FMT, VIMSAR, Burla

Table 2, depicts the distributions of different parameters across the homicidal deaths. The table depicts that-out of total cases, 84.2 % cases are 'known' cases whereas 15.8 % are unknown or unidentified cases. As far as the gender of the deceased is concerned, 79.6 % (121 cases) are male compared to 20.4 % (13 cases) are female. As the places of occurrences are concerned, in 42.1 % cases the incidence occurred inside house, while in 57.9 % cases it occurred outside of house. Similarly, it is found that in 80.3 percent cases the incidence was occurred in the night time. As far as the occurrence of death is concerned, in 91.4 percent cases it is found that the death has occurred instantly. Similar findings are observed by Mada and Krishna[2], who have found while 58.3 percent were male homicides, in 89 percent the identity of the deceased was known and in 72.7 percent cases there was instant or death at the spot.

Table 2: Distribution of Homicides cases across gender, place and time of occurrence and occurrences of death

Sl. No.	Homicide Case Characteristics	Number	Percentages
1.	Total number of autopsy cases	6149	100
2.	Total number of confirmed homicide cases	152	2.47
3.	**Gender of deceased**		
	Male	121	79.6
	Female	31	20.4
4.	**Place of Occurrence**		
	Inside	64	42.1
	Outside	88	57.9
5.	**Identity of cases**		
	Unknown	24	15.8
	Known	128	84.2
6.	**Time of Occurrence**		
	Day	27	17.8
	Evening	1	0.7
	Night	122	80.3
	Unknown	2	1.3
7.	**Occurrence of Death**		
	Instant	139	91.4
	Within a day	2	1.3
	After one day	11	7.2

Source: Department of FMT, VIMSAR, Burla

Table 3, presents the distribution of homicides cases by victim's age. It is found that highest number of homicides death are recorded in the age group of 31 to 40 (28.9 %) followed by 21.7 percentage in the age group of 21 to 30. For comparison purpose while we have calculated the percentage of victims in the age between 18 to 40, it found 62.5 % compared to 64.63 percent found by Rastogi, et. al[3].

Table 3: Distribution of Homicides cases by victim's Age

	Sex			Percentages Distribution		
	Female	**Male**	**Total**	**Female**	**Male**	**Total**
Less than 10	1	1	2	3.2	0.8	1.3
11 to 20	7	19	26	22.6	15.7	17.1
21 to 30	5	28	33	16.1	23.1	21.7
31 to 40	11	33	44	35.5	27.3	28.9
41 to 50	3	18	21	9.7	14.9	13.8
51 to 60	1	12	13	3.2	9.9	8.6
> 60	3	10	13	9.7	8.3	8.6
Total	31	121	152	100	100	100

Source: Department of FMT, VIMSAR, Burla

Table 4 presents the assailant-victim relationship and causes of death. the assailant-victim relation depict that in 58.6 % cases the assailant is either a family member or relative of the victim followed by in 24.3 % cases the assailant is not related to the victim. But in 17 % cases assailant is unknown. As the causes of death of victim are concern in 51.3 % cases the victim died because of Craniocerebral followed by 32.9 % by shock and hemorrhage.

Table 4: Distribution of Homicides cases by assailant-victim relation and causes of death

1.	Assailant-victim relation	Number	Percentage
	Related (Family member and relative)	89	58.6
	Not Relation (Neighbour, friends etc)	37	24.3
	Not known	26	17.1
2.	**Cause of death**		
	Asphyxia	18	11.8
	Craniocerebral	78	51.3
	Shock and Hemorrhage	50	32.9
	Miscellaneous	6	3.9

Source: Department of FMT, VIMSAR, Burla

Table 5, presents the distribution of homicides death by different motives. The table depict that - the single most leading motive behind committing homicides is 'wealth', which includes land and money related disputes, the second leading cause is 'women'

which includes extra marital affairs, love etc. The table also found that - around five percent of the homicides committed in the form of human sacrifice, which is based on the blind believe of the people.

Table 5: Distribution of Homicides cases by different motives

	Sex			Male as percentage of Total
	Female	Male	Total	
Human Sacrifice	1	7	8 (5.06)	87.5
Unknown	0	2	2 (1.32)	100.0
Wealth	7	70	77 (50.66)	90.9
Wine	3	13	16 (10.53)	81.3
Women	16	18	34 (22.37)	52.9
Miscellaneous	4	11	15 (9.87)	73.3
Total	31	121	152 (100)	79.6

Source: Department of FMT, VIMSAR, Burla

Table 6 presents the distribution of homicides cases by different types of weapons used for committing the crime. The table state that the most common form of weapon used in committing murder is the hard and blunt objects (51.97 %) followed by sharp cutting (28.29 %). There is no case found female homicide using gun shot. Similar findings are also found by Rastogi et. al[3].

Table 6: Distribution of Homicides cases by the types of weapon used

Type of weapon used	Sex			Male as percentage of Total
	Female	Male	Total	
Gun shot	0	7	7 (4.61)	100
Hard and Blunt	10	69	79 (51.97)	87.34
Ligature	5	6	11 (7.24)	54.55
Sharp cutting	11	32	43 (28.29)	74.42
Miscellaneous	5	7	12 (7.89)	58.33
Total	31	121	152 (100)	79.61

Source: Department of FMT, VIMSAR, Burla

To understand the effects of seasons on homicides, distributions of homicidal death by different months have been analysed and it is found that the maximum number of homicide cases are recorded in the month of March and June (13.16 % each) followed by in the month of February, September and October (each at around 11 %). In January and July it is minimum (3.95 % each), in April and November each 7.89 %, in May and August each at around 5 % and in December it is 7 %.

CONCLUSION

The paper concluded that homicidal death constituted 2.47 % of total autopsy. Though it is quite lower than the similar thing found in different studies, yet since it is homicides it cannot be neglected as far as preventive policies are concerned. The major motive found behind homicides is 'wealth' (50.6 %). It is the economic adversity, i.e. land and money related disputes and robbery lead to homicides. Further, the major types of weapons used in homicide are hard and blunt (51.97). The maximum number of homicides has been committed in the age group of 21 to 40. (50.6 %). The maximum cases occurred during the month of February, March, June and October (together 49.34 %). In maximum cases the cause of death was cranio-cerebral injury (51.3 %) followed by shock and hemorrhage (32.9 %). As far as the hypothesis of the paper is concern (a) homicidal death are not related wealth, women and wine- the study infer that 50.66 % cases homicidal death is related to wealth followed by in 22.37 % cases it is related to women. However, only in 10.53 cases it is related with wine. Therefore, at an aggregate level, the null hypothesis that 'homicidal death are not related with wealth, women and wine has been rejected and its alternative hypothesis that homicidal death are related to wealth, women and wine has been accepted. The other null hypothesis of the paper is that (b) homicidal victim has no significant relationship with the accused and they do not belonged to any specific age group-the findings suggest that in 58.6 % cases the accused is the relative of the victim. Further it is found that 62.5 % of the victims belonged to the age group of 18 to 40. Hence here too the null hypothesis has been rejected and its alternative hypothesis are accepted-that is in majority of the homicide cases the accused is either a family member or a relative and in majority cases the victim belonged to a specific age group, here it is 18 to 40 age group. Since in most of the cases occurred

because of wealth and women and in majority cases the accused are family member or relative and belonged to specific age group, policies may be formulated in this direction to control homicides.

Ethical Clearance: Taken from Veer Surendra Sai Institutional Research & Ethics Committee (VIREC).

Source of Funding: Self

Conflict of Interest: Nil

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A Study to Assess Knowledge Regarding Medical Ethics among Undergraduates in a Rural Medical College of Mandya District, Karnataka

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ABSTRACT

The principle objective of the medical profession is to render service to humanity with full respect for the dignity of Profession and also to the humanity. Getting reward or financial gain or any kind of benefit is a subordinate consideration. Who so-ever chooses this profession, assumes the obligation to conduct himself in accordance with its ideals. A physician should be an upright man, instructed in the art of healings. He shall keep himself pure in character and be diligent in caring for the sick; he should be modest, sober, patient, prompt in discharging his duty without anxiety; conducting himself with propriety in his profession and in all the actions of his life.

Objective: To assess the knowledge among undergraduate medical students on medical ethics**.**

Materials and Methods: A cross sectional study was conducted on II year medical students of adhichuchanagiriinstitiute of medical science Karnataka in the month of november 2014 after obtaining the prior permission from the concerned authority. The data was collected by students using semi structured questionnaire.

Results: In our study 35(29.7%) of the repondents were with the opinion that medical ethics is very important in their proffesion.118 respondents 62(52.5%) were males and 56 (47.5%) were females with mean age of 20 years. 76(64.4%)of the students were in favour of euthanasia in case of terminal illness which is against the medical ethical code of conduct.

Conclusion: Even though the medical ethics has been included in the syllabus of MBBS by Medical council of India the knowledge about the ethical issues was low among students. Hence there should be sufficient training classes, CME programmes, workshops, conferences to stress the importance of ethical practice and to make the doctors confident enough to deal the ethical dilemma themselves and to adopt principles for better professional efficiency.

Keywords: *Doctors, Ethics, MCI, Euthanasia, Legal.*

INTRODUCTION

There is now a shift from the traditional individual patient, doctor relationship, and medical care. With the advances in science and technology and the needs of patient, their families and the community, there is an increased concern with the health of society. There is a shift to greater accountability to the society. Doctors and health professionals are confronted with many ethical problems. It is, therefore necessary to be prepared to deal with these problems.[1,2]There is now a shift from the traditional individual patient, doctor relationship, and medical care. With the advances in science and technology and the needs of patient, their families and the community, there is an increased concern with the health

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of society. There is a shift to greater accountability to the society. Doctors and health professionals are confronted with many ethical problems. It is, therefore necessary to be prepared to deal with these problems.[3,4]

The recent increase in litigation against doctors is an issue of immediate concern. . The reasons for these are social, economic, professional and judicial. Social factors include increasing media awareness about medical facts and fallacies, professional accountability, and rights of patients in terms of information, decision-making and assessing outcomes. Negative publicity in the media about the profession has done further damage. Moreover, doctor-patient confrontations have been increasing in the recent past. The medical profession has been traditionally considered a noble profession with great respect for doctors. Over the years the medical profession has been defied and mystified. Hence in this scenario this study was done to asses the knowledge of undergraduates who are going to be future doctors reading there awareness of Medical ethics among them.

OBJECTIVE

To assess the knowledge among undergraduate medical students on medical ethics.

MATERIALS AND METHOD

A cross sectional study was conducted onII year medical students of Adhichuchanagiri Institiute of Medical science Karnataka in the month of November 2014 after obtaining the priorpermission from the concerned authority. The data was collected by students using semi structured questionnaire.

RESULTS

Out of the 118 respondents 62(52.5%) were males and 56 (47.5%) were females with mean age of 20 years.

Table 1: Knowledge of medical students of ethics:

		Frequency (n)	Percentage (%)
How important are ethical issues in your profession.	Not at all	3	2.5
	Important	80	67.8
	Very important	35	29.7
Source of your knowledge	Lecture class	58	49.15
	Textbooks	78	66.1
	Workshops	25	21.1
	Conference	8	6.7
	Journals	5	4.2
	Mass media	32	27.1
Is there an ethical committee in your institution	Yes	28	23.7
	No	20	16.9
	Don't know	70	59.4

In our study 35(29.7%) of the respondents were with the opinion that medical ethics is very important in their profession, with majority of the students gained knowledge about ethics through textbooks and lecture classes and mass media too playing its roll in small proportion to enhance the awareness of ethics among students and in public. The source of knowledge was textbooks followed by classroom, workshop and mass media. Around 28(23.7%) percent of the students were aware about the existence of ethical committee in there institution.

Table 2: Response of students on statements related to ethical issues.

	Yes	No	Don't know
Ethical conduct is important to avoid legal action	24	73	21
During treatment always adherence to the Patient wishes	78	30	10

Contd…

Irrespective of patients opinion doctor should give the best possible treatment	69	36	13
If something goes wrong during treatment patient should be informed about it	108	8	2
Parents/guardians to be told always if something goes wrong during treatment	108	8	2
Doctors should refuse to treat the patient who behave violently	27	80	11
Privacy of one patient may be ignored for the benefit of the larger group.	77	14	27
Patient have right to seek second medical opinion	113	3	2

Only 24(20.3%) were of the opinion that following ethical principles in their proffesion will avoid them from facing legal issues from the patients. 78(66.1%) of the respondents would always adhere to the patient's wishes during the course of treatment but 69(58.4%) said that irrespective of the patients opinion doctor should give the best possible treatment to the patients.

Majority of the students 108(91.5%) said they would inform the patient about the complication that have been raised during the course of the treatment and 108(91.5%) would inform the parents/guardians about the same. Around 27(22.8%) of the respondents said its right on the part of doctor and nurses to treat the patients who behave violently with them. Nearly 77(65.25%) agreed that doctors can disclosing the health condition of their patients to the concerned authority at the cost of compromising the patients privacy only when a larger group of people or society will be benefited by that disclosure. 113(95.7%) agreed that patient have a right to seek a second medical opinion about the diagnosis, treatment and outcome of the disease.

Table 3: Knowledge on code of conduct implied to medical Practitioners as per MCI guidelines.

	Yes	**No**	**Don't know**
Physician may print his photograph along with his qualification and specialty	28	80	10
Physician may run an open shop for dispensing drugs and appliances prescribed by other doctors	30	78	10
Its better to use brand name than generic name of drug	56	52	10
It is not necessary for a physician to keep a copy of the certificate issue by them	92	18	8
Clinically confirmed cases should also undergo laboratory investigation as a routine	76	25	17
Confidentiality – important in all aspects	112	2	6
Consent to be taken always for (examination ,investigation, treatment, procedure)	86	30	2
Will you treat the patient if he is unable to pay for medical expenses	109	7	2

With respect to medical council of India/Karnataka medical council code of conduct implied to the private practitioners , 28(23.7%) responded that physician can print his photograph also along with his qualification and other details in the signboard and prescription pad. 30(25.4%) were of the opinion that physician can run an open shop for dispensing medicine and other appliance prescribed by the other doctors,56(47.45%) of them said it will be better to use brand name rather than generic name of the drug during prescription to the patients , which are all against the ethical code of conduct .A physician had to keep any certificates issued by him to any one for a minimum period of three years from the date of issue but in our study only 18(15.25%) were aware about it. 76(64.4%) of the respondents said they would prefer to go for confirmatory laboratory investigation as a routine even though the cases are clinically confirmed.

Nearly 112(94.91%) of the students said they would treat the person even if they are unable to pay for the medical expenses on humanity grounds which is most promising finding in our study to say future doctors of India are not behind the money and there to serve humanity!!!!!!!.

Table 4: Others

	Yes	No	Don't know
Red cross emblem is the right of the doctors	12 (10.16%)	88 (74.5%)	18 (15.25%)
Do you Favour Euthanasia	76 (64.4%)	25 (21.1%)	17 (14.4%)
Ethical clearance must for any study or research	98 (83%)	10 (8.5%)	10 (8.5%)

Red cross emblem is the right of doctor was said by only 12(10.16%) students. 76(64.4%)of the students were in favor of euthanasia in case of terminal illness which is against the medical ethical code of conduct. Around 98(83%) of them were aware that ethical clearance is must before starting the study or any research.

DISCUSSION

In our study 35(29.7%) of the respondents were with the opinion that medical ethics is very important in their profession. In the study done by Angadi M M[5] (52.7%) and Biswath et al[6] (55.2%) more number of students considered ethics as very important when compared to our study findings.

The major sources of knowledge of ethics to the undergraduates in our study was also simialer to our study findings of Angadi MM[5] , Warlrond E R eta[7] and Biswath etal.[6]

Only 23.7% of the students were aware about the institututional ethical committee in there college , which is almost similar to the Angadi MM [5]findings .in the study done by Biswath et [6]al only 10.9% were aware about the institutional ethical committee.

In our study Only 24(20.3%) were of the opinion that following ethical principles in their profession will avoid them from facing legal issues from the patients which is again similar to Angadi M M[5] findings(22.8%) but greater than Mohammed et al [8] findings .66.1% of the respondents adhered to patient wishes while treating in our study which is comparable to Seetharam et al[9] and Mohammed et al[8] findings.

The findings of the study done by Seetharam et al[9] and BiswathChatterjee[6]et al regarding the attitude of the students about informing the complication incurred during treatment to patients and gaurdians were lesser to our study findings but similar to the Mohammed et al findings.

In our study 27(22.8%) opined that doctors can refuse to treat the patients based on patients behaviurs. Even the study done by Angadi MM[5] ,Biswath Chatterjee[6] and Mohammed [8]were almost similar to our findings.

Only 10.16% of the students said doctors has right to use red cross emblem in our study which is lesser than the study done by Shreemantha Kumar et al [4]and similar to Angadi M M[5] findings. 76(64.4%)of the students were in favour of euthanasia in case of terminal illness in our study which is much greater than the Biswath et al [6](10.8%) , Mohammed et al [8](2.3%) , Shreemanth Kumar (10%) [4], xavierbabu (38%)[10].

Nearly 83 % were aware that ethical clearance is must for any research or study can be attributed to the ICMR STS project for the undergrraduates.

CONCLUSION AND RECOMMENDATION

There is also an argument that doctors and nurses should be taught medical ethics simultaneously. Physicians should try continuously to improve medical knowledge and skills and should try available to their patients and colleagues the benefits of their professional attainments. The Physician should practice methods of healing founded on scientific basis and should not associate professionally with anyone who violates this principle. The honoured ideals of the medical profession imply that the responsibility of the physician extend not only to individuals but also to society.

Ethical Clearance: Taken from ethical committee

Source of Funding: Self

Conflict of Interest: Nil

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A Study on Pattern of Injuries in Fatal Cases of Fall From Height in the Rural Areas of Mandya District

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ABSTRACT

Background: Factors influencing the pattern of injuries in fall from height are height of fall, orientation of the body, surface of impact and deceleration of the body. The injury pattern from fall can be direct or indirect injuries. Higher the fall higher the velocity of impact.

Objective: To study the pattern of injuries in cases of fall from height.

Materials and Methods: The present study was carried out in department of forensic medicine Adichunchangiri Insitute of Medical Sciences during the period October 2014 to June 2015.A total number of 35 cases were included in the study .Post mortem examination of the cases was carried out as per the standard procedure mentioned in the "Autopsy diagnosis and techniques" by Otto saphire(5) and blood, viscera were sent for chemical analysis when indicated.

Results: A total of 35 cases of death by fall was reported to the hospital for the post morterm .Majority (22.8%) of the population were in the age group of 31-40 years of age and least in the 40-50 years of age. The highest incidence of fall was reported from construction site (31.4%) where workers are always at risk of fall from height places. In the present study it was observed that primary injuries to the head/face was high (34.2%) followed by feet/lower limb (14.2%).The highest incidence of fall was reported from construction site (31.4%) where workers are always at risk of fall from height places.In the present study it was observed that primary injuries to the head/face was high (34.2%) followed by feet/lower limb (14.2%).

Conclusions: A total of 35 cases of death by fall was reported to the hospital for the post morterm .Majority (22.8%) of the population were in the age group of 31-40 years of age and least in the 40-50 years of age.

Keywords: *Fall, Height, Injury, Postmortem, Head and neck*

INTRODUCTION

Fall from height is the one of the major cases of death and morbidity among the rural population in India. In the present era of extreme industrialization and intense urbanization, deaths due to fall from height are alarmingly increasing. Deaths due to fall from height, form an important area of study due to diversity of the injuries sustained, complexity of the patterns involved and various phenomenons associated there with.[1]

The fall from the height is increasing more in recent years as many activities at workplace, household activities involves height like construction sites , climbing trees, painters, decorators . Lack of proper training, planning, equipment's and inexperience being the major causes of the falls . Other causes contributing to deaths due to fall from height include fall from tree, fall of children while playing which is a most unfortunate happening in recent times. Fall from height refers to fall from one higher level to another level involving ladder, stairs, roof, etc[2] International classification of diseases (ICD9) states that a fall from height is an event where a person falls

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to a Ground from upper level. frailty and injuries co-operative studies of intervention studies (FICSIT) define fall from height as unintentionally coming to rest on the Ground, floor or other lower level.[3]

Fall from height can be classified in several ways.

Depending on the height of fall which may vary from high rising building to ladder, chairs, tables or staircases, etc into:

- Low falls
- High falls

Depending on condition affecting, into:

- Intrinsic (where some events or condition affects postural control)
- Extrinsic (where an environmental factor is the main contributing reason for the fall.).[(3)]

During fall, the potential energy due to height is converted to kinetic energy under the influence of gravity. Fall from height, which results in injuries associated with rapid vertical deceleration; represent a unique form of blunt trauma. Victims of fall from height tend to sustain a unique pattern of injuries that depends on inertia of the body, movement of the body, rigidity of stationary objects and the nature of Ground nature against which body falls.

In a study conducted by W.H.O. it was estimated that 283000 people died due to falls in the year 2000, and a quarter of all fatal falls occurred in the high income countries. In India, fall related mortality rate was 2.1 per 1 lakh population. In all regions of the world, adults and elderly females have significant higher fall related mortality rates than the younger persons.. Europe and western pacific combined foe nearly 60% of the total number of fall related deaths worldwide. Over 40% of global mortality due to falls occurred among persons aged 70 years and over.[4]

The study of pattern of external and internal injury may together indicate the primary site of impact and height from which the fall has occurred. The determination of actual or probable anatomical site of primary impact may be useful in reconstruction of the events, which led to fatal falls.

Hence this study was conducted to assess the pattern of injuries in fatal cases of fall from height in the rural areas of the Mandya district Karnataka.

OBJECTIVE

To study the pattern of injuries in cases of fall from height.

MATERIALS AND METHOD

The present study was carried out in department of forensic medicine Adichunchangiri Insitute of Medical Sciences during the period October 2014 to June 2015.A total number of 35 cases were included in the study .Post mortem examination of the cases was carried out as per the standard procedure mentioned in the "Autopsy diagnosis and techniques" by Otto saphire[(5)] and blood, viscera were sent for chemical analysis when indicated. In the present study fall from height refers to "Any fall from one higher level to another lower level involving ladder, stairs, tree, roof, etc" History of approximate height of fall obtained from the police in all the cases.

Detailed information regarding the deceased and circumstances of death was collected from police, eyewitness, relatives and friends. In some of the instances information was supplemented by either visit to scene of occurrence or from photographs of scene of occurrence.

Inclusion criteria: All cases with history of fall from height brought by police to Adichunchanagiri hospital mortuary at B G Nagar, Mandya.

Exclusion criteria: Cases with history of fall from moving vehicles like train, bus etc.

RESULTS AND DISCUSSION

A total of 35 cases of death by fall was reported to the hospital for the post morterm.Majority (22.8%) of the population were in the age group of 31-40 years of age and least in the 40-50 years of age.

Table No. 1: Distribution of the study population according to Age and Sex

Age group	Frequency	Percentage
11-20 Years	4	11.4
21-30 Years	14	40
31-40 Years	8	22.85
40-50 Years	2	5.7
51-60 Years	3	8.5
61-70 Years	4	11.4

The maximum incidence of fall from height in the age group of 31-40 years may be contributed to factors like, carelessness at work place, taking opportunities involving risks, alcoholic intoxication, and lack of safety measures at work.

In the study done by Risser D et al[6] ,Dogra T D et al [7] and Murthy O P et al [2]also found similar findings as in our study.

Table No. 2: Distribution of study population based on type of fall from Height

Type of fall	Number of cases	Percentage
Construction site/Building	11	31.4
Tree	4	11.4
Stairs	5	14.2
Well	2	5.7
Electric pole	2	5.7
Others	11	31.4

The highest incidence of fall was reported from construction site (31.4%) where workers are always at risk of fall from height places.

Murthy O P et al[2] , Elisabeth E Turk et al [8]also showed similar findings as our study but Dogra T D et al [7]had contrasting findings to our study

Table No. 3: Distribution study population according to Period of Survival

Period of Survival	Number of cases	Percentage
Spot death	16	45.7
Less than one day	4	11.4
1-7 Days	3	8.5
More than 7 days	12	34.28

Nearly 45.7% of the falls reported with spot death at the spot due to extensive injuries with heavy bleeding and internal injuries . Among the cases which were bought to hospital nearly 34% of the cases had survived for 7 days . in the study done by U.K.D.AlbertGoonetilleke [9] and S.Goren[10] majority of the falls resulted in death at the work place it self due to fall. It is observed from the present study that, number of falls from 0-20 feet were highest (40.%) followedby from 21-40 feet height (34.28%).

Table No. 4: Distribution of study population according to time of fall.

Time of fall	Cases	Percentage
Morning	7	20
After Noon	5	14.3
Evening	18	51.4
Late Night	5	14.3

In our study the falls was observed in the evening (51.4%) was more than any time in the 24 hrs day cycle.Fatigue , loss of concentration and contious work without rest may be the precipitating factors for the falls .Nearly 4 (11.4%) of the cases had history of alcohols consumption and 17.1% had dizziness while working and had fall from the heights . history of drug consumption for few common disease was present before the fall.

Table No. 5: Distribution of study population according to site to primary impact.

Primary Impact	Number of cases	Percentage
Head/Face	12	34.2
Feet/Lower Limb	5	14.2
Hand/Upper Limb	3	8.5
Upper limb/ lower limb	4	11.42
Front of the Body	6	17.1
Back of the Body	3	8.5
Side of the Body	2	5.7

In the present study it was observed that primary injuries to the head/face was high (34.2%) followed by feet/ lower limb (14.2%). Similar observations were observed in study conducted by U.K.D.AlbertGoonetilleke [9] and Mason J.K[1]had contrasting findings to our study.

Table No. 6: Distribution of study population according to Head and Neck injuries sustained.

Sl. No.	Type of Injury	Number of cases	Percentage
01.	External Injuries	04	11.4
02.	Injuries to Neck	05	14.2
03.	*Fracture of vault, base of skull* Fissured Fracture: 10 Comminuted Fracture: 8 Ring Fracture:6 Depressed Fracture:02	26	74.2
04.	*Intracranial Hemorrhages* Subdural and Subarachnoid Hemorrhages Extradural Hemorrhages	24	66.6
05.	Lacerations of Brain	12	34.2

The fall from the height resulted in injuries ranging from simple soft tissue injury to complex fracture of long bones , base of skull and fracture of vault. In the present study 14.2% sustained neck injuries and 74.2% had fracture of vault and the base of the skull. 66.6% had intracranial Hamorrhages and 34.2% had brain lacerations on autopsy.

Similar findings were observed in the studies conducted by, T.D.Dogra et al.[7] , Elisabeth E.Turkand Michael Tsokos[8]., U.K.D.AlbertGoonetilleke.[9] Murthy O.P et al [2].

Table No. 7: Distribution of study population according the manner of death.

Manner of death	No. of Cases	Percentage
Accidental	29	82.85
Suicidal	01	2.8
Allegation	5	14.2

Based on the history of the police and relatives nearly 82.85% cases were reported as accidental causes with only 2.8% were suicidal and 14.2% allegation were on the other persons for the fall .Similar findings were observed in the studies conducted by S.Goren[10] and Murthy O.P et al.[2]

CONCLUSION AND RECOMMENDATION

In our study the fall from the heights was most common in unorganized working sector in the community and few cases were due to occupational works. Proper health education regarding the risk of the fall from height, protective measures to be taken while working at heights for both the workers and owners should be taken up by both the police and local governance.

Active and effective management of cases of falls from heights at centers well equipped with modern diagnostic facilities and advanced techniques so that precious human lives can be savedat the site of the accident.

Investigation officer and doctor should prepare sketch of injuries on body diagrams. It is advised that care should be taken to note even smaller injuries which would help in reconstruction of the event of fall later on in cases of suspicion as to manner of fall.

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Autopsy Profile of Strangulation Deaths in Homicides at a Tertiary Care Teaching Hospital in South India

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ABSTRACT

The present prospective study aims to establish the Autopsy Profile of Strangulation deaths in Homicides and cause of death among cases which were subjected to post-mortem examination in a tertiary care teaching hospital in South India for a period of two years (June 2010 to May 2012). The study revealed that among 211 homicides conducted in the study period, strangulation accounted for 59 cases (27.96%). Ligature strangulation was common (54.24%) when compared to manual strangulation. The most common external finding was cyanosis i.e. (80.36%). Fracture of thyroid cartilage was noticed in 17 cases (28.81%). Among the Internal findings, the most common finding was congestion of internal organs (91.53%).

Keywords: *Homicidal deaths, Manual Strangulation, Ligature Strangulation, Post mortem findings*

INTRODUCTION

There is a global rise in homicide and annually, it causes over 5 lakhs deaths worldwide.[1,2] Asphyxial deaths have contributed considerably to homicidal, suicidal and accidental deaths which include hanging, strangulation, smothering, drowning, chocking and traumatic asphyxia.[3,4] Strangulation is form of asphyxia in which there is compression of neck structures by a constricting force other than the body's own weight. The force being exerted by different means either by ligature, by use of hand, when it is known as throttling or manual strangulation, elbow (mugging) and bamboos (bansdola).[5] Ligature and manual strangulation, with the former reported as the more frequently recorded method of asphyxial homicide.[6,7] The application of pressure on the neck often results in findings, which are quite variable.[6,-10] A proper assessment of various post-mortem findings is therefore necessary in such circumstances. The present study aims to determine this objective by focusing on the autopsy findings in cases of strangulation.

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MATERIALS AND METHOD

The prospective cohort study aims to establish the profile of post-mortem examination findings in strangulation in homicidal deaths which were subjected to autopsy in a tertiary care teaching hospital in Hyderabad, Telangana, South India for a period of two years from June, 2010 to May, 2012. On the basis of police inquest and autopsy, 59 cases were selected. Post mortem examination was carried out as per the standards. All this information pertaining to the type of strangulation, external and internal findings during post mortem examination was collected on proformas, computerized master data sheet was prepared and analyzed.

Table 1: Distribution of study population according to type of strangulation

S. No.	Cause of Death	Number	Frequency
1.	Ligature strangulation	32	54.24%
2.	Manual Strangulation (Throttling)	27	45.76%
	Total	59	100%

Table 2: Distribution of study population according to postmortem findings

S. No.	Postmortem finding	Number	Frequency
External			
1.	Facial congestion	36	61.02%
2.	Cyanosis	48	80.36%
3.	Cresentric nail marks	24	40.68%
4.	Ligature mark	32	54.24%
5.	Other Abrasions	24	40.68%
6.	Contusions	26	44.07%
7.	Lacerations	4	6.78%
8.	Bleeding from nose & ears	37	62.71%
Internal			
1.	Contusions	25	42.37%
2.	Hyoid bone fracture	9	15.25%
3.	Thyroid cartilage fracture	17	28.81%
4.	Cricoid cartilage fracture	4	6.78%
5.	Effusion of tissues	26	44.07%
6.	Congestion of organs	54	91.53%
Petechial hemorrhages			
1.	Eyes	26	44.07%
2.	Under scalp	20	33.9%
3.	Under pleura & pericardium	23	38.98%
4.	Skin	16	27.12%
5.	Brain	22	37.29%

OBSERVATIONS

The study revealed that 59 cases of homicidal strangulation were noticed which constituted 0.58% among 10137 autopsies and 27.96% among 211 cases of homicides. In the present study, it was observed that the common type was ligature strangulation i.e. 32 cases (54.24%) and manual strangulation was observed in 27 cases (45.76%). (Table 1) The postmortem findings were explained in three categories i.e. external findings, internal findings and petechial hemorrhages. Among the external findings, the most common finding was cyanosis i.e. (80.36%), followed by bleeding from the nose and ears (62.71%), facial congestion (61.02%), ligature mark (54.24%), contusions (44.07%), other abrasions (40.68%), crescentic nail marks (40.68%) and lacerations (6.78%). Among the internal findings, the most common finding was congestion of internal organs (91.53%), followed by tissue effusion (44.07%), contusions (42.37%), fracture of thyroid (28.81%), fracture of hyoid bone (15.225%), cricoid cartilage fracture (6.78%). The most common site for petechial haemorhages was eyes (44.07%), followed by brain (37.29%), scalp (33.9%), under pleura and pericardium (38.98%) and in the skin (27.12%). (Table 2)

DISCUSSION

In the present study, 59 cases (27.96%) of homicidal strangulation were noticed among 211 cases of homicides. Similar observations was found in other studies.[11,12] But other studies reported low incidence.[13-15] Ligature strangulation was common type compared to manual strangulation.[6,11,15] This is in contrast with other studies.[7]

Cyanosis was commonly observed in our study as in study by others.[17,18] Congestion of internal organs, contusion of neck muscles, haemorhages in eyes and neck was common finding in our study and found to be in consistence with study of Ma J et al.[17] Bleeding from mouth and nose, abrasion, nail marks, contusion, facial congestion was common observation in our study, was uncommon in study of Shaikh MM et al.[18] Congestion of face and contusion of neck muscles was noticed in most cases of strangulation in study of Patel AP.[19] Nail marks and contusion as seen in our study was also commonly noticed in study by Srivastava AK et al.[7] In our study, fracture of thyroid cartilage was found to be common when compared to hyoid bone, which was in accordance with studies by Verma SK et al.,[6] Srivastava AK et al.,[7] Verma SK and Lal S[6] and Rangaiah YK,[20] but fracture of hyoid cartilage is commonly found in study of Patel AP et al.[19] and Ma J et al.[18] Higher incidence of laryngeal cartilage fracture in association ligature strangulations was most common observation as noted in present study.[6,7,21]

CONCLUSION

Strangulation accounted for 59 cases (27.96%) among 211 homicides. Ligature strangulation was common type. The most common external finding was cyanosis i.e. (80.36%). Fracture was common in thyroid cartilage. The most common finding was congestion of internal organs (91.53%).

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Regression Analysis to Determine Body Weight from Foot Impression Breadth Measurements in Bidayuhs of East Malaysia

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ABSTRACT

Forensic anthropology is most often employed in person identification. Researchers have proved that body dimensions differ for various populations. There exists a relationship between one's body weight and foot impressions. Hence the aim of this study was to investigate the relationship between human body weight and breadth measurements of foot impressions among Bidayuh ethnic groups in east Malaysia. The results showed significant positive correlation between body weight and breadth measurements of foot impressions. The correlation coefficient (R) values in pooled sample are found to be comparatively higher in the foot impressions (footprint 0.265-0.457; foot outline 0.414-0.484) than those of males (footprint 0.128-0.371; foot outline 0.324-0.348) and females (footprint 0.241-0.380; foot outline 0.275-415). The result of this research has provided regression equations to determine body weight from foot impressions for person identification.

Keywords: *Forensic anthropology, body weight, footprint, foot outline, breadth measurements, Bidayuhs, east Malaysia*

INTRODUCTION

Anthropologists assist in identifications primarily by constructing a biological profile. This includes estimating stature, gender, body weight, etc[1]. Studies have indicated that body dimensions differ for various populations[2]. Forensic anthropologists are interested in body weight estimation through foot impression[3]. Person identification using footprint analysis is an emerging biometric technique[4]. The whole body of a human has a strong relationship with each part of his/her body[5]. The characteristic features of foot impressions can provide useful clues to establish identity[6]. Foot impressions are found at crime scenes since offenders often remove their footwear, either to avoid noise or to gain better grip in climbing walls etc.[7]. Two-dimensional dust impressions occur when a foot comes in contact with a surface heavily coated with loose material such as dust or dirt. Three-dimensional impressions occur when a foot comes in contact with a soft receiving surface[8]. The outer border of the impression or foot may be drawn as preserved as foot outline (3D). Thus the feet may produce 2D and 3D impressions in hard and soft surfaces. Examination of footprints[9-14], foot outlines[15-18] and feet [19-23] can provide valuable information to estimate stature. Anthropologists have been conducting studies on sex determination from foot [24-25] and footprint [26-27] for forensic application. Also studied the relationship between footprint[28-30], foot outline[31-32] lengths and body weight. It is important that racial and cultural aspects of foot morphology must be considered and hence a single formula cannot represent for all races or regions in a country[10-19]. Hence, the present study attempted to derive regression equations to derive body weight from foot impression's (2D & 3D) breadth measurements for Bidayuh ethnic groups in east Malaysia.

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MATERIALS AND METHOD

The sample collection from the consented subjects (100 males and 100 females) was conducted at Sarawak state, east Malaysia and the participants ages ranged

from 18 to 64 years. Subjects with any apparent foot-related diseases or disorders were excluded from the sample collection. Following the standard procedure, footprint [8-13], foot outlines [15-18] and body weight[28-32] were collected and the anatomical marks on foot outline and footprint are shown in figure 1.

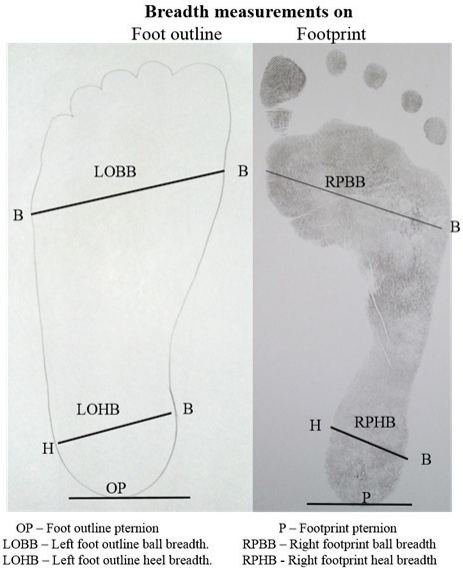

Fig. 1: Landmarks and measurements on left foot outline and right footprint

Anatomical landmarks

P–Mid-rear heel point on footprint

OP–Mid-rear heel point on foot outline

BB–Ball breadth

HB–Heel breadth

LOBB–Ball breadth measurement in left foot outline

LOHB–Heel breadth measurement in left foot outline

RPBB–Ball breadth measurement in right footprint

RPHB–Heel breadth measurement in right footprint

The data were analyzed using PASW Statistics version 20 (Predictive Analytic Software). The linear regression analysis method was employed to derive regression equations for living body weight estimation from foot impression breadths[30].

RESULTS

Table 1 presents the descriptive statistics of body weights in males, females and pooled sample (combined male and female subjects).

Table 1: Descriptive statistics of body weight (in kg) in adult males, females and pooled sample among Bidayuhs of east Malaysia

Variable	Male (N=100)				Female (N = 100)				Pooled sample (N = 200)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
Body weight (kg)	50.2	88.0	63.9	9.5	44.2	66.0	54.6	6.1	44.2	88.0	58.4	7.8

Min: minimum; Max: maximum; N: sample size; SD: standard deviation

The table 1 shows that the mean body weight of male is found to be comparatively higher (63.9 kg) than the mean body weight of females (54.6 kg).

Table 2: Descriptive statistics of ball and heel breadth measurements (cm) in the footprints of adult males, females and pooled sample among Bidayuhs of east Malaysia

Variable	Male (N = 100)				Female (N = 100)				Pooled sample (N = 200)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
LPBB	8.0	10.7	9.25	0.6	7.4	10.0	8.57	0.5	7.4	10.7	8.91	0.6
LPHB	3.5	5.7	4.64	0.5	2.8	5.6	4.32	0.4	2.8	5.7	4.48	0.5
RPBB	8.1	10.7	9.28	0.5	7.3	10.2	8.61	0.5	7.3	10.7	8.94	0.6
RPHB	3.3	5.9	4.66	0.4	3.0	5.7	4.34	0.4	3.0	5.9	4.49	0.5

Min: minimum; Max: maximum; N: sample size; SD: standard deviation; LPBB: ball breadth in left footprint; RPBB: ball breadth in right footprint; LPHB: heel breadth in left footprint; RPHB: heel breadth in right footprint

Table 2 shows that the size of both ball and heel breadth measurements are found to longer in males (BB 9.25-9.28 cm; HB 4.64-4.66 cm)) compared to females (BB 8.57-8.61 cm; HB 4.32-4.34 cm)). In males the left ball breadth is longer than right ball breadth but not significant. The standard deviation values are very low in both genders.

Table 3: Descriptive statistics of ball and heel breadth measurements (in cm) in the foot outlines of adult males, females and pooled sample among Bidayuh of east Malaysia

Variable	Male (N = 100)				Female (N = 100)				Pooled sample (N = 200)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
LOBB	9.2	12.0	10.56	0.6	8.5	10.6	9.56	0.5	8.60	12.0	10.07	0.7
LOHB	5.5	8.0	6.66	0.5	4.9	7.4	6.05	0.5	4.90	8.0	6.36	0.6
ROBB	9.3	11.7	10.55	0.5	8.5	10.7	9.58	0.5	8.50	11.7	10.08	0.7
ROHB	5.6	7.9	6.53	0.5	4.8	7.1	5.89	0.5	4.80	7.6	6.22	0.5

Min: minimum; Max: maximum; N: sample size; SD: standard deviation; LOBB: ball breadth in left foot outline; ROBB: ball breadth in right foot outline; LOHB: heel breadth in left foot outline; ROHB: heel breadth in right foot outline

Table 3 presents the descriptive statistics of various ball breadth and heel breadth measurements in foot outlines among males, females and pooled sample on both sides.The result indicated that the mean size of both ball and heel breadth measurements are found to longer in males compared to females.

Table 4: Linear regression equations to determine body weight (kg) through ball and heel measurements (cm) and ANOVA in the footprints of adult males, females and pooled sample among Bidayuhs of east Malaysia

Gender	Side	Linear regression equations	R	R^2	SEE	ANOVA
Male N=100	LPBB	5.909 + 6.072LPBB	0.371	0.138	8.569	15.640 (1, 98) ; p = 0.000
	LPHB	49.277 + 2.762LPHB	0.139	0.019	9.137	1.940 (1, 98) ; p = 0.167
	RPBB	11.082 + 5.497RPBB	0.319	0.102	8.744	11.139 (1, 98) ; p = 0.001
	RPHB	49.727 + 2.654RPHB	0.128	0.016	9.152	1.622 (1, 98) ; p = 0.206
Female N=100	LPBB	2.429 + 6.339LPBB	0.380	0.145	8.271	16.560 (1, 98) ; p = 0.000
	LPHB	35.784 + 4.848LPHB	0.241	0.058	8.680	6.031 (1, 98) ; p = 0.016
	RPBB	1.870 + 6.377RPBB	0.382	0.146	8.266	16.715(1, 98) ; p = 0.000
	RPHB	30.000 + 6.168RPHB	0.296	0.088	8.543	9.399(1, 98) ; p = 0.003
Pooled sample N=200	LPBB	0.108 + 6.656LPBB	0.457	0.208	8.392	52.129 (1, 198) ; p = 0.000
	LPHB	36.079 + 5.207LPHB	0.265	0.070	9.095	14.952 (1, 198) ; p = 0.000
	RPBB	1.180 + 6.513RPBB	0.436	0.190	8.488	46.541 (1, 198) ; p = 0.000
	RPHB	33.078 + 5.857RPHB	0.288	0.083	9.033	17.903 (1, 198) ; p = 0.000

W: body weight; Max: maximum; N: sample size; R: correlation coefficient; R^2: coefficient of determination; SEE: standard error of estimation; LPPB: ball breadth in left footprint; RPBB: ball breadth in right footprint; LPHB: heel breadth in left footprint; RPHB: heel breadth in right footprint.

Table 4 presents the linear regression equations for body weight estimation in males, females and pooled sample from footprints' and Correlation coefficient(R) with ANOVA. Correlation coefficient values are found to be more in the pooled sample (0.262-0.342) when compared with males (0.082-0.265) and females (0.218-0.249).

Table 5: Linear regression equations to estimate body weight (kg) through ball and heel measurements (cm) and ANOVA in the foot outlines of adult males, females and pooled sample among Bidayuhs of east Malaysia

Gender	Sides	Linear regression equations	R	R^2	SEE	ANOVA
Male N=100	LOBB	0.640 + 5.999LOBB	0.348	0.121	8.988	13.543(1, 98) ; p = 0.000*
	LOHB	21.535 + 6.371LOHB	0.350	0.123	8.982	13.702 (1, 98) ; p = 0.000*
	ROBB	3.824 + 5.701ROBB	0.324	0.105	9.072	11.479(1, 98) ; p = 0.001
	ROHB	22.111 + 6.408ROHB	0.307	0.094	9.125	10.219(1, 98) ; p = 0.002
Female N=100	LOBB	1.777 + 5.524LOHB	0.414	0.171	5.579	20.227(1, 98) ; p = 0.000*
	LOHB	26.852 + 4.587LOHB	0.389	0.151	5.645	17.465(1, 98) ; p = 0.000*
	ROBB	10.771 + 4.575ROBB	0.345	0.119	5.751	13.238(1, 98) ; p = 0.000*
	ROHB	33.122 + 3.645ROHB	0.275	0.075	5.892	7.990(1, 98) ; p = 0.006
Pooled sample N=200	LOBB	1.453 + 5.657LOBB	0.473	0.223	6.884	56.975(1, 198) ; p = 0.000
	LOHB	16.812 + 6.540LOHB	0.484	0.234	6.837	60.518(1, 198) ; p = 0.000
	ROBB	6.950 + 5.104ROBB	0.434	0.189	7.037	46.020(1, 198) ; p = 0.000
	ROHB	20.961 + 6.021ROHB	0.414	0.172	7.111	40.993(1, 198) ; p = 0.000

N: sample size; R: correlation coefficient; R^2: coefficient of determination; SEE: standard error of estimation; LOBB: ball breadth in left foot outline; ROBB: ball breadth in right foot outline; LOHB: heel breadth in left footprint; ROHB: heel breadth in right foot outline

Table 5 shows the linear regression equations for body weight determination in adult males, females and the pooled sample through various breadth measurements in foot outline with ANOVA. The standard error of estimate (SEE) is comparatively lower in females (5.579-5.892) than males (8.982-9.125) and pooled sample (6.837-7.111). Correlation coefficient (R) values are significant and found to be more in pooled sample (0.414-0.484) when compared with males (0.307-0.350) and females (0.275-0.414).

DISCUSSION

Malaysia is a multi-racial country and Bidayuh is one of the indigenous ethnic groups[33]. The present investigation shows that body weight, heel and ball breadth measurements are found to be larger in males than females. This finding is in according with the previous studies[28-32]. This may attributed to the general male-female differences and natural size in both sexes[34]. The present study shows that the correlation coefficient (R) between body weight and footprint breadth measurements are in the range of 0.128-0.371 for males, 0.296-0.382 for females and 0.265-0.457 pooled samples. On the contrary the (R) values are found to be higher in Melanaus in footprints of males (0.509-0.527), females (0.569-0.591) and pooled samples (0.592-0.602).

The (R) values in foot outlines in Bidayuhs have been presented for males (0.307-0.350), females (0.275-0.414) and pooled sample (0.414-0.484). While in Melanau population (R) values are comparatively higher for males (0.559-0.641) and females (0.458-0.463) but lower for pooled sample (0.412-0.442)[35]. The standard error of estimate (SEE) in the present investigation shows lower value. Many investigators considered foot impression is "unimportant" and neglected in their investigation[36]. But foot impression can provide more valuable information than fingerprints.

CONCLUSION

The present study provided population specific regression equations to determine body weight from foot impression breadths among Bidayuhs. The regression equations derived for the pooled sample can be employed to determine body weight when the sex of the perpetrator remains unknown. Hence the researchers are suggested to conduct similar studies on other ethnic groups living in different regions and countries so that effect of genetics and regions can be investigated in forensic terms.

Conflict of Interest: NIL

Source of Funding: Self

Ethical Clearance: Done

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Body Weight Estimation from Footprint Anthropoetry in Lun Bawang Ethnic of East Malaysia

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ABSTRACT

Footprint is an important physical evidence and weight is a biometric trait. Body weight involves a variety of cultural and physical variables. Limited studies were conducted correlating body weight and footprint. Hence the present study was aimed to develop regression equations to estimate body weight from footprint lengths, collected from 200 consented Lun Bawangs in east Malaysia. The results show that all footprint lengths exhibit statistically positive significant correlation with body weight. The correlation coefficient (R) in pooled sample (0.235-0.296) is found to be comparatively higher than those of male (0.125-0.144), and females (0.083-0.138). The result findings have been presented in the form of tables. The equations derived for pooled sample can be used even when the sex of the footprint owner remains unknown.

Keywords: *Forensic anthropology, Body weight, footprint length, Lun Bawangs, east Malaysia.*

INTRODUCTION

Identification is a key element in any forensic investigation[1], not only the dead but also the living individual[2]. An aspect of human identification is the study of foot impressions[3]. Identification through footprint analysis is an emerging biometric technique[4]. The characteristic features of an individual's footprint is as unique as fingerprints[5]. The presence of foot impressions at the crime scenes form a valuable physical evidence[6,7]. Foot impressions are found at crime scenes since offenders often remove their footwear, either to avoid noise or to gain better grip in climbing walls, etc.[8]. Researchers have conducted study on footprints[9-14], foot outlines[14-16] and feet [17-21] to estimate stature in crime investigation. Weight is also a biometric trait and is an indicator of one's physical aspects[22]. Literature reviews recorded limited studies, correlating body weight with footprint. Body weight involves a variety of cultural, racial and physical variables[23] and hence a single formula cannot represent for all races or regions in a country[24-27]. Hence, the present study was aimed to derive formulae to estimate body weight from footprint lengths among Lun Bawangs, living in Sarawak state, east Malaysia.

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MATERIALS AND METHOD

The subjects were from colleges, universities and general public, age ranged from 18 to 60 years. The foot prints were collected from the participants following the standard procedure [9-16]. The five diagonal footprint lengths were taken from the mid-rear heel point (P) to most anterior point of each left toes (LT1 to LT5). The left footprint length measurements were designated as PLT1-PLT5 while right prints as PRT1-PRT5. The land marks and length on right footprint are shown in Figure 1. The weight of the subjects were recorded following the procedure adopted by Irene[24].

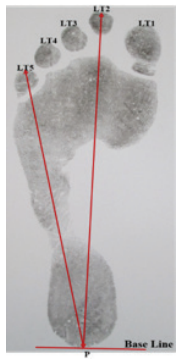

Fig. 1: Landmark P, pternion to the toe points LT2-LT5, illustrative example of diagonal length measurements PLT2 and PlT5 on left footprint

The data were analyzed using PASW Statistics version 20. The linear regression analysis method was employed to derive regression equations for body weight estimation from footprint lengths[25].

RESULTS

Table1 presents the descriptive statistics of weights in males, females and pooled sample. In males, the body weight ranges from 37.2 to 106.5 kg (mean 66.24 kg) and in females the body weight ranges from 45.0 to 82.0 kg (mean 61.43 kg). In pooled sample, the body weight ranges from 37.2 to 106.5 kg (mean 65.76 kg). The result showed that mean weight is found to be higher in males than females.

Table 1: Descriptive statistics of body weight in males, females and pooled sample of Lun Bawang in east Malaysia

Variable	Male (N = 100)				Female (N = 100)				Pooled sample (N = 200)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
Body weight (kg)	37.2	106.5	66.24	11.40	45.0	82.0	61.43	8.96	37.2	106.5	65.76	9.76

Min: minimum; Max: maximum; N: sample size; SD: Standard deviation

The descriptive statistics of footprint lengths in males, females and pooled sample is presented in table 2. The mean footprint length in males (20.07-23.80 cm) is found to be higher than females (18.24-21.83 cm) . The mean second toe-heel footprint lengths (PLT2, PRT2) are found to be the longest in males while in females the mean PLT1 and PRT1 are the longest.

Table 2: Descriptive statistics of footprint lengths (in cm) in males, females and pooled sample of Lun Bawangs in east Malaysia.

Variables	Male (N = 100)				Female (N = 100)				Pooled sample (N = 200)			
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
PLT1	20.7	26.6	23.59	1.1	18.7	23.2	21.69	0.8	18.7	26.6	22.73	1.4
PLT2	20.4	27.2	23.80	1.2	18.8	23.3	21.63	0.9	18.8	27.2	22.79	1.5
PLT3	20.0	26.7	23.02	1.2	17.6	22.6	20.89	0.9	17.6	26.7	22.03	1.5
PLT4	17.9	25.1	21.81	1.1	16.5	21.4	19.79	0.8	16.5	25.1	20.88	1.4
PLT5	17.5	23.1	20.20	1.0	15.1	22.2	18.32	0.9	15.1	23.1	19.34	1.3
PRT1	20.3	26.6	23.60	1.1	19.0	23.6	21.83	0.8	19.0	26.6	22.82	1.3
PRT2	20.4	26.9	23.68	1.1	19.0	23.5	21.69	0.9	19.0	26.9	22.78	1.4
PRT3	19.7	26.5	22.89	1.2	17.9	23.0	20.89	0.9	17.9	26.5	21.98	1.4
PRT4	18.4	25.1	21.67	1.1	16.6	21.9	19.76	0.8	16.6	25.1	20.81	1.3
PRT5	16.9	22.7	20.07	1.0	15.2	19.8	18.24	0.8	15.2	22.7	19.24	1.3

Min: minimum; Max: maximum; PLT1 to PLT5: left footprint lengths; PRT1 to PRT5: right footprint lengths; SD: standard deviation; N: sample size.

Table 3: Linear regression equations for body weight estimation from footprint lengths on left and right sides among male Lun Bawangs in east Malaysia

Variables	Regression equations	SEE	R	ANOVA
PLT1	33.688 + 1.380PLT1	11.35	0.135	1.822 (1, 98) ; p = 0.180
PLT2	36.197 + 1.262PLT2	11.36	0.129	1.666(1, 98) ; p = 0.200

Contd…

PLT3	37.738 + 1.238PLT3	11.37	0.127	1.604(1, 98) ; p = 0.208
PLT4	35.556 + 1.407PLT4	11.35	0.137	1.871(1, 98) ; p = 0.175
PLT5	34.279 + 1.582PLT5	11.35	0.135	1.831 (1, 98) ; p = 0.179
PRT1	36.130 + 1.276PRT1	11.37	0.125	1.555(1, 98) ; p = 0.215
PRT2	36.325 + 1.263PRT2	11.37	0.127	1.606(1, 98) ; p = 0.208
PRT3	36.694 + 1.291PRT3	11.36	0.131	1.714(1, 98) ; p = 0.194
PRT4	33.419 + 1.515PRT4	11.34	0.144	2.062(1, 98) ; p = 0.154
PRT5	36.534 + 1.480PRT5	11.36	0.130	1.677(1, 98) ; p = 0.198

PLT1 to PLT5: left footprint lengths; PRT1 to PRT5: right footprint lengths; R: correlation coefficient; SEE: standard error of estimate.

Table 4: Linear regression equations for body weight estimation from footprint lengths on left and right sides among female Lun Bawangs in east Malaysia

Variables	Regression equations	SEE	R	ANOVA
PLT1	27.781 + 1.551PLT1	8.917	0.138	1.899 (1, 98); P = 0.171
PLT2	37.807 + 1.092PLT2	8.948	0.111	1.222(1, 98); P = 0.272
PLT3	37.132 + 1.163PLT3	8.943	0.115	1.319(1, 98); P = 0.254
PLT4	34.031 + 1.384PLT4	8.929	0.128	1.629 (1, 98); P = 0.205
PLT5	45.563 + 0.866PLT5	8.972	0.083	0.672(1, 98); P = 0.414
PRT1	38.564 + 1.047PRT1	8.968	0.088	0.764(1, 98); P = 0.384
PRT2	39.169 + 1.026PRT2	8.953	0.105	1.103(1, 98);P = 0.296
PRT3	43.323 + 0.867PRT3	8.968	0.088	0.771 (1, 98); P = 0.382
PRT4	43.339 + 0.915PRT4	8.971	0.084	0.694(1, 98); P = 0.407
PRT5	32.863 + 1.566PRT5	8.925	0.132	1.729 (1, 98); P = 0.192

PLT1 to PLT5: left footprint lengths; PRT1 to PRT5: right footprint lengths; R: correlation coefficient; SEE: standard error of estimate.

Table 5: Linear regression equations for body weight estimation from footprint lengths on left and right sides among pooled sample of Lun Bawangs in east Malaysia.

Variables	Regression equations	SEE	R	ANOVA
PLT1	17.183 + 2.137PLT1	9.347	0.296	18.967 (1, 198); p = 0.000
PLT2	24.469 + 1.812PLT2	9.398	0.278	16.597 (1, 198); p = 0.000
PLT3	27.060 + 1.757PLT3	9.431	0.266	15.099 (1, 198); p = 0.000
PLT4	26.949 + 1.859PLT4	9.436	0.264	14.880(1, 198); p = 0.000
PLT5	31.495 + 1.772PLT5	9.509	0.235	11.623(1, 198); p = 0.001
PRT1	18.967 + 2.050PRT1	9.416	0.272	15.780(1, 198); p = 0.000
PRT2	24.284 + 1.821PRT2	9.428	0.267	15.252(1, 198); p = 0.000
PRT3	26.060 + 1.806PRT3	9.430	0.267	15.145 (1, 198); p = 0.000
PRT4	27.470 + 1.840PRT4	9.466	0.253	13.535(1, 198); p = 0.000
PRT5	29.183 + 1.901PRT5	9.483	0.246	12.755(1, 198); p = 0.000

PLT1 to PLT5: left footprint lengths; PRT1 to PRT5: right footprint lengths; R: correlation coefficient; SEE: standard error of estimate.

The linear regressions to estimate body weight from various footprint anthropometry in adult males, females and pooled sample are presented in Tables 3-5 with ANOVA. The tables show that the correlation coefficient (R) between various footprint lengths and body weights are positive and statistically significant. The (R) values are found to be more in the pooled sample (0.235-0.296) than males (0.27-0.144) and females (0.083-0.138). The investigation shows that statistically significant correlation exists between body weight and footprint lengths in Lun Bawangs.

DISCUSSION

Malaysia is a multi-ethnic and multi-religious country. In east Malaysia indigenous ethnic groups viz. Iban, Bidayuh, and Lun Bawang are living with their own identity in culture and lifestyle [27-28]. The present investigation reveals that body weight and footprint lengths are found to be larger in males, showing the gender difference and this finding is in accordance with the previous studies[29-32]. The mean left footprint length in male is found to be longer than right showing the asymmetry. This finding is in accordance with Malaysian Malayalees[33]. The minimum age of the subjects was fixed as 18 years and is considered appropriate[34]. In Melanaus, the left and right footprint sizes are similar in males while in females, the right side is longer than left showing bilateral asymmetry[31]. This findings in accordance with Ibans[30]. The present study shows that the mean weight of pooled sample is found to be 65.8 kg while Iban is 57.0 kg, Bidayau is 59.4 kg and Melanau is 56.7 kg. The study also shows that the standard error of estimate (SEE) is lower in females than pooled sample and males. The regression equations provided body weight estimation from unknown footprint length in the form of range, not an exact figure[35]. Discovering pedal evidence can be difficult, however, and a conscious effort must be made to do so[36]. Some of the investigators have been underestimating the value of footprint. But the researchers have proved that footprint can provide more information than finger print in solving crime[37].

CONCLUSION

The present study has successfully reported the relationship between living body weight and footprint anthropometry among Lung Bawangs of east Malaysia. The result of the study has developed regression equations to estimate body weight from footprint lengths. These equations are population specific and unsuitable to apply weight estimation for any other populations.

Conflict of Interest: NIL

Source of Funding: Self

Ethical Clearance: Done

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Evaluation of Mandibular Parameters for Gender Assessment by Digital Panoramic Radiography and Its Relevance in Forensic Odontology–A Retrospective Study

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ABSTRACT

Purpose: A retrospective study was conducted with an aim to determine if there is a correlation between mandibular parameters (gonial angle, ramus height) for gender determination in dentate subjects to enable future advances in forensic odontology.

Methodology: 320 radiographs of patients with age of 20 years and above were selected. To ensure consistency and to avoid intra-observer bias, one observer was responsible for selection and measurements of radiographs based on the inclusion and exclusion criteria which was verified by the supervisor by random selection. The mean and standard deviations were calculated for each clinical parameter and One-way ANOVA statistical test of significance was used to compare gonial angle and ramus height. Statistical significance was set at $P < 0.05$

Findings: The results showed high significance when gender was compared. The gonial angle decreases among males, whereas ramus height increases among males as compared to females on both the right and left side.

Conclusion: The mandiblular parameters plays an important role in gender identification. Future research should be conducted across a vast area to provide a more representative sample that accurately reflects the entire population.

Keywords: *forensic odontology, gender, mandible, panoramic radiography*

INTRODUCTION

Forensic Odontology was defined by Keiser NS (1970)[1] 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." The honour of being the *Father of Forensic Odontology* is bestowed on Dr. Oscar Amoedo, a Cuban dentist and also the author of first treatise on forensic odontology in 1898 entitled "*L'Art dentaire en Medecine Legale*" which was an important contemporary text on many aspects of the use of teeth for legal purposes.[2]

The mandible is a paired bone that develops within the mandibular arch, embedding teeth and forming an articulation of the jaw with the cranium: the temporomandibular joint.[3,4] Longitudinal studies have shown that remodelling of the mandibular bone occurs with age.[5]

In the past, lateral cephalograms were the radiograph of choice for measuring morphological changes to the

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mandible [6]. However as they do not allow bilateral mandibular assessment due to the superimposition of the ramus, researchers have now looked to orthopantomograms for a more reliable method of obtaining data[7-14]. Studies[9,13] published reveals that the gonial angle was the parameter with acceptable accuracy and precision in determining gender, which in turn suggests a forensic implication[13].

Upadhyay et al.[15] has suggested that gonial angle alone is not sufficient to determine age, as there are multiple factors that influence its development. For this reason, further research is required relating to other morphological characteristics of the mandible.[15]

Joo JK et al.[16] found men have a higher value for ramus height in edentulous subjects. Also international studies have been conducted in an attempt to correlate age and gender with mandibular parameters but at present, there are no known studies conducted on the Australian population.[17]

The aim of this study is to determine if there is a correlation between the mandibular parameters (gonial angle, ramus height) and age or gender in dentate subjects among Jodhpur population. This data may enable future advances in forensic cadaver identification, as well as monitoring growth patterns of individuals in forensic odontology assessments.

MATERIALS

A retrospective study was conducted using panoramic radiographs for which the study radiographs were selected from the Department of Oral Medicine and Radiology at Jodhpur Dental College General Hospital, Jodhpur, Rajasthan, India with age of 20 years and above.

All the radiographs were taken with VATECH Digital Panoramic X- ray system (Pax – 400C) on Kodak radiographic film.

The selected radiographic images were imported by Easydent digital Software with specific tools for making linear measurements on images of the mandibular jaw using mouse-driven method.

METHODOLOGY

Sample Size: 320 high quality radiographs of patients with age of 20 years and above was selected from the Department of oral medicine and radiology to see gonial angle and the ramus of the mandible**.**

Inclusion criteria

- All the patients with age above 20 years
- Evidence of alveolar crest resorption in premolar and first molar regions should be minimum or absent.

Exclusion criteria

- Hereditary facial asymmetries
- Radiographs of completely edentulous patients will be excluded
- Surgical intervention, patients with orthognathic surgeries
- Presence of pathologies, periodontal lesion and congenital anomaly in the lower jaw that could affect the interpretation of radiographic image

Examiner Reliability: To ensure consistency and to avoid intra-observer bias, one observer was responsible for selection and measurements of radiographs based on the inclusion and exclusion criteria which was later verified by the supervisor by random selection. The parameters measured are as follows:

Gonial angle: This was measured using a technique given by Mattila *et al*.[10]Gonial angle is measured as the angle formed by the ramus line (RL) and the mandibular line (ML) where RL is the tangent to the posterior border of the mandible and ML the tangent to the lower border of the mandible

Ramus height: A modification of the technique given by Amorium *et al*. is used.[18] Ramus height is measured as a line parallel to the RL from the deepest point on the sigmoid notch up to a tangent drawn to the lower border of the mandible.

Panoramic radiographs for study purpose: Radiographs obtained in the Department of Oral Medicine and Radiology, Jodhpur Dental College General Hospital, Jodhpur, Rajasthan, India.

Statistical analysis of study: All the collected data was entered in the Microsoft Word Excel Sheet 2007 version and the data obtained was analyzed using the SPSS (Statistical Package for the Social Sciences) 20 Version for the descriptive analysis and statistical tests

of significance. The mean and standard deviations were calculated for each clinical parameter and One way ANOVA statistical test of significance was used to compare gonial angle and ramus height with age groups and gender for both right and left side. Statistical significance will be set at $P < 0.05$

FINDINGS

Table 1: Comparison of right and left gonial angle among male and female at age of 20-40 years

Gender	Male	Female	F-test	p-value	Significant
Right Gonial	122.4 ± 5.51	127.5 ± 3.16	45.777	0.000	S
Left Gonial	122.8 ± 5.37	127.4 ± 3.33	36.98	0.000	S

(p ≤ 0.05 – Significant, CI = 95 %)

When One- way ANOVA was applied to see the relation between right and left gonial angle among male and female at age of 20-40 years. It was found that there was significant relationship between them and females were having increased gonial angle as compared to males on both right and left side (p=0.000, Table 1)

Table 2: Comparison of right and left ramus height among male and female at age of 20-40 years

Gender	Male	Female	F-test	p-value	Significant
Right Ramus Height	47.3 ± 3.85	42.4 ± 3.91	55.759	0.000	S
Left Ramus Height	46.7 ± 3.73	41.4 ± 3.39	77.929	0.000	S

(p ≤ 0.05 – Significant, CI = 95 %)

Table 2 shows relation between right and left ramus height among male and female at age of 20-40 years. It was found that there was highly significant relationship between right and left ramus height among male and female at age of 20-40 years where males were having increased height as compared to females on both right and left side (p= 0.000).

Table 3: Comparison of right and left gonial angle among male and female at age of 41-60 years

Gender	Male	Female	F-test	p-value	Significant
Right Gonial	122.6 ± 3.57	128.4 ± 4.57	66.660	0.000	S
Left Gonial	122.9 ± 4.26	128.7 ± 5.39	47.652	0.000	S

(p ≤ 0.05 – Significant, CI = 95 %)

When One- way ANOVA was applied to see the relation between right and left gonial angle among male and female at age of 41-60 years. It was found that there was significant relationship between them and females were having increased gonial angle as compared to males on both right and left side (p=0.000, Table 3)

Table 4: Comparison of right and left ramus height among male and female at age of 41-60 years

Gender	Male	Female	F-test	p-value	Significant
Right Ramus Height	47.4 ± 3.69	42.1 ± 2.86	76.099	0.000	S
Left Ramus Height	46.7 ± 3.56	41.3 ± 2.85	86.538	0.000	S

(p ≤ 0.05 – Significant, CI = 95 %)

Table 4 shows relation between right and left ramus height among male and female at age of 41-60 years. It was found that there was highly significant relationship between right and left ramus height among male and female at age of 41-60 years where males were having increased height as compared to females on both right and left side (p= 0.000).

Table 5: Comparison of right and left gonial angle among male and female at age of 61-82 years

Gender	Male	Female	F-test	p-value	Significant
Right Gonial	122.3 ± 3.8	127.03 ± 3.91	7.806	0.008	S
Left Gonial	123.1 ± 3.84	128.7 ± 4.76	10.159	0.003	S

($p \leq 0.05$ – Significant, CI = 95 %)

When One-way ANOVA was applied to see the relation between right and left gonial angle among male and female at age of 61-82 years. It was found that there was significant relationship between them and females were having increased gonial angle as compared to males on both right and left side (p=0.008,0.003, Table 5)

Table 6: Comparison of right and left ramus height among male and female at age of 61-82 years

Gender	Male	Female	F-test	p-value	Significant
Right Ramus Height	47.0 ± 2.87	41.4 ± 2.38	19.936	0.000	S
Left Ramus Height	45.7 ± 2.57	41.1 ± 2.32	16.967	0.000	S

($p \leq 0.05$ – Significant, CI = 95 %)

Table 6 shows relation between right and left ramus height among male and female at age of 61-82 years (One way ANOVA). It was found that there was highly significant relationship between right and left ramus height among male and female at age of 61-82 years where males were having increased height as compared to females on both right and left side (p= 0.000).

DISCUSSION

This study was performed to assess the measurement of gonial angle and ramus height on digital panoramic radiographs and compare between gender and different age groups in dentate subjects among Jodhpur population.

A wide range of age was selected, so that the effect of aging on the different parameters can be investigated. Several studies have reported that panoramic radiographs are reproducible and accurate for the linear and angular measurements on mandibles.[19,20,21] Shahabi et al[22] concluded that panoramic radiography can be used to determine the gonial angle as accurately as a lateral cephalogram.

In this study, two parameters were evaluated; ramus height and gonial angle. Ramus height represent the vertical dimensions whereas gonial angle formed by the intersection of vertical with anteroposterior dimensions. The implication of these two mandibular parameters is of great importance to evaluate the morphology of the mandible and demonstrate gender differences and influence of aging process on the remodeling changes of mandibular bone.

In the previous studies,[22,10,23,24] it has been stated that panoramic radiographs were accurate in determining the gonial angle and there was no significant difference between the right and left sides in panoramic radiography.[11]

In this study, female subjects had higher values of the gonial angle and males had higher values of the ramus height as compared to male and female counterparts respectively. Gender differences in gonial angle as well as ramus height were found to be highly significant. These results are in agreement with previous studies,[22] who did not find any statistically significant gender differences in the gonial angle determined from the digital panoramic radiographs. In addition, they found that the gender had little effect on the size of the gonial angle. However, other researchers have shown that statistically significant larger gonial angles in female subjects compared to the

males.[4,25] These findings concerning gender differences may be explained by the fact that, on average, men have greater masticatory force than women.

The present study showed that older subjects had significantly larger gonial angle and smaller ramus than younger ones. The findings are probably because of the generally altered mandibular basal bone morphology associated with decreased masticatory muscle functioning as a result of aging. In addition, the decrease in ramus height with age might be explained by the anterior-rotation of the mandible. These results confirmed a widening of the gonial angle with age has also been noted in earlier studies.[5]

CONCLUSIONS

Digital Panoramic radiography have been proven to be a valuable tool for the determination of morphological dimensions of the mandible. Through the use of mandibular parameters such as gonial angle and ramus height, variations and correlations between age and gender can be examined. The implications of such correlations have numerous applications in the fields of forensic identification and orthodontic analysis. From the results obtained within the Jodhpur population; several conclusions can be drawn. Males had a larger ramus height than females; however, on average females had the larger gonial angle. There was a steady decrease later in life in ramus height, with gonial angle generally increasing as the population aged. Future research should be conducted across a vast area of Rajasthan to provide a more representative sample that accurately reflects the entire population.

Conflicts of Interest: Nil

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Ethical Clearance: Approved by the Institutional Ethical Committee, Jodhpur, Rajasthan, India.

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Study of Death Due to Hanging in Southern Marathwada Region of Maharashtra

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ABSTRACT

Death occurring due to hanging is not uncommon cause in the present day. Suicidal manner is more common in hanging deaths. The present medico-legal autopsy study was carried out in the Department of Forensic Medicine & Toxicology, Government Medical College, Latur during period of 1st January 2015 to 31st December 2016. During study period total 1678 autopsies were conducted by the department of which 99 (5.89%) cases of death due to hanging were selected and studied to determine the burden of deaths due to hanging in various age and sex groups, in different seasons, place of residence and incidence, with special emphasis on site of ligature mark and neck dissection findings. This study will certainly help the medico-legal experts, police and judiciary officials while dealing with death due to hanging cases.

Keywords: *Hanging, Ligature Mark, Site, Neck, Dissection, Significant Findings*

INTRODUCTION

Death occurring due to hanging is not uncommon cause in the present day. Suicidal manner is more common in hanging deaths. The tendency towards suicidal hanging is found to be higher because of easy availability of ligature material. Any long flexible or rigid material can be used for hanging. In India, Hanging is among the top 5 methods of choice for committing suicide, other preferred methods being poisoning, drowning, burning, and jumping from the tall structure or in front of a train[1].

Hanging is that form of asphyxia which is caused by suspension of the body by ligature which encircles the neck, the constricting force being weight of the body[2]. In hanging where the point of suspension is over the centre of occiput there is maximum possibilities of occlusion of arteries and this is known as typical hanging, while all other points of suspensions are called atypical hanging[3]. Hence attempt was made to study the burden of deaths due to hanging in various age and sex groups, in different seasons, place of residence and incidence, with special emphasis to site of ligature mark and neck dissection findings.

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MATERIAL AND METHOD

The present medico-legal study was carried out in the Department of Forensic Medicine & Toxicology, Government Medical College, Latur during period of 1st January 2015 to 31st December 2016. During study period total 1678 autopsies were conducted by the department of which 99 (5.89%) cases of death due to hanging were selected. Detailed history was taken before postmortem examination and studied to determine the burden of deaths due to hanging in various age and sex groups and in different seasons, place of residence and incidence, with special emphasis on site of ligature mark and neck dissection findings.

OBSERVATION AND RESULTS

Table No. 1: Study of death due to hanging at different age groups (n = 99)

Age Group (in years)	No. of Cases	Percentage (%)
<10	00	00
11-20	21	21.21

Contd…

21-30	35	35.35
31-40	20	20.20
41-50	14	14.14
51-60	04	4.04
61-70	04	4.04
> 70	01	1.01
Total	99	100

In the present study (Table No.1), out of 99 cases maximum number of deaths i.e. 76.76% observed between 11-40 years of age group with the highest percentage of death due to hanging found between the age group 21-30 years was 35.35% followed by 11-20 years of age group had 21.21%. 31-40 years of age group were 20.2% and least percentage was observed i.e. 1.01% in more than 70 years of age.

Table No. 2: Study of death due to hanging in both sexes (n = 99)

Sex	No. of Cases	Percentage (%)
Male	70	70.7
Female	29	29.3
Total	99	100

In the present study, Table No. 2 shows comparative study of death due to hanging in both sexes. It was observed that, males were 70 (70.7%) and females were 29 (29.3%). Males outnumbered the females with Male: Female ratio 2.41:1.

Table No. 3: Study of death due to hanging in different seasons (n = 99)

Season	No. of Cases	Percentage (%)
Summer	37	37.37
Rainy	39	39.39
Winter	23	23.23
Total	99	100

In the present study (Table No. 3), it was observed that death percentage was highest in rainy season i.e. 39.39% followed by summer i.e. 37.37% and 23.23% in winter.

Table No. 4: Distribution of cases as per place of residence (n = 99)

Place of Residence	No. of Cases	Percentage (%)
Rural area	39	39.4
Urban area	60	60.6
Total	99	100

Table No. 4: Distribution of cases as per place of residence. It was found that out of 99 cases, maximum i.e. 60 (60.6%) death cases belonging to urban area & 39 (39.4%) cases belonging to rural area.

Table No. 5: Study of death due to hanging at different place of incidence (n = 99)

Place of Incidence	No. of Cases	Percentage (%)
Outdoor	28	28.28
Indoor	71	71.71
Total	99	100

Table No. 5: Study of death due to hanging at different place of incidence. It was seen that maximum i.e. 71.7% deaths occurred indoor & 28.3% occurred outdoor.

Table No. 6: Study of different site of ligature mark on the neck in hanging (n = 99)

Site of Ligature Mark on the Neck	No. of Cases	Percentage (%)
Above the level of thyroid cartilage	73	73.73
At the level of thyroid cartilage	19	19.19
Below the level of thyroid cartilage	07	7.07
Total	99	100

In the present study (Table No. 6), it was observed that the site of ligature mark on the neck was highest above the level of thyroid cartilage in 73.73% cases, at the level of thyroid cartilage in 19.19% cases and least below the thyroid cartilage in 7.07% cases.

Table No. 7: Study of significant neck dissection findings in death due to hanging

Significant Neck Dissection Findings	No. of Cases	Percentage (%)
Hemorrhages in strap muscles	24	24.24
Injury to neck muscles	08	8.08
Fracture to hyoid bone	09	9.09
Injury to thyroid cartilage	04	4.04
Injury to cricoid cartilage	00	00
Carotid artery intimal tear	07	7.07

In the present study (Table No. 7), out of total 99 cases the significant neck dissection findings in death due to hanging were hemorrhages in the strap muscles in 24.24% cases, injury to neck muscles in 8.08% cases, fracture of hyoid bone seen in 9.09% cases, injury to thyroid cartilage in 4.04% cases and carotid artery intimal tear in 7.07% cases.

DISCUSSION

In the present study of death due to hanging in southern Marathawada region of Maharashtra, it was observed that the burden of death due to hanging cases was 5.89% out of total medico-legal autopsies.

Out of total 99 cases, maximum number of deaths i.e. 76.76% observed between 11-40 years of age group with the highest percentage of death due to hanging found between the age group 21-30 years was 35.35% followed by 11-20 years of age group had 21.21%. 31-40 years of age group were 20.2% and least percentage was observed i.e. 1.01% in more than 70 years of age (Table No.1). From study results, it seems that maximum deaths occurred in the young age group. This observation is consistent with Sheikh MI and Agarwal SS[4], Sharma BR et al[5], Meera T and Singh MB[6], Momin SG et al[7], Vinita VE et al[8], Bhausaheb NA et al[9], Guntheti BK et al[10] and Patel JB et al[11]. It certainly indicates that, youth have surrendered to death through easy and painless method by hanging because it is the age dreaming and struggling for their better future and most of them build castle in the air. When they got disappointed in personal & socio-economic life, they develop depression. They could not find any alternate way except suicide by easy and pain less method of hanging.

Moreover **(**Table No. 2), it was observed that males were 70 (70.7%) and females were 29 (29.3%). Males outnumbered the females with Male: Female ratio 2.41:1. This observation is consistent with Sheikh MI and Agarwal SS[4], Sharma BR et al[5], Meera T and Singh MB[6], Momin SG et al[7], Vinita VE et al[8], Bhausaheb NA et al[9], Guntheti BK et al[10], Patel JB et al[11], Jani CB and Gupta BD[12] and Sharma BR et al[13]. It indicates that, males were more than females and ended their life in the state of anxiety and depression. Males are the bread earners of the family in the study region. Due to continuous pressure of handling family & society affairs, males are more prone to commit suicide.

It was also noted that (Table No. 3), death percentage was highest in rainy season i.e. 39.39% followed by summer i.e. 37.37% and 23.23% in winter. Similar finding is observed by Guntheti BK et al[10]. This may be due to inadequate raining when required or excessive raining when not required during rainy season ultimately affects the crop which leads to economic losses and failure in the business in study region.

It was found that (Table No. 4), out of 99 cases, maximum i.e. 60 (60.6%) death cases belonging to urban area & 39 (39.4%) cases belonging to rural area. This observation is in contrast with Guntheti BK et al[10] observation. They observed highest numbers of 23 (71.81%) victims were from rural. It again gives a thought that, rural people were leaving satisfactory and compromised life than urban areas. The urban youth and adult develop complexity by comparing themselves with other well to do or affluent personalities, their habit and habitat. This inferiority complexion snatch away their sleep and compromised life which leads to anxiety, depression, addictions like alcohol, smoking, drugs etc ultimately loose their mental state and surrender to death by suicidal hanging. In addition to this educational competition, lack of employment, high expectations of the parents, nuclear family, working parents and love break-ups are more in urban areas.

It is also confirmed that (Table No. 5), maximum i.e. 71.7% deaths occurred indoor & 28.3% occurred outdoor. This observation is consistent with Meera T and Singh MB[6], Vinita VE et al[8] and Guntheti BK et al[10]. This may be due to victims before committing suicide most commonly choose closed place rather than open. It may be because of easy availability of ligature material and victims who were suffering with depressive illness found more comfortable in loneliness and commit suicide in sequestered place.

In the present study (Table No. 6), it was observed that the site of ligature mark on the neck was highest above the level of thyroid cartilage in 73.73% cases, at the level of thyroid cartilage in 19.19% cases and least below the thyroid cartilage in 7.07% cases. It suggests that in case of hanging most common site of ligature mark was above the level of thyroid cartilage. This observation is in agreement with Sharma BR et al[5], Momin SG et al[7], Vinita VE et al[8], Bhausaheb NA et al[9], Guntheti BK et al[10], Patel JB et al[11], Shaikh MMM et al[14] and Dekal V and Shruthi P[15]. Ligature mark over the

neck is important external finding for the differentiation between hanging and ligature strangulation. It should be meticulously inspected. Its appearance or pattern and situation on the neck depend upon the composition of ligature material and type of hanging.

In the present study (Table No. 7), out of total 99 cases, the significant neck dissection findings in death due to hanging were hemorrhages in the strap muscles in 24.24% cases, injury to neck muscles in 8.08% cases, fracture of hyoid bone seen in 9.09% cases, injury to thyroid cartilage in 4.04% cases and carotid artery intimal tear in 7.07% cases. These findings are more or less in agreement with Meera T and Singh MB[6], Vinita VE et al[8], Bhausaheb NA et al[9], Guntheti BK et al[10], Patel JB et al[11] and Shaikh MMM et al[14]. These significant neck dissection findings of various injuries and fractures confirms that death by hanging occurred during panic states moreover composition of ligature material, force applied on the neck and its duration along with body weight also play vital role for injury, fracture or breakage. Tear of Carotid artery could be due to hard fixed noose & long drop. Fracture of hyoid bone and injury to thyroid cartilage in complete hanging occurred more commonly in the victims aged above 40 years.

SUMMARY

In the present study burden of death due to hanging cases was 5.89% out of total medico-legal autopsies. Males outnumbered the females with Male: Female ratio 2.41:1. Maximum number of deaths i.e. 76.76% observed between 11-40 years of age group with the highest percentage found in 21-30 years. Death percentage was highest in rainy season (39.39). Urban area had maximum deaths i.e. 60.6%. 71.7% deaths occurred indoor. The site of ligature mark on the neck was highest above the level of thyroid cartilage in 73.73% cases.

CONCLUSION

The present study will certainly help the medico-legal experts, police and judiciary officials while dealing with death due to hanging cases. Detailed history of the case especially about the reason behind hanging and meticulous postmortem examination is necessary before arriving at the opinion. Problem solving strategy should be implemented by the family and society rather than negligent attitude or abetment of suicide. Such deaths in young age groups are affecting the productivity and development of the nation.

Conflict of Interest: None to declare

Source of Funding: Nil

Ethical Clearance: This study does not violate any ethical, moral or legal guidelines.

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A Research Study on Deaths Due to Injuries to Abdomen Brought to Ananthapuram Govt. Medical College Mortuary, Andhra Pradesh from January 2010 To December 2016

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ABSTRACT

Injuries to abdomen can be fatal leading to death of victim because of the effect of trauma to vital organs present inside the abdominal cavity. Injury to abdomen involves risk of shock due to hemorrhage as result of rupture of vital organs present inside the abdomen. Trauma to Abdomen is caused either by blunt force or penetrative force. Abdominal injuries are also very commonly seen in case of fall from height especially fall on flat surface from small heights. Stabbing of abdomen may lead to opening of large blood vessels present inside the abdomen leading to profuse bleeding. Rupture of bowel can lead to spilling of its contents into peritoneal cavity lead to peritonitis and death due to systemic infection. Abdominal trauma is also frequently encountered in road traffic accidents. Victims with abdominal trauma usually presents with abdominal pain, tenderness, distension, diminished or absent bowel sounds. Abdominal guarding is an important sign seen because of tensing of abdominal wall muscles to guard inflamed organs inside the abdomen. Protrusion of abdominal organs especially bowel, out through the wound may be seen in case of penetrative injury to the abdomen. Sports injuries also commonly affect abdomen.

Keyword: *Abdomen, rupture of viscera, hemoperitoneum, stabbing, blunt injury, infection*

INTRODUCTION

Abdominal organs are vulnerable to variety of injuries from blunt trauma because lax and compressible abdominal walls can transmit the force to the abdominal viscera. Injuries of the abdomen can be classified into–1. Non-penetrative or closed i.e, peritoneum is intact. It is caused by blunt force, seen in falls, traffic accidents and assaults by blunt weapon. 2. Penetrating or open i.e, when peritoneum is ruptured, it is open to infections[1]. Apparently trivial injuries may rupture abdominal viscera. In order of frequency, the structures most likely to be damaged in blunt abdominal trauma are; Liver, spleen, kidney, intestine, abdominal wall, mesentry, pancreas and diaphragm. Severe or fatal internal hemorrhage may occur without any sign of injury on the abdominal wall especially if clothing overlies the area probably due to compressive, absorbable nature of abdominal wall. Solid organs are more readily lacerated by blows than hollow organs[2].

Penetrating wounds may be produced by a cutting or stabbing instrument, by a firearm, by the horns or claws of an animal or by a fall on a sharp pointing object. Penetrating wounds of the lower chest may extend through the diaphragm and injure liver, spleen, stomach or intestines. Penetrating wounds of the liver

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are relatively common than the spleen. Complications of abdominal injuries - Laceration of the spleen produces rapid and copious hemorrhage. Laceration of the liver produces slow bleeding due to relatively low pressure in the hepatic sinusoids but considerable bleeding occurs over a period of time. Peritonitis is more common in ruptures of the large intestine than ruptures of the small intestine due to the presence of pathogenic organisms in the colon. Chemical peritonitis is caused by the leakage of the gastric contents or pancreatic juice into the peritoneal cavity. Multiple contusions of the intestine may produce paralytic ileus[3].

Injuries to stomach & intestines: Bruise or the rupture of stomach and intestines frequently occur from 1. Blunt and crush injuries caused by vehicular accidents 2. Falling from a height 3. Firearm injuries 4. Blast injuries 5. Penetrating or stabbing wounds. Predisposing factors – When distended with food or diseased from ulcer or growth. Injuries take place at the point of impact. Margins are clean cut or uneven and irregular. Complications include peritonitis due to the expulsion of contents into the peritoneal cavity, thrombosis or hemorrhage if the mesentry gets injured. Severe injuries to rectum are caused by accidentally falling on iron railing or some projecting point or piercing with a broken piece of glass. Complications include laceration of the large mesenteric artery may cause death due to massive hemorrhage[4].

Injuries to Liver: Liver is the most frequently damaged abdominal organ. Most injuries occur on convex surfaces. It is commonly ruptured by a blow, kick, crushing motor accidents, fall or by a sudden contraction of the abdominal muscles. Signs of external injury may or may not be present. Blunt force to the liver may produce 1. Transcapsular lacerations 2. Subcapsular lacerations 3. Non-communicating or central lacerations in the substance of liver 4. Coronal laceration 5. Laceration of inferior surface of liver 6. Contracoup laceration involving posterior surface of the right lobe of the lobe. Transcapsular lacerations may cause rapid death from hemorrhage and shock. Mild degree of external violence may rupture the liver if it is distended. Penetrating wounds of the liver are relatively more common and may cause death by hemorrhage and shock. Injuries of the gall bladder and extra hepatic bile ducts are rare. A gall bladder distended with stones may rupture spontaneously. The extravasations of bile into peritoneal sac may cause peritoneal irritation and infection[5].

Injuries to Spleen & Pancreas: Rupture of the diseased and enlarged spleen is a very common occurrence and generally caused by external violence like blow with fist, wooden lathi, kick, fall from height, kneading the abdomen with elbow and knees etc. Rupture of the spleen may also take place during artificial respiration. The rupture is most common on the inner surface as capsule is thinnest at the site. The peritoneal cavity may be found to be full of blood. The spleen may have one or more than one site of rupture or may be crushed into pieces and totally disorganized. Death occurs due to shock and hemorrhage. There may or may not be any mark of injury on the abdomen[6]. Pancreas is located retroperitoneally and hence wounds of the pancreas are very rare. The pancreas may be injured by compression forces when the viscera are crushed against the spinal column when stomach is empty. A kick or a punch in the abdomen may injure pancreas and cause death within few days from inflammation. Penetrating wounds of pancreas are not common. Laceration of pancreas may produce profuse intra-peritoneal hemorrhage[7].

Injuries to Kidney, Adrenal Glands & Urinary Bladder: Injuries to the kidneys are not common as they are situated in relatively well protected part of the body. Laceration of the kidneys may be Transcapsular, Subcapsular and Transrenal. These may cause hemorrhage into the perinephric fat and form a large perirenal hematoma. The kidneys may be ruptured when is run over by a vehicle or fall from height or is crushed. In Transrenal laceration, hemorrhage may occur and cause death from shock. Penetrating wounds with retroperitoneal hemorrhage is produced by bullets or pointed weapon. The adrenal gland may be injured by the same force which damages the kidney and may be lacerated or crushed. Hemorrhage may be rarely seen and usually associated with other injuries[8]. Rupture of urinary bladder often accompanies pelvic fracture. Even violent muscular contraction can lead to rupture of a full bladder. Ruptured bladder is usually accompanied by extra-peritoneal extravasation of urine or bladder. Shock, bleeding, peritonitis, infections are common complications[9].

MATERIALS & METHOD

This research work was carried out by scrutinizing autopsy reports, crime scene photographs & reports, medical treatment records, along with police inquest reports. Number of deaths due to abdominal injuries which came for autopsy per year, sex incidence, age of the victims and cause of death were studied and analysed.

FINDINGS

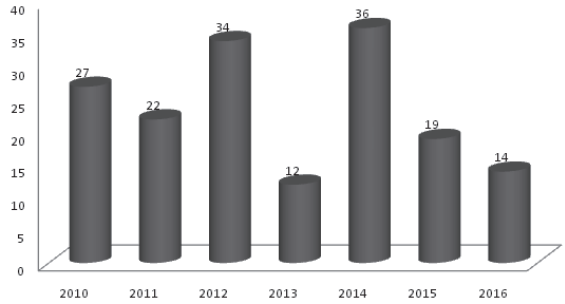

Table 1: Year wise number of autopsies conducted at Govt. Medical College Mortuary, Ananthapuram, A.P (Total 164 Cases)

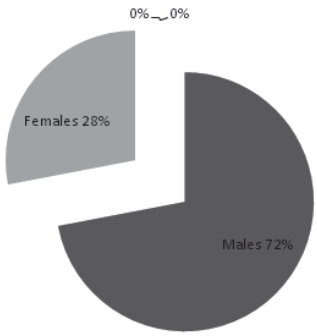

Table 2: Sex distribution among deaths due to injuries to abdomen

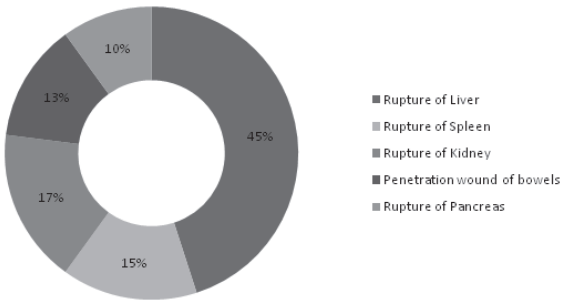

Table 3: Cause of death in injuries to abdomen cases

Table 4: Age incidence in deaths due to injuries to abdomen cases

Sl. No.	Age of Victim	Incidence
1.	1–20 years	5%
2.	20–40 years	55%
3.	40–60 years	25%
4.	>60 years	15%

DISCUSSION

A total of 164 cases of death due to injuries to abdomen were brought to autopsy to Ananthapuram government medical college mortuary during 2010 to 2016 years. Death due to injuries to abdomen is very more in males than females because of more involvement with road traffic accidents, assaults and fall from height at work place. Decreasing order of cause of death in case of injuries to abdomen includes 1.Rupture of liver 2. Rupture of spleen 3. Rupture of kidney 4. Penetrating injury of bowels 5. Rupture of pancreas. No rupture of urinary bladder and genital injuries were noticed. Incidence of death due to abdominal injuries is high in the age group of 20 – 40 years followed by age group of 40 to 60 years and least in the age group of 1–20 years.

CONCLUSION

Most deaths due to abdominal injuries are preventable if diagnosed early and promptly treated. If the diagnosis and treatment is delayed, outcome is worse with high morbidity and mortality. Diagnostic techniques like CT scan, Ultra sound scan, X-ray can diagnose abdominal injuries precisely. Ultra sound scan can easily identify collection of fluid or GI contents inside the abdominal cavity. Diagnostic laparoscopy or explorative laparotomy may be performed in case of inconclusive results given by investigations like X-ray, Ultra sound scan & CT scan. In case of profuse hemoperitoneum, laparotomy is life saving. The main goal is to stop bleeding followed by reparative work of the damaged part.

Ethical Clearance: Forensic Medicine Department Mortuary, Ananthapuram Govt. Medical College, Andhra Pradesh

Source of Funding: Self

Conflict of Interest: Nil

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Dating of Laceration by Gross and Histo-pathological Examination of skin−A Postmortem Study

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ABSTRACT

Introduction: The precise dating of injury is extremely important in practice of forensic pathology. As we know when injuries occur, the host responds by setting a series of events, consisting inflammation, proliferation and maturation in well-orchestrated sequence. Even though there are many literatures on this subject from abrasion; Studies on wound dating from laceration are very few. In this context, the present study of wound dating from gross and microscopic level was taken up.

Materials and methods: 'Dating of Laceration by Gross and Histo-pathological Examination of skin - A Postmortem Study' was carried out in the Department of Forensic Medicine, in M S Ramaiah Medical College. A total of 70 samples were correlated to time frame the occurrence of different gross changes and microscopic changes that follow the injury.

Results: Amongst the > 2weeks old injuries, histological study increased the accuracy (80%) as compared to gross examination (20%). On gross examination, the presence of hemorrhage or redness with swelling indicates that laceration is approximately 1 day old. However, in cases where comorbidities were found significant delay in the healing process was observed.

Conclusion: This study signifies that, gross appearance of lacerations during later stages (>1 day old) were inconsistent for dating the injury. However, by histopathological examination, reliability and accuracy of wound dating increases.

Keywords: *Forensic Pathology, Dating of laceration, Gross and Histopathological examination.*

INTRODUCTION

Deaths due to blunt force trauma are one of the most common cases encountered by the forensic pathologist. Three types of skin injuries are seen in blunt force trauma namely abrasion, contusion and laceration. The precise dating of such wounds becomes very essential in some of the cases to rule out the guilt or innocence of a person charged with criminal act. During examination apart from establishing the type of wound, site, size, pattern and nature of the wound as ante mortem or post mortem; the aging of the wound has huge medico-legal significance in forensic pathology.

Even though age determination from abrasion is commonly used in practice, in cases where laceration is the only blunt trauma found, it has to be examined and estimate the age. Author Reddy N.K.S mentioned that, age determination of laceration is difficult unless there are clear signs of healing, such as granulation tissue, fibroblast in growth, or organizing infiltrate.[1] The body's response to trauma is diverse and affected by innumerable variables. These may be subject dependent factors like anatomical region, age, and their medical status or object related like type of material/substance involved in causing or surface making contact with the body and time duration of the contact.[2]

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The body's ability to replace injured or dead cells is critical to survival. It is a dynamic process. When injuries occur to cells and tissues, the host responds by setting a series of events, which are broadly separated into two processes, ***regeneration*** and ***healing***. Regeneration involves the restitution of tissue components identical to those removed or killed. By contrast, healing is a fibro-proliferative response that "patches" rather than restores a tissue. It is a *complex but orderly* phenomenon mediated through growth factors and cytokines involving a number of events, which is generally divided into, *inflammation, proliferation, and maturation*.[3] Unfortunately, as with so many problems, biological variability introduces a wide margin of uncertainty [4] and the precise orchestration of these events still remains beyond our grasp. The changes will vary according to the size, type of injury, the tissue involved, age and health of the victim and also whether there is infection or not.

So, accurate dating of injuries has been an area of considerable research and debate since long ago. Even though there are many literatures on this subject from blunt trauma, abrasion; Studies on wound dating from laceration are very few.

Hence, this study of wound dating of lacerated skin by gross and histo-pathological examination was taken up in our setup to look into the accuracy of dating by comparing with the age determined by gross changes and by microscopic examination with that of the time of infliction of injury. We have made an attempt to compare the result with available data to either validate it or suggest changes to be made so that medico-legal issues are solved in the approved manner.

AIM: A postmortem study of dating of laceration by gross and histo-pathological examination of skin.

OBJECTIVES

(a) To determine the age of laceration by gross and histo-pathological examination.

(b) To correlate gross and histo-pathological changes in relation to survival period after infliction of injury.

MATERIALS AND METHODS

Source of Data: The present study was conducted in the department of Forensic Medicine, M.S. Ramaiah Medical College from Oct 2011 to March 2013, for a period of 18 months.

Method of collection of Data: Fatal cases having well demarcated lacerations with known time of injury were included among the cases subjected to medico legal autopsy. A total of 70 samples were included in the study after fulfilling the inclusion criteria. A pre-tested semi structured proforma proforma was used to collect information regarding time of injury, time of death, treatment history and associated co morbidities. Consent was obtained for tissue section after detailed interviews with investigating officer, relatives, friends or whoever witnessed the incident, and hospital records of the deceased. Standard autopsy protocol was followed and relevant details of the injuries like site, size and color were noted in relation to the age of injury.

Then injuries were grouped under 7 different time intervals; **0-4 h, 4-12 h, 12-24 h, 24-72 h, 4-6 days, 7-14 days and more than 2 weeks old, based on the survival period after infliction of injury.** The representative areas of injury with control sample was taken and preserved in 10% formalin for a day and then samples were processed and blocks were created using paraffin and sections of tissues were made using microtome. These slices are layered on a glass slide for staining by haematoxylin and eosin (often abbreviated H&E) and viewed under microscope.

Inclusion Criteria: Cases with laceration where the time of infliction of injury was known.

Exclusion Criteria: Bodies in the state of decomposition.

RESULTS AND DISCUSSION

Table No. 1: Age and Sex distribution of the cases

Age (in years)	Gender		Total
	Male	Female	
	No. (%)	No. (%)	No. (%)
0–10	0(0.0%)	0(0.0%)	0(0.0%)
11–20	9(12.9%)	0(0.0%)	9(12.9%)
21–40	31(44.3%)	4(5.7%)	35(50.0%)
41–60	18(25.7%)	4(5.7%)	22(31.4%)
> 60	3(4.3%)	1(1.4%)	4(5.7%)
Total	61(87.1%)	9(12.9%)	70(100.0%)

A total of 70 samples were studied. In which, 61 cases (87.1%) were males and the remaining 9(12.9%) were females. Among which the vulnerable age group were those in the 21- 60 years age group(57 cases). The reason being that, they form the major working population and hence more prone to injuries due to road traffic accidents, fall, assaults etc.

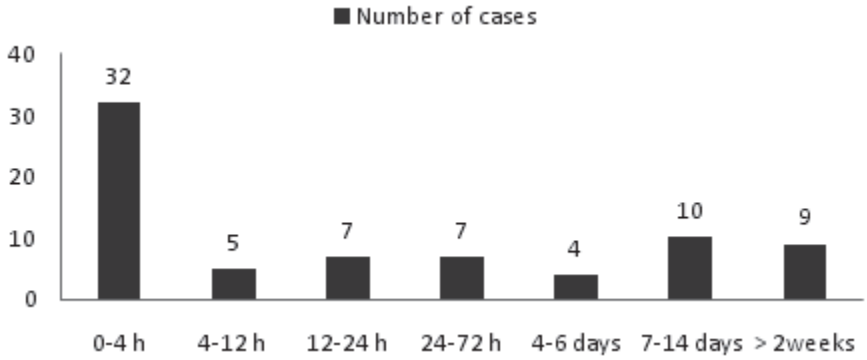

Fig. 1: Distribution of cases based on survival period

Among 70 cases, 32 (45.7%) cases were 0-4 h old, 5 (7.1%) cases were of duration 4 -12 h, 7 (10.0%) cases were 12-24 h & 24-72 h old each, 4 (5.7%) cases were 4-6 days old, 10 (14.3%) cases were of 7-14 days and the remaining 5(7.1%) cases were > 2 weeks old.

LACERATION

Table No. 2: Distribution of lacerations by its gross changes

Age of injury	Gross changes					Total
	A	B	C	D	E	
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
0-4 h	22 (84.6)	10 (55.6)	-	-	-	32 (45.7)
4- 12 h	4 (15.4)	1 (5.6)	-	-	-	5 (7.1)
12-24 h	-	6 (33.3)	1 (10.0)	-	-	7 (10.0)
24-72 h	-	1 (5.6)	5 (50.0)	1 (7.1)	-	7 (10.0)
4-6 days	-	-	2 (20.0)	2 (14.3)	-	4 (5.7)
7-14 days	-	-	2 (20.0)	7 (50.0)	1 (50.0)	10 (14.3)
>2weeks	-	-	-	4 (28.6)	1 (50.0)	5 (7.1)
Total	26 (100.0)	18 (100.0)	10 (100.0)	14 (100.0)	2 (100.0)	70 (100.0)

$\chi^2 = 105.3$ df = 24 $P < 0.001$

Table No. 3: Earliest, routine and latest appearance of gross changes of lacerations

Gross changes	Earliest appearance	Routine appearance	Latest appearance
Gross haemorrhage	10 min	0-4 h	6 h
Redness with swelling	30 min	0-4 h	28 h
Soft red scab	18 h	24- 72 h	11 days
Brownish black scab	68 h	7-14 days	17 days*
Scar formation	14 days	>2weeks	30 days

* With comorbid conditions brownish-black scab was observed on 45 days.

**With comorbid conditions scar formation was observed on 30 days.

Gross changes: 70 lacerations were studied (Table-2):, amongst which, 26 (37.1%) showed haemorrhage grossly, 18 (25.7%) redness with swelling, 10 (14.3%) soft red scab, 14 (20.0%) brownish black scab and scar formation was noted in 2 (2.9%) injuries. Among 26 lacerations which showed haemorrhage grossly, 22 (84.6%) of them were 0-4h old. The remaining 4 were of 4-12 h. The gross **Haemorrhage (A)**was observed upto 6 h but routinely it was seen between 0-4 h. In a similar study conducted by Sharma A et al quoted that the haemorrhage occurs in 10 min and persisted upto 2 h.[5] However in our study the gross haemorrhage was noted even upto 6 h.

Redness with swelling(B) was observed in 18 injuries, of which 10 (55.6%) injuries were 0-4 h old, 6 were of 12-24 h old and the remaining 2 injuries were of 4-12 h & 24-72 h (1 injury each). It was observed from 30 min and latest upto 28 h.

In a similar study by Sharma A et al found the redness in 10 min and persisted upto 7 h. [5] In another similar study conducted it was observed that 66% of cases appeared red on the 1st day.[3]

The soft red scab(C) was noted in 10 injuries, of which 5 (50%) injuries were 24- 72h old, 1 injury was 12- 24 h old, 2 injuries were 4-6 days old and the remaining 2 injuries were of 7-14 days, however the injuries were situated over less vascular areas like lower extremity where delay was observed. Soft red scab was observed earliest at 18 h and latest upto 11 day.

In the study by Sharma A et al quotes soft red scab was first observed in 7 h.[5] Another author describes that on 2nd day the margins are separated with difficulty instead of separating easily.[6]

The brownish black scab(D) was noted in 14 injuries, in which 7 (50.0%) injuries were 7-14 days old. 1 was 24-72 h old, 2 were of 4-6 days old, 4 were of >2weeks old. It was observed earliest at 68 h. All 3 injuries of less than 6 days were situated overhead (more vascular area) and were not having any co morbidities. The latest was observed upto 17 days in healthy individual where the wound was surgically approximated by suture. The delay was observed upto 45 days in an individual having infection.

In a similar study conducted by Sharma A et al hard brown scab was observed from 31 h onwards.[5] An author also describes that on the 3rd day to 5th day; the injuries will have glued margins and can be separated with difficulty.[6]

The scar formation(E) was noted in 2 injuries, among which one case was 7-14 days old (14 days), in which the deceased was young adult, injury was situated over scalp and did not have comorbidities whereas in another case who was elderly male in coma, the scar formation was observed at 1 month.

Table No. 4: Distribution of lacerations by its microscopic changes

Age of injury	Microscopic Scoring										Total
	1	2	3	4	5	6	7	8	9	10	
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
0-4 h	24 (82.8)	2 (100.0)	4 (100.0)	2 (100.0)		-	-	-	-	-	32 (45.7)
4-12 h	4 (13.8)	-	-	-	1 (8.3)	-	-	-	-	-	5 (7.1)
12-24 h	1 (3.4)	-	-	-	6 (50.0)	-	-	-	-	-	7 (10.0)
24-72 h	-	-	-	-	3 (25.0)	4 (57.1)	-	-	-	-	7 (10.0)
4-6 days	-	-	-	-	-	2 (28.6)	1 (100.0)	1 (16.7)	-	-	4 (5.7)
7-14 days	-	-	-	-	2 (16.7)	1 (14.3)	-	5 (83.3)	1 (50.0)	1 (20.0)	10 (14.3)
>2 weeks	-	-	-	-			-	-	1 (50.0)	4 (80.0)	5 (7.1)
Total	29 (100.0)	2 (100.0)	4 (100.0)	2 (100.0)	12 (100.0)	7 (100.0)	1 (100.0)	6 (100.0)	2 (100.0)	5 (100.0)	70 (100.0)

$\chi^2 = 170.93$ df = 54 $P<0.001$

The Scoring for microscopic changes as given in the following order:

1. Hemorrhage and/or Congestion of vessels
2. Edema formation
3. Margination of polymorph cells
4. Early infiltration of polymorph cells
5. Predominant polymorph infiltration with poorly differentiated mononuclear cells.
6. Predominant mononuclear cell infiltration
7. Appearance of fibroblast
8. Granulation tissue with rich leucocyte infiltration and much fibroblasts
9. Collagen tissue deposition
10. Cellular reaction subsides, fibroblasts are more active with increased collagen formation (regression phase of injury)

Table No. 5: Earliest and routine appearance of common histologically detectable changes of lacerations

Microscopic changes	Earliest appearance	Routine appearance
Congestion/ haemorrhage	10 min	0-4 h
Oedema formation	10 min	0-4 h
Margination of polymorph cells	15 min	0-4 h
Early infiltration of polymorph cells	3h	0-4 h
Predominant polymorphs infiltration	8 h	12-24 h
Mononuclear cell infiltration	24 h	24-72 h
Appearance of fibroblast	78 h	4-6 days
Granulation tissue deposition	4 days	7-9 days
Collagen formation	6.5 days	>2weeks
Regression phase	14 days	>2weeks

Microscopic changes: Table 4 shows among 29 lacerations which showed only **hemorrhage and/or congestion of vessels,** 24 (83.0%) injuries were 0-4 h old, 4 were of 4-12 h, and 1 was 12-24 h old. The earliest change was noted at 10 min and persisted upto 14 h. The formation of oedema was noted earliest at 10 min. **Margination** of the polymorph cells was observed in 4 injuries, all were of 0-4 h old. This was noted only after 15 min.

Early polymorph cells infiltration was observed in 2 injuries during the period of 0-4 h and the earliest was noted at 3 h. In a similar study by Amit Sharma et al. early infiltration was first noted at 7 h.[5] An author also quotes that, margination of polymorph cells occurs in 30 min to 4 h.[4] In contrary another author says that during first hour isolated polymorph infiltration is seen.[7]

Predominant polymorphs infiltration was observed in 12 injuries, of which 6 (50%) injuries were 12- 24 h old. This was noted only after 8 h and the count decline was observed between 4-6 days. However in 2 cases micro abscesses was observed in injuries of 7-14 days old. The observations in our study was in agreement with a study conducted by Russell Ross et al, wherein they found that wound was rich in polymorph nuclear leucocytes within 12 h, the numbers of these cells increased for the first 24 hours to a maximum and by 24 hours the process of disruption starts and decreased after 3rd day.[8]

Similar observation was made by Sharma A et al in their study, wherein significantly increased infiltration was seen by 19 h and persisted upto 3 days[5] also the author quotes that polymorphs infiltration routinely observed 15 h after trauma.[9]

Mononuclear cells infiltration was first observed at 24 h, predominant increase in there counts was noted in 7 injuries, of which 4 (57.1 %) injuries were 24-72 h old, 2 were of 4-6 days and remaining was >7-14 days old. The injury of 7-14 days old was associated with micro abscesses. The **active fibroblasts** were evident after 78 h. The **early regenerative change of epithelium** was noted at 65 h. Similar observation was made by Sharma A et al in his study, wherein he observed significant infiltration after 39 h and remained upto 7th day.[5]

The author quotes that, the cell population consists largely of macrophages and increased fibroblasts at 3 days.[8] To the contrary another author describes that at 12 to 24 h mononuclear cells become more evident and polymorphs will decline.[4]

The granulation tissue was noted in 6 injuries of which 5(83.3%) injuries were of 7-14 days old and more so most of these were in the period of 7-9 days.

The collagen tissue deposition was observed in 2 injuries; of which earliest was observed at 158 h (6.5 days). In study by Sharma A et al collagen formation was observed after 3 days.[5] This was in agreement with the author Knight B.[4]

The regression phase was noted in the 5 injuries, of which 4(80%) injuries were of >2 weeks old. The regression phase at the earliest was noted at 14 days and was observed upto 1 month.

Table No. 6: Correlation of gross changes with microscopic changes of lacerations

Gross changes	Microscopic Scoring										Total
	1	2	3	4	5	6	7	8	9	10	
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
A	22 (84.6)	1 (3.8)	2 (7.7)	1 (3.8)	-	-	-	-	-	-	26 (100.0)
B	7 (38.9)	1 (5.6)	2 (11.1)	1 (5.6)	6 (33.3)	1 (5.6)	-	-	-	-	18 (100.0)
C	-	-	-	-	3 (30.0)	5 (50.0)	1 (10.0)	1 (10.0)	-	-	10 (100.0)
D	-	-	-	-	3 (21.4)	1 (7.1)	-	5 35.7	1 7.1	4 (28.6)	14 (100.0)
E	-	-	-	-	-	-	-	-	1 50.0	1 (50.0)	2 (100.0)
Total	29 (41.4)	2 (2.9)	4 (5.7)	2 (2.9)	12 (17.1)	7 (10.0)	1 (1.4)	6 (8.6)	2 (2.9)	5 (7.1)	70 (100.0)

$\chi^2 = 109.8$ df = 36 $P < 0.001$

Cross tabulation between gross changes and microscopic changes in laceration was found to be statistically significant (P<0.001)

Correlation of gross changes with microscopic changes: Table 6 shows out of 26 injuries, which showed gross haemorrhage, microscopically 22 (84.6%), had only haemorrhage and/or congestion of vessels, the remaining was associated with oedema, margination of polymorphs and early polymorph cells infiltration.

Out of 18 injuries which showed redness with swelling, microscopically 7 (38.9%) of them had only haemorrhage and/or congestion of vessel and 6(33.3%) of them showed predominant polymorph cells infiltration and remaining injuries were associated with oedema, margination of polymorphs and early polymorph cells and mononuclear cell infiltration.

Soft red scab was noted in 10 injuries, in which 5 (50%) had predominant mononuclear cell and 3(30%) had polymorph cells infiltration respectively.

Brownish black scab was noted in 14 injuries, in which majority of them 35.7% had granulation tissue and others were in regression phase 4(28.6%).

Among the 2 injuries where there was **scar formation** one had dense collagen tissue and other one was in the regression phase.

By comparing gross changes with microscopic changes, amongst the injuries of > 2weeks old, only 1(20%) out of 5 lacerations showed scar formation, whereas by histological study 4 (80%) injuries showed dense collagen tissue with decreased cellular reaction, which confirmed the injury as > 2 weeks old.

CONCLUSION

A 'Dating of Laceration by Gross and Histo-pathological Examination of skin–A Postmortem Study was carried out in the Department of Forensic Medicine, M.S. Ramaiah Medical College from Oct 2011 to March 2013. A total of 70 samples were taken up for study.

The results concluded as follows; on gross examination, Gross haemorrhage was seen in injuries of less than 6 h. Redness with swelling was seen upto 28 h. Soft red scab was observed from 18 h upto 11 days. Brownish black scab was observed in the injuries of

more than 68 h and complete scar formation was noted after 14 days.

On microscopic examination, Haemorrhage and congestion of vessels was seen in injuries of less than 14 h. Predominant polymorph cell infiltrations was observed only after 8 h. Mononuclear cell infiltration was observed in injuries more than one day old. Granulation tissue was seen after 4 days. Collagen tissue formation was observed after 158 h (6½ days).

To conclude, amongst the > 2weeks old injuries, histological study increased the accuracy (80%) as compared to gross examination (20%). On gross examination, the presence of hemorrhage or redness with swelling indicates that laceration is approximately 1 day old. However the later changes have wider range. Hence gross appearances of lacerations were inconsistent for dating the injury. However, in relation to cases where comorbidities were found such as diabetes, sepsis, malnutrition; delay in the scab formation was observed.

LIMITATIONS

The degree of possible observer variation could not be assessed as only one observer was involved in the study for gross changes.

Scope for Further Study: As gross changes of lacerations are not consistent with dating of injury, the gluing nature of laceration can be considered for further study.

With microscopic changes, the further studies on enzyme histochemistry, biochemical assays and fluorescence studies can be done and correlated. This will help in bringing more objectivity to the observation and interpretation.

RECOMMENDATIONS

The present study sheds light into the usefulness of laceration in wound dating. The lacerations which are a week old or more; histological examination for dating of the wound is helpful.

In cases with multiple injuries over different sites, the healing process may vary due to various factors and thus opining the age of the injury would be difficult and would not correlate with the time of infliction of the injury as alleged by the police or relatives, hence the autopsy surgeon should exercise caution while opining the age.

In histopathology slide examination, the presence of artefacts in the form of sand, mud particles, glass pieces etc. are to be kept in mind.

In case of multiple lacerations, preferably choose the wound which is small in size to have better results also injuries which are sutured to be considered to have better results comparing to non-sutured one.

Conflict of Interest: NIL

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Estimation of Supine Length from Percutaneous Measurement of Hand Length

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ABSTRACT

Identification of the deceased is important at the time of medicolegal autopsy in case of mutilated dead bodies. Stature is one of the parameter which could help in identification of the deceased especially in cases of mass disasters wherein mutilated or amputated body fragments are brought to the mortuary for the purpose of examination. The aim of the present study was to estimate supine length from percutaneous measurement of hand length in 200 dead bodies (100 male and 100 female) brought to the mortuary of University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi. The results showed significant positive correlation between hand length and supine length (right hand length r = 0.898 and left hand length r = 0.866).

Keywords: *Stature, Supine Length, Hand length, Percutaneous measurement.*

INTRODUCTION

Identification means determination of exact individuality of a person, living or dead.[1] When the person is known by his name with complete address, it is known as complete identification. But in certain circumstances when some details like age, sex etc. can only be established it is known as partial identification. The question of identification may arise in living and dead and also in civil and criminal cases. Identification is basic responsibility of investigative agencies. The identification of dead bodies is required in cases of sudden and unexpected deaths, fire explosions, and railway or aircraft accidents.

For establishing the identity points taken into consideration include : (i) Age (ii) Sex (iii) Religion (iv) Complexion (v) General development including stature (vi) Anthropometric measurements (vii) Fingerprints and footprints (viii) Superimposition (ix) Teeth (x) DNA fingerprinting and (xi) Personal belongings.

Stature refers to body length from the crown to the bottom of the feet in standing position. Supine length refers to the body length taken in supine position from the vertex of skull to heel of feet. Body length increases after death by about 2 cm due to loss of muscle tone, relaxation of joints and tensions of inter vertebral discs.[2] According to Belgian mathematician Adolphe Quetelet, there is one in four chance of two persons having same height[3]. Stature varies with race and is determined by genetics of a person, geographical location, environment and climatic conditions.[2] Estimation of stature is an important objective in the identification of an individual from dismembered and skeletal remains in forensic case work.[4] Establishing the identity of an individual from mutilated, decomposed and amputated body fragments has become an important necessity in recent times due to increase in mass disaster, be it natural disasters like earthquakes, tsunamis, cyclones, floods or man-made disasters like terror attacks, bomb-blasts, mass accidents, wars, and plane crashes etc.[5]

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A Number of multiplication factors and regression equations have been developed from long bones throughout the world. Multiplication factors as given by Pan (1924) for East Indians (Hindus) are as follows: Humerus (5.30), Radius (6.90), Ulna (6.30), Femur (3.70) and Tibia & Fibula (4.48).[2] Estimation of stature from bones is a tedious and time consuming process and gives erroneous results due to considerable statistical differences between the lengths of fresh and dry bones.

Some of the equations used to estimate the stature include parameters like length between the tips of one middle finger to that of the opposite when the arms are fully extended, length of arm from acromial process of scapula to tip of olecranon process, length from vertex to symphysis pubis, length from sternal notch to symphysis pubis, length of forearm from tip of olecranon process to tip of middle finger etc.[2] Many studies have been conducted on the determination of stature from percutaneous measurements of various body parts including arm[7], forearm[8], hand[9], foot etc. This is usually conducted by correlating various measurements of body with height of the person using scientifically derived formula such as multiplication factors and regression equations.

The regression equations for western population were first evolved by Trotter and Gleser, Dupurtuis and Hadden.[2] The present study is aimed to deduce the correlation between supine length of adult cosmopolitan population of Delhi with their hand length for subsequent determination of supine length.

MATERIAL AND METHOD

Supine length and bilateral hand lengths was recorded from 100 Male and 100 Females dead bodies within the age group of 21 to 45 years brought to mortuary of GTB hospital for medicolegal postmortem examination. Individuals without any anatomical distortion of body in relation to stature were included in the study. Cases with physical deformity, disease or defect affecting the growth in general or of bones and suffering from gigantism or dwarfism were excluded from the study.

Procedure: After breaking rigor mortis by treating the dead body with warm water, supine length and bilateral hand lengths were recorded. Dead body was placed in supine position on autopsy table, with knee and hip joints extended, and neck & feet in same plane.

- Supine length was measured from vertex of head to the base of heel using scientifically standardized graduated anthropometer.
- Hand length was measured as the distance between the mid-point of radial and ulnar tuberosity to tip of middle finger on dorsum of hand when the hand was held straight and stretched using scientifically standardized graduated Vernier calipers.

The measurements were tabulated and appropriate statistical tests were applied.

RESULTS

Supine Length: Supine length in males ranged from 155 cm to 180 cm with mean supine length of 166.23 cm & standard deviation of 4.75 cm. In females, supine length ranged from 140 cm to 167 cm with mean supine length of 154.32 cm & standard deviation of 5.30 cm.

Hand Length: The descriptive variables of hand lengths of both sides in males and females are as shown in table 1.

Table 1: Measurements of hand length on both sides

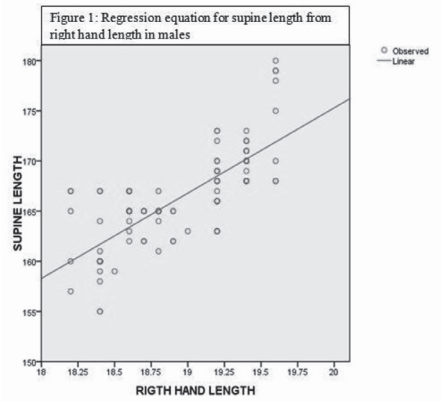
Gender	Measurement side	Minimum	Maximum	Mean	Standard deviation
Male (n = 100)	R	18.2	19.6	18.934	0.4219
	L	18.9	20.6	19.729	0.5094
Female (n = 100)	R	17.2	19.6	17.780	0.5637
	L	17.2	20.2	17.976	0.8617

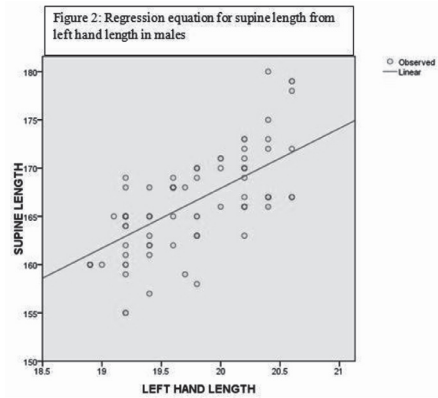
Regression Equation: Linear regression equation, derived from both hand lengths for estimation of supine length in males and females showed significant positive correlation of right hand length with lesser value of standard error as compared to left hand length as illustrated in table 2

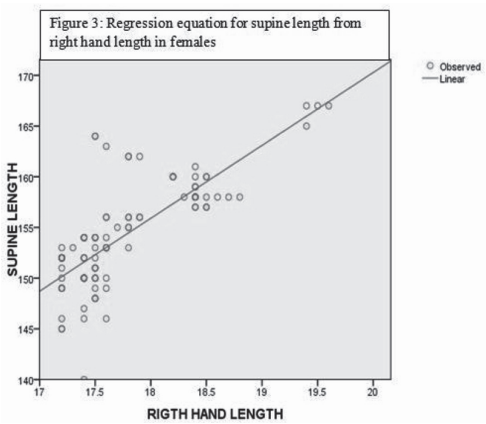
Table 2: Regression equation for estimation of supine length

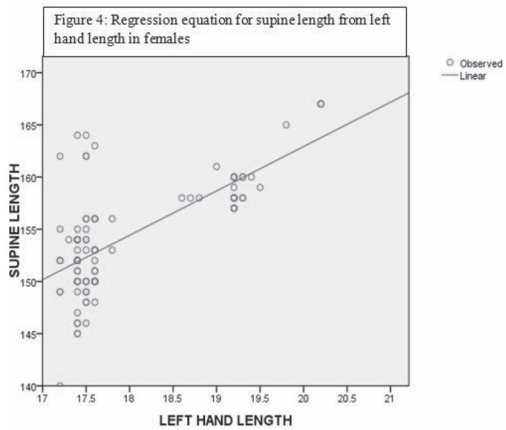
Gender	Measurement side	Regression equation for Supine length	Std error of estimate(+/–) cms	Correlation coefficient (r)
Male	R (Figure 1)	5.172 + 8.506 × RHL	3.124	0.754
	L (Figure 2)	43.772 + 6.207 × LHL	3.556	0.664
Female	R (Figure 3)	26.458 + 7.191 × RHL	3.424	0.764
	L (Figure 4)	77.951 + 4.248 × LHL	3.842	0.690
Combined	R (Figure 5)	9.193 × RHL – 8.482	3.434	0.898
	L (Figure 6)	47.266 + 5.994 × LHL	3.906	0.866

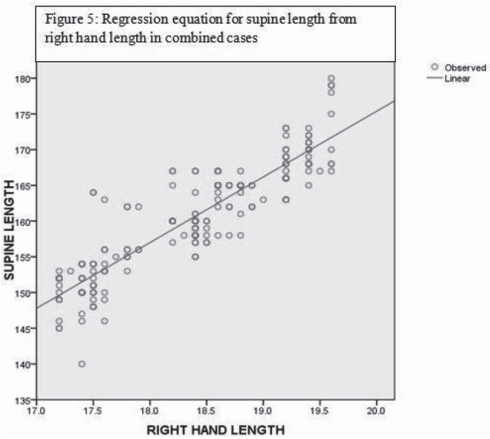
Right hand length gives better prediction of stature as compared to left hand length in both genders. Correlation was significantly positive and highest for both right and left hand length when total cases were combined together.

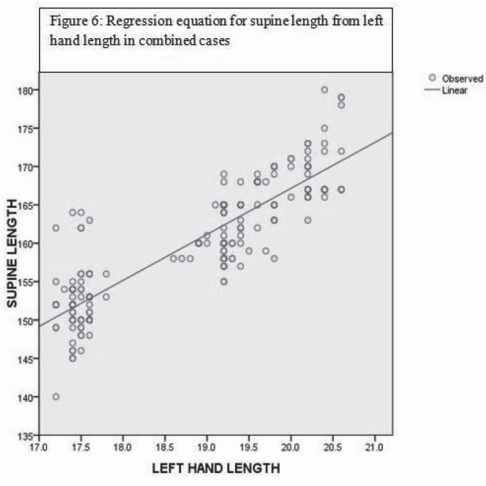












Multiplication Factor: Multiplication factor was derived for both hand lengths for estimation of supine length. In males multiplication factor was 8.779 and 8.425 for right and left hand lengths respectively. Among females the multiplication factor was 8.679 and 8.584 for right and left hand lengths respectively.

DISCUSSION

Stature estimation is an important for identification of commingled remains in forensic examinations. Two basic methods i.e. anatomical and mathematical method are used for estimating living stature from long bones and body parts, the anatomic method is generally preferred over mathematical method when the complete skeleton or cadaver is available.

The anatomical method involves the direct reconstruction of stature by measuring and adding together the lengths or heights of a series of contiguous skeletal elements from the skull through the foot. Many authors consider that the anatomical method provides best approximation of stature when applicable to skeleton or cadaver. To calculate the living stature of an individual using the anatomical method, correction factors that compensate for soft tissue also need to be added. However, when mutilated remains and skeletal parts are referred for personal identification in forensic examinations, the forensic experts have to rely upon mathematical methods for stature estimation.

Mathematical methods utilize the measurements of one or more bones or body parts to estimate stature. Thus a distinct advantage of mathematical methods is that a single body part can be used to estimate the living stature of an individual. Standard error of estimate needs to be considered giving a possible range of stature from a given bone/body part. Moreover, different formulae are required for different population groups, different bones or body parts. Mathematical methods employed in stature estimation include multiplication factor and regression analysis. Forensic significance of these mathematical methods is based on the principle that there is a high linear correlation between an individual's stature and the body part or bone length[10].

Trotter[9] states that the most accurate estimates of stature can be obtained when the equation applied to the unknown has been derived from a representative sample of population of same sex, race, age and geographical area to which the unknown is believed to belong.

The present study was aimed at and concentrated on finding the co-relation between supine length and anthropometric measurements of both hands of both male and female in cosmopolitan population of Delhi for subsequent determination of supine length.

Hand length in Males and Females: Gender difference in estimation of supine length from right and left hand length was studied in the present study. It was observed that forearm length exhibited statistically significant bilateral differences in males and females ($p< 0.01$). It was observed that hand length exhibited statistically significant bilateral differences in both males and females ($p< 0.01$) in the present study. This is in contrast with the study done by Krishan[12] where no statistically significant differences were found in hand length measurements.

Table 3: Gender difference in estimation of Supine length from hand length

Variable	Males				Females			
	Mean difference	Std deviation	t- value	p – value	Mean difference	Std deviation	t- value	p – value
Hand length	0.780	0.613	12.731	< 0.01	0.230	0.601	3.830	< 0.01

Habib[10] estimated stature from hand and phalanges lengths of Egyptians in 159 students (77 females and 82 males) in 18 – 25 year age group. The correlation coefficient was positive and significant.

Krishan[12] derived stature from dimensions of hands and feet in a north Indian population of 246 rajputs (123 males and 123 females) in 17 – 20 years age group and found significant correlation of stature with both right and left hand length in both males and females.

Agnihotri[9] predicted stature from hand dimensions in 250 cases (125 males and 125 females) and formulated that left hand length in males alone explained very significantly($p<0.01$) for the variation (about 35 %) in stature amongst males with a significantly positive correlation($r=0.594$). Similarly by applying linear regression for left hand length in females stature was

explained significantly (>54% variation explained) as compared to males.

Jasuja[13] estimated stature from hand and phalange length in 30 male and 30 female Jat Sikhs in age group of 18 – 60 years and formulated regression equations with the standard error ranging from 4.033 to 4.82 centimeters in case of the males and 5.061 to 5.127 in case of female.

Table 4: Comparison of statistical parameters used for supine length estimation from right hand length among different authors

Authors	Gender	Regression equation	Correlation coefficient(r)	Mean (cm)	Std deviation	Std. Error of Mean
Habib et al[10]	M	57.70 + 6.06 × RHL	0.697	19.29	0.84	0.009
	F	101.13 + 3.39 × RHL	0.495	17.60	0.80	0.009
Krishan et al[12]	M	89.63 + 4.31 × RHL	0.599	18.24	0.90	0.08
	F	81.22 + 4.43 × RHL	0.686	16.83	0.80	0.07
Jasuja et al[13]	M	69.513 + 5.223 × RHL	0.502	19.80	0.73	0.13
	F	84.742 + 4.491 × RHL	0.529	17.51	0.81	0.14
Present study	M	5.172 + 8.506 × RHL	0.754	18.93	0.42	0.04
	F	26.458 + 7.191 × RHL	0.764	17.78	0.56	0.05

In the present study the correlation between stature and right hand length was significantly positive with highest 'r' value as compared to previous studies as shown in table 4.

Table 5: Comparison of statistical parameters used for supine length estimation from left hand length among different authors

Authors	Gender	Regression equation	Correlation coefficient (r)	Mean (cm)	Std deviation	Std. Error of Mean
Habib et al[10]	M	63.49 + 5.74 × LHL	0.670	19.36	0.86	0.009
	F	90.15 + 4.01 × LHL	0.563	17.62	0.77	0.009
Krishan et al[12]	M	88.63 + 4.37 × LHL	0.609	18.21	0.91	0.08
	F	84.54 + 4.24 × LHL	0.677	16.8	0.83	0.08
Agnihotri et al[9]	M	94.835 + 4.187 × LHL	0.594	18.90	0.87	0.078
	F	74.404 + 4.945 × LHL	0.739	17.22	0.93	0.084
Jasuja et al[13]	M	130.954 + 1.612 × LHL	0.452	19.79	0.76	0.13
	F	130.035 + 1.660 × LHL	0.557	17.47	0.80	0.14
Present study	M	43.772 + 6.207 × LHL	0.664	19.72	0.50	0.05
	F	77.951 + 4.248 × LHL	0.690	17.97	0.86	0.08

Correlation between stature and left hand length was significantly positive in the present study and is consistent with previous studies as shown in table 5. The value of mean left hand length in females is consistent with Habib[10], Agnihotri[9] and Jasuja[13]. The standard error of mean in the present study is almost similar with the studies by Krishan[12] and Agnihotri[9]. The standard deviation noted in the present study is consistent with Krishan[12] and Jasuja[13].

CONCLUSIONS

Right hand length gives better prediction of stature as compared to left hand length in both genders. Correlation was significantly positive and highest for both right and left hand length when total cases were combined together. Hand length exhibits statistically significant bilateral differences in both males and females. Hence hand length can be used for estimation of supine length in cases of mutilated bodies and amputated body fragments.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from Institutional Ethical committee, University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi.

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The Influence of Culture and Society on Mental Health

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ABSTRACT

Introduction: Mental illnesses alter a person's mood, behaviour and thinking. It is estimated that the global burden of mental illness accounts for 32·4% of years lived with disability (YLDs) and 13·0% of disability-adjusted life-years (DALYs). Mental health is understood differently and the various mental afflictions are interpreted differently in different cultures.

Aim: This review article tries to bring out the attitudes and understanding towards mental health considering the opinions, treatment-seeking behaviour, racism and stigma across different cultures with special emphasis on racial and ethnic minorities.

Discussion: People of different cultures have a varied understanding about the cause of mental illnesses. Consequently, the treatment seeking behaviour considerably varies. The ethnic and racial minorities may resort to treatment at a very later stage of illness, reluctance arising out of stigma attached to mental illnesses.

Conclusion: It is imperative that the stakeholders should have a thorough knowledge so that a customised health care option is provided for maximum benefits.

Keywords: *Attitude, Understanding, Mental illness, Stigma*

INTRODUCTION

Mental illness refers to a wide range of disorders that affect a person's mood, behaviour and thinking. The global burden of mental illness accounts for 32·4% of years lived with disability (YLDs) and 13·0% of disability-adjusted life-years (DALYs).[1] The culture of a society on mental health, mental illness, and mental health services. The key is the understanding for developing mental health services that are more responsive to the cultural and social contexts of racial and ethnic minorities.[2] Cultural diversity and its impact on mental health has become an increasingly important issue in the modern era everywhere, where the interactions between cultures continue to grow exponentially.

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Approaches for help, the types of help expected, management strategies and social supports, and extent of stigma attached to mental illness has a cultural bearing. People may understand their illness differently which is also influenced by culture. Consumers of mental health services, whose cultures vary both between and within groups, naturally carry this diversity directly to the service setting.[2]

This article tries to presents critical areas how health and illness are perceived, coping styles, treatment-seeking patterns, impacts of history, racism, bias and stereotyping, gender, family, stigma and discrimination.

ELEMENTS OF CULTURAL DIVERSITY AND ITS EFFECT ON MENTAL HEALTH

Evidences are there to show that not only culture does play a significant role in terms of how society *understand* our health, but that different cultures *observe* this aspect differently and that these differences can play a key role in terms of how illness is managed.[3]

One aspect of difference across cultures relates to what the cause or nature of disease or illness is perceived to be. Studies done in different regions have revealed varied views Mental illness have been considered as a result of family conflicts, opportunity to receive divine messages, involvement of supernatural forces or phenomena or something that is predestined.[4-9] Thus, views of health or illness causality range across the individual, the natural world and the social world, and every cultural group may see this differently.[10,11] Health professionals will be able to address the issues effectively with understanding of different perceptions of same illness.

Culture modifies our *coping styles*, or the ways that we cope with everyday problems and to more extreme types of difficulty. Not only are there cultural variations in the types of stressors that people experience, but the assessment of stressors also varies, as do the choice of responses to stressors.[12]

The US Department of Health and Human Services noted such differences in coping styles when reporting that children in Thailand were two times more likely than children in the US to report reliance on covert coping methods, such as 'not talking back', as against overt methods such as 'screaming' and 'running away'.[13]

Psychological and psychiatric, spiritual, social support are the various management strategies of mental illness that people opt. The Treatment-seeking patterns also vary across cultures and society to society. People from ethnic minorities are less likely to seek mental health treatment and also more likely to present in crisis compared with the majority community in Western countries.[14] Most of the people resort to traditional healing methods before approaching modern treatment.[15,16] Informal ways of care-giving through clergy, traditional healers and family and friends preferred by minority or ethnic groups.[17] People opinion or trust on the therapeutic systems, interventions and therapists is formed on the background of historical persecution and struggles with racism and discrimination. Countries like Australia, where minority groups such Aboriginal and Torres Strait Islander people have historically struggled with oppression and dispossession. Mental health professionals may be viewed as part of the problem.[18]

Stigma attached to mental illnesses is another major obstacle in the way of management and treatment and delivery of proper care. Stigmatizing attitudes also vary across cultures. People with mental illnesses are perceived more dangerous and less competent of managing their own affairs in varying degrees across cultures. In some Asian cultures, stigma is so extreme that mental illness is thought to reflect poorly on family lineage and thereby diminishes marriage and economic prospects for other family members as well[19,20]

The *historical context* can also play a significant role in terms of how mental health professionals perceive and work with their clients across cultures of different parts of the world. Many of the assumptions of what is normal and what is abnormal that are central to Western therapeutic approaches are based in Western, middle-class constructions that may not be valid when working across cultures,[21]adversely impacting on assessment, intervention and evaluation- planning processes.[22]

Racism is an especially potent influence within culture and its effect on mental health. Racism and discrimination are "umbrella terms referring to beliefs, attitudes, and practices that abuse individuals or groups because of phenotypic characteristics, e.g., skin color, facial features, etc.[7] Racism and discrimination have a negative impact on both mental as well as physical health. People exposed to such discrimination are at risk for developing depression and anxiety.[23-25]

CONCLUSIONS

Mental disorders are prevalent across all populations, regardless of race, religion, sex and ethnicity. However, the socio-cultural diversity plays an important role that influences the approach for management. The ethnic and racial minorities face a social and economic inequality that includes greater exposure to racism and discrimination, violence, and poverty, all of which take a toll on mental health. Racism and discrimination are stressful events that adversely affect health and mental health. Stigma discourages major segments of the population, majority and minority alike, from seeking help. Attitudes toward mental illness held by minorities are as unfavourable, or even more unfavourable, than attitudes held by whites. Mistrust of mental health services is an important reason deterring minorities from seeking treatment. The cultures of ethnic and racial minorities alter the types of mental health services they use. Cultural misunderstandings or communication problems between patients and clinicians

may prevent minorities from using services and receiving appropriate care.[2]

While cultural differences provide a number of challenges to mental health policy and its implementations they also provide a number of prospects to work in distinctive and effective ways towards positive mental health. Ethno- specific approaches to mental health that incorporate traditional and community-based systems can provide new avenues for working with culturally diverse populations.

Whatever the socio-cultural impact on mental health may be, the health care providers, society and civil bodies must follow the rules, declarations and international treaties related to mental health in letter and spirit and should create a positive environment for all those needy people.

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Age Assessment by Ten Phase System Formulated by Todd in Haryana Population

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ABSTRACT

Age is an essential identification parameter in the living and the dead. In case of decomposed remains the bones serve as a valuable source of information to establish the age. Age assessment by pubic symphysis is a common method used by the experts. The study was aimed to correlate the change in the morphological features present in the symphyseal surface of pubic bone in Haryana population with age progression and group them according to the ten phase system of Todd. In the present study the age interval of the various phases were comparable to the Todd age interval but there is overlapping of ages in different phases. The results of the present study were compared with studies conducted in India and abroad.

Keywords: *Pubic Symphysis, Todd Ten Phase method, Age, Haryana Population*

INTRODUCTION

Establishing and individuals identity is a very important aspect in the field of legal medicine, whether the individual is dead or alive. The age forms an important aspect in the identification of an individual along with other parameters like sex, stature, anthropometric measurements, fingerprints, dental identification methods, DNA examination etc. Facial and personal identification is the easy and effective means of identifying an individual.[1] But if the face is not recognized the other parameter help in narrowing down the identity of the individual. In case of mutilation, decomposition, skeletonization where visual identification becomes difficult, the bones serve as a valuable source to establish the identification parameters. Of the various bones, pubic bone can be used to establish one of the inevitable parameter, the age.[2-6]

The idea of using pubic symphysis in anthropological assessment dates back to 1743 when Hunter described that the lipping of the dorsal symphyseal margin and ventral bevelling appeared during the third decade of life.[7] Aeby (1858) observed various changes occurred in upper extremity, lower extremity and surface of pubic symphysis with age.[8] Cleland (1889) used features of the pubic symphysis as a rough tool to approximate the age and sex of an individual.[9] Martin R (1914) used height of pubic symphysis for age estimation.[10]

A systematic method of age assessment from pubic symphysis was first described by Todd. The symphyseal surface has been described as a modified diaphysis-epiphyseal plane[11]. The symphyseal surface has many distinctive features: on the dorsal aspect dorsal margin, dorsal plateau, on the ventral side ventral bevelling, rampart, on the symphyseal face ridges, lower extremity, ossific nodule, upper extremity, and symphyseal rim.[11] The different features of the pubic bone undergo a series of morphological changes with age progression. These morphological changes are unique and are specific to particular age group.

Todd grouped the pubic bone into ten phases According to the changes in the features

Phase I: Till 18 years of age, only ridges and furrows were present. Dorsal margin and ventral bevel were not formed.

Phase II: At about 20 to 22 years of age, formation of dorsal margin occurred and may have a foreshadowing of ventral bevelling.

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Phase III: At about 22 to 24 years of age, there was the formation of the dorsal plateau, gradual filling of ridges and furrows and commencement of definite ventral bevel formation.

Phase IV: At about 25 to 26 years of age, distinct lower extremity formed.

Phase V: At about 27 to 29 years of age, there was the formation of ventral rampart with more delineation of lower extremity.

Phase VI: At about 30 to 33 years of age, ventral rampart fully formed with increasing definition of extremities.

Phase VII: At about 33 to 38 years of age, the oval outline of the symphyseal face was not complete, and there was no rarefaction and lipping of the bone. This was a phase of diminishing activity.

Phase VIII: At about 39 to 45 years of age, symphysis and ventral side of pubis became regular and dormant . Oval outline is complete but no lipping was observed.

Phase IX: At about 45 years of age, development of lipping along dorsal margin along with complete oval outline, lipping of ventral margins occurs.

Phase X: At about 50 years of age, erosion of bone occurs.

METHOD AND MATERIALS

The study was conducted on Haryana population in a tertiary care centre in North West region of India with an objective of correlating the morphological changes present in the symphyseal surface of the pubic bone with age progressions and group the features according to ten phase of Todd. After informed consent from the deceased relatives, the pubic bone was collected in Haryana population. Those cases where there is a discrepancy in information regarding age and residence, pelvic fracture, any congenital deformity and surgical procedure to pubic bone were excluded from the study. At a distance of 2.5 cm from the pubic tubercle, the superior- pubic rami and inferior -pubic rami of both sides was cut using osteotome. The bone complex was then removed en-block. The muscle attachments were dissected using scalpel. The harvested bone was placed in boiling water mixed with caustic soda till the attached soft tissues sloughed off from the bone and pubic symphysis got separated. A total of 300 samples were examined. The bones were examined for various features as mentioned in Todd method

RESULTS

A total of 300 samples were collected for the study of which 225 were from males and 75 from females. The pubic bone in the younger age group was transversed by horizontal ridges and furrows. In the present study, the ridges and furrows were more prominent till 24 years of age in all-male pubic symphysis and up to 30 years in female. As age progresses the ridges and furrows were gradually filled up. The ridges and furrows begin to fill from the dorsal aspect starting from the margin. A thin flat surface was noted at the dorsal edge called as dorsal margin. Dorsal margin completion first observed at 18 years in both sexes. The age of the five female pubic bone in which dorsal margin was absent was between 18-22 years. As the ridges and furrows were filled by the bony substance the dorsal margin expanded to form a flat surface called as the dorsal plateau. The completely formed dorsal plateau was first observed at 22 years in males and 25 years in females.

On the ventral side, the bevelling of edges begin to occur. The ventral bevel was first observed at 22 years in males 25 years in females and was last observed till 32 years in males and 30 years in females. The bevel metamorphosis to ventral rampart. Complete formation of ventral rampart occurred at 30 years in both sexes in the present study. A clear lower extremity was first observed at 24 years in males and 25 years in females. As the age progresses the extremities are well defined. The moderately defined lower extremity persists till 45 years in males and 36 years in females. Well defined lower extremity was first observed at 32 years in males and 29 years in females. The well-defined lower extremity persists up to upper limit of the study period in both sexes

A complete dorsal rim formation occurred at 28 years in males and 27 years in females. Completion of the ventral symphyseal rim is first observed at 40 years in males and 35 years in females. As a whole complete symphyseal rim formation was observed at 40 years in males and 35 years in females and present up 45-49 years in females and 60 years in males. As age advances there occurs breakage of rim most commonly in upper 1/3 of ventral rim. These degenerative changes in symphyseal rim first observed at 48 years in males and 42 years in

females. Dorsal lipping formation first occurred at 41 years in males and 38 years in females. After the age of 49, most of the pubic symphysis had dorsal lipping formation. Ventral lipping formation first occurred at 45 years in males and 40 years in females

As the age-progressed the bones become less dense or porous, and it is called as rarefaction. This rarefaction and erosion breakage begins at 48 years in males and 42 in females. After the 48 years in males and 42 years in females all pubic bone samples showed rarefaction and erosion

The distribution of male and female pubic bones as per Todd system were tabulated (Table I, Table II)

Table I: Distribution of male pubic bones according to Todd male phases

Todd phase-Todd Age Range (years)	Age Range in the present study (years)	N	Mean age (years)
I(18-19)	-	-	-
II(20-21)	18-22	13	20.15
III(22-24)	19-27	36	21.57
IV(25-26)	24-32	10	28.4
V(27-30)	24-36	25	25.52
VI(30-35)	30-40	22	32.32
VII(35-39)	32-45	39	38.6
VIII(39-44)	40-45	7	41.67
IX(45-50)	41-48	21	44.86
X(50+)	48-75	52	60.19
Total		225	

Table II: Distribution of female pubic bones according to Todd female phases

Todd phase-Age Range (years)	Present study Age Range (years)	N	Mean (years)
I(16-?)	18-22	5	19.2
II(-25-?)	18-24	6	21.67
III(25-26)	21-25	3	23.25
IV(26-27)	25-30	8	27.88
V(27-30)	25-31	5	28.00
VI(30-36)	30-32	4	31.25

Contd…

VII(36-40)	31-35	2	33.00
VIII(40-45)	35-40	6	38.5
IX(45-50)	38-40	4	39.00
X(50+)	42-80	32	56.44
Total		75	

DISCUSSION

Only a few studies have been conducted in India on the metamorphic features of pubic symphysis in relation to age on Todd method. The sample size (n=300) in the present study was much higher as compared with other Indian studies. The cases were selected in such a way that the results reflected the metamorphic changes occurring in the pubic symphysis across a well-defined population i.e., Haryana population.

In the present study, the metamorphic changes occurred in a predictable fashion. Initially the dorsal margin was formed on the dorsal demi face, which then progressed to form dorsal plateau. The dorsal plateau gradually extended throughout the dorsal demi face and concluded not less than 22 years and 25 years in males and females respectively.

Bevelling started initially on the ventral demi face, which later transformed into rampart. With progression of age, the rampart became more defined. In the present study, the completion of ventral rampart formation was first observed at 30 years in both sexes.

There was simultaneous filling up of the ridges and furrows along with the changes occurring in dorsal and ventral regions of pubic symphysis. The extremities gained definition and a completely formed symphyseal rim was first noticed at 40 years in males and 35 years in females. Degenerative changes occurred in the form of disintegration of symphyseal rim was first observed at 48 years and 42 years in males and females respectively.

Table III shows comparison of ages of formation of different features in various studies conducted in India and abroad. The Todd method ages phases are similar to our study and similar results were obtained in study conducted by Sodhi et al.

Table III: Comparison of age of occurrence of pubic symphyseal characters in various studies (Male samples)

Feature	Age in years						
	Present study	Sinha et al [12]	Sodhi et al[13]	Mc Kern and Stewart[14]	Todd[11]	Raj Kumar Singh[15]	Suchey-Brooks[16]
Dorsal Margin	18	18	20	18	22	21	
Dorsal Plateau Formation Begins	19	18	22				
Dorsal Plateau Complete	22	35		23	25	18	21
Ventral Bevelling	22	20	20	19	22		
Ventral Rampart Formation Begins	24	20		21	27	22	19
Ventral Rampart Fully Formed	30	35		24	30	35	19
Lower Extremity	24	18	25		25	22	19
Symphyseal Rim	40	39	39	24	40	50	27
Symphyseal Rim Breakage	48	39	45	29	50	50	34

In order to establish a guidelines for assessing the age from this method a study with a large sample size should be used from a particular population

In the present study the age interval of the various phases were comparable to the Todd age interval but in the present study there is overlapping of ages in different phases. Such overlapping is not found in the original Todd phase system

The variations in the different features may be because of the racial geographical environmental factors and *dietetic factors*[12] *along with varying occupational stress*[17] *might contribute to the differences in the observations between the present study and other studies*

CONCLUSION

For using bone as a method of age assessment large sample size of a particular race and population should be used. And that data should be used in that particular population as means to assess the age. The present study can be considered as an initiative for age assessment in Haryana population from pubic symphysis. Further for age assessment more than one method should be used.

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Age-wise Distribution with Occurrence of Ascending Aorta Atherosclerosis-An Autopsy Based Study

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ABSTRACT

The most frequent cause of sudden and unexpected death that constitutes a considerable portion of the autopsies conducted in our country is the cardiovascular diseases. In the World population, cardiovascular diseases remain the leading cause of death. The peculiarity of heart disease in Indian population compared to other parts of the globe is that its onset is 5-10 years earlier and hence the complications may occur in the age group of 35-65 years. Recent studies indicate that atherosclerosis has become a preceding factor for heart diseases and has contributed to sudden deaths in younger age groups also. The incidence of coronary artery disease has increased more than twice in the last 30 to 40 years and could become the single largest disease accounting for about one-third of deaths in India and the conditions that predict the risk of heart disease will be associated with the extent and severity of atherosclerosis.

Keywords: *Cardiovascular diseases, Coronary artery disease, Atherosclerosis, Age groups, Sudden Death, India.*

INTRODUCTION

The most common cause of sudden death all over the globe is of cardiovascular origin. Deaths due to cardiovascular disease in 2008 were more than 17 million out of which deaths occurring below the age group of 60 years was 3 million. [1]

10% of all deaths are sudden and unexpected deaths.45 to 50% sudden deaths involve the cardiovascular system. About 80% of cardiovascular deaths are myocardial infarction due to coronary artery atherosclerosis.[2]

Of all the global deaths in 2012, 31% were due to cardiovascular diseases, estimated to be about 17.5 million.

The peculiarity of heart disease in Indian population compared to other parts of the globe is that its onset is 5-10 years earlier and hence the complications may occur in the age group of 35-65 years, who are the backbone of our country's economy.

Recent studies indicate that atherosclerosis has become a preceding factor for heart diseases and has contributed to sudden deaths in younger age groups also.

The extent and severity of atherosclerosis is the most frequent pathological lesion which develops to coronary artery disease. The process of atherosclerosis can start in childhood and adolescence due to the cumulative effect of its risk factors. The risk factors include inappropriate diet, abuse of harmful substances like tobacco and alcohol, sedentary lifestyle, obesity and overweight, systemic hypertension, diabetes mellitus, hypercholesterolemia, poverty, poor educational awareness, advancing age, psychological factors like stress and genetic predisposition.[3]

The incidence of coronary artery disease has increased more than twice in the last 30 to 40 years and could become the single largest disease accounting for about one-third of deaths in India.

This predicts a possible prevalence of about 6.4 crores of cases, out of which 96% could be coronary artery disease.[4]

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So, the most common cause of sudden death is of cardiovascular origin dominated by coronary artery disease. This adds to a quite large number of medico-legal autopsies done in the mortuary of Department of Forensic Medicine in India.

MATERIALS AND METHOD

All the cases of sudden death and unnatural death such as accidents, thermal injuries, asphyxia and poisoning brought to the mortuary of Department of Forensic Medicine, SRMC & RI , Porur, Chennai during the period of September 2014 to September 2015, were studied in detail.

As this study focused on atherosclerosis as a risk factor, the ascending aorta was first studied in detail to give a knowledge of progression of atherosclerosis to coronary artery and abdominal aorta in younger age groups.

Permission of the ethical committee on the use of human material for research purpose was obtained prior to the commencement of the study.

Before each study, after detailed explanation about the study design, a written consent was taken from the patient's attenders and then documented. Cases showing signs of decomposition and patient attenders not willing to consent for study purpose were excluded.

Detailed examination of the heart was performed.

- Heart was removed from the pericardial sac and examined.
- Ascending aorta was dissected and examined for atherosclerosis.
- This was done by inflow outflow method.[5]
- The tissue was fixed in 10% formalin.

The concerned tissue specimens were then sent to Department of Pathology of Sri Ramachandra Medical College and Research Institute for histopathological examination to note the type of atherosclerosis.

Aorta was examined by gross and histopathological studies to look for the presence of atheromatous plaques and atherosclerotic lesions which were then classified according to American Heart Association.[6, 7]

The Statistical Package for Social Sciences (SPSS) version 11.5 was used with frequency and percentage being the mode of expression for data analysis.

All the above details and findings were documented in the concerned proforma prepared for this study.

RESULTS AND DISCUSSION

A total of 62 cases done between September 2014 and September 2015 were included in the study and assessment of atherosclerosis in ascending aorta was done which was subjected to histopathological examination for further analysis.

Table 1: Types of Atherosclerosis in Ascending Aorta

Types	Number of cases (n = 62)	Percentage (%)
Type I	1	1.6
Type IIa	1	1.6
Type III	10	16.1
Type IV	27	43.5
Type Va	17	27.4
Type Vb	2	3.2
Unremarkable	4	6.5

In the present study, atherosclerosis of ascending aorta was found in 58 cases (93.5%) with Type IV atherosclerosis seen in 27 cases (43.5%) followed by Type Va atherosclerosis seen in 17 cases (27.4%).

The earliest lesion seen in atherosclerosis is the fatty streaks. This progress into fibrous plaques which further develops into pathological lesions of serious degree.

Bharati Jha et al[8] observed that type IV and type V being the most common types of atherosclerosis and root of aorta was involved in 35% cases of myocardial infarction (MI).

McGill[9] observed that after 30 years of age ,the fatty streaks are found to increase at a faster rate in the aorta and M Maru[10] observed in 124 patients that atherosclerosis of aorta was found in 58 (47%) of the cases.

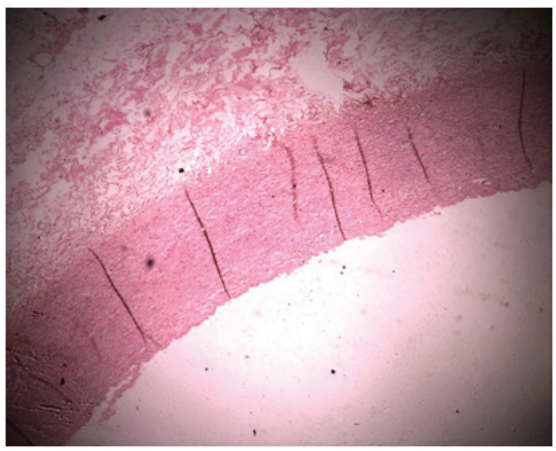

Fig. 1: Normal Aorta (H & E x 20)

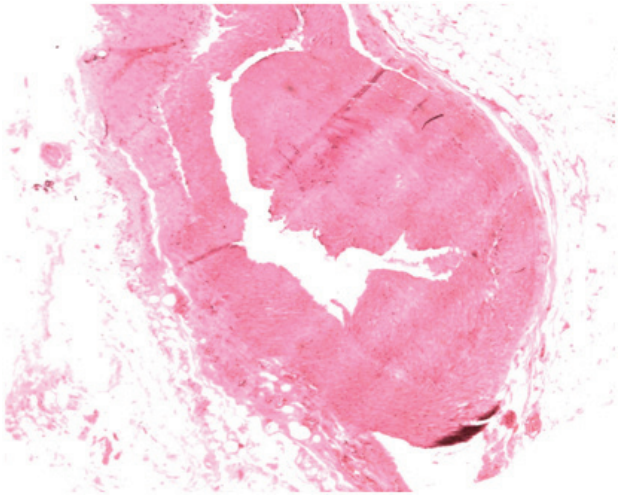

Fig. 2: Aorta showing Type III intermediate lesion (H & E x 40)

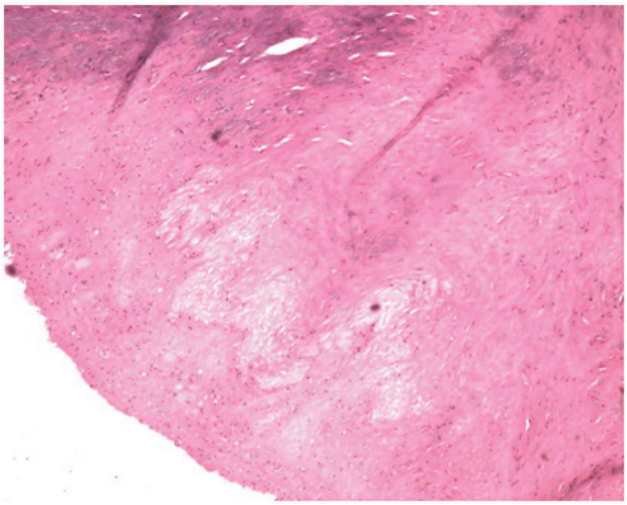

Fig. 3: Aorta showing Type IV atheroma (H & E x 40)

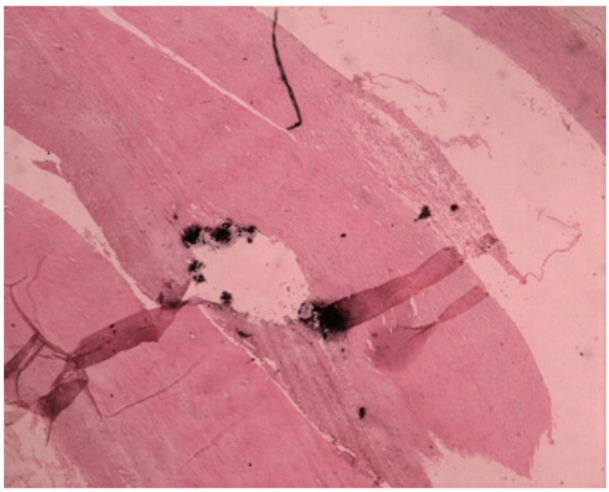

Fig. 4: Aorta showing Type Vb calcified plaque (H & E x 20)

Table 2: Age Group and Ascending Aorta Atherosclerosis

Age group (years)	Ascending aorta atherosclerosis Present (n = 58)	Ascending aorta atherosclerosis Absent (n = 4)
21-30	13 (22.4%)	1
31-40	14 (24.2%)	2
41-50	10 (17.2%)	1
51-60	12 (20.7%)	0
61-70	7 (12.1%)	0
71-80	2 (3.4%)	0

Among the 58 cases with ascending aorta atherosclerosis, maximum number of cases were found between 31-40 years with 14 cases (24.2%) followed by 21-30 years with 13 cases (22.4%).

A study on 2876 subjects between the age group of 15 to 34 years by Strong et al[11] showed that intimal lesions in the aorta develop between 15-19 years which is the youngest group in the study and the prevalence increased in the age group of 30- 34 years. After 30 years of age

Priti Vyas et al[12] observed that in 83 cases with atherosclerosis 24 cases were between 41-50 and 31-40 years followed by 10 cases between 21-30 years.

So, the present study implies that atherosclerosis can develop very early in life with a gap of 20 years between the development of atherosclerosis and manifestation of clinical disease.

CONCLUSION

Atherosclerosis is the predisposing factor for myocardial infarction. Myocardial infarction is most prevalent in age group of 41-60 years and atherosclerosis starts at the young age of 21 years proving that cardiovascular causes are the most common in sudden death. Therefore, the risk factors for development of atherosclerosis should be detected and evaluated in adolescent and young adults to adopt preventive measures.

General public should be educated regarding the risk factors for atherosclerosis and myocardial infarction with lifestyle modifications. Regular health checkup with cardiovascular screening must be recommended every 6 months from the age of 25 years to prevent the menace of Cardiovascular Diseases.

Ethical Clearance: Obtained from Institutional Research Ethics Committee, Sri Ramachandra Medical College & Research Institute (Deemed to be University) Ref: CSP-MED/14/FEB/11/24

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Disappearing of Daughters or Failure to Perforate the Chakravyuha of Favoritism from Womb to Tomb

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ABSTRACT

A woman is considered the best creation of nature and her absence is not an only peril to human continuation but also cause of fading natural scenery. The present study relates to state Haryana which has the most severe shortage of girls compared to boys among twenty-nine states of India, as accepted by the census of India. The work is based on secondary data obtained from Primary Census Abstract, Haryana to different census years and evaluates the sex ratio in Haryana since 1901 to 2011 and shows that the continual disappearing of girls becomes more tremendous during the last some decades. The girl's child is missing mainly through abortion, high female infant transience and son preference by the people. It represents the social and mental backwardness of people. The argument comprises what the people and government of state and nation have done to upgrade the serious unfairness against girl's child and women and what additional steps might be in use to recover the sex ratio. Pearson's correlation coefficient has been used to measure the degree of association between sex ratio and its major determinants. The study highlights certain facts about consistent declining male-female ratio of the population of Haryana and the observation unearths those facts (strong son preference, maternal mortality, sex-selective abortions etc.) which are responsible for regional variation in sex ratio as well as the adoption of double standards for the girl and boy child. The study also tries to justify that in any form, disgracing and missing of females can't be a development for any nation.

Keyword: *Infant transience, Preference, Unfairness, Abortion, Sex-selective Abortion.*

INTRODUCTION

Undoubtedly, daughters are missing from the dais of the mother planet which is a matter of a great concern. Aside from a short span of a few civilizations, the discrimination against woman has remained a historical issue. Instead of nature rules, the possibilities of her survival are determined by various socio-cultural aspects and economic calculations [(1,2)]. Often, even mothers and other female family members are not in favour of having the female child at their homes because, after motherhood, the mother's status and care are determined by the gender of a newborn baby. It is a general assumption of the patriarchal society that girls are an economic and social burden for family and they need more expenses rather than insignificant returns while sons are not only the driver of ancestry but also their future investment of which remuneration will be provided in old age. In addition, girls suffer unfairness prior to birth and it remained with her till the end [(3)]. It can't be said that girl's existence has remained the same till now, yes, paradoxically there is an improvement of technology which always hits her continuation odds. Where in past, in rural areas girls were killed by dire manners like poisoning, drowning, slapping, dumping in garbage, starvation [(4)], in new era, the smart technique of sex detection acts like a silent killer and without a sound they are murdered in mother's womb and in this way, in so-called educated or civilized world, really millions of daughters are missed from the scenery. More willingly than knowing the status of the foetus, this ultrasound medical technology is widely exercised for illegal sex determination, abortion and female foeticide [(5)] which props the destructive aspect of the science [(6)].

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Why Daughters are Nipped in Bud or Ignored? In population studies, the demographic perfection is measured through the symmetry of males and females [7] and the ratio between mathematical strength of both sexes is known as population sex ratio. It is not only important for demographically but also determines the status of women in society. Both sexes are complementary of each other so the term sex composition is supposed additionally significant for population geographers[8]. The imbalance between male-female proportions causes spacious and atrocious impacts upon the society. In most of cases, the lack of girl's results violence against women and a type of *women's market* arises where girls from remote areas and different caste, culture and religion are brought by buying, kidnapping or wheedling to sell as wives [9]. The missing of girls or choice of special sex at various levels of sex composition (primary, secondary and tertiary respectively at the time of conception, at the time birth and at the time enumeration) is an outcome of various external socio-economic factors (low status of women, social practices, violence against women, labeled as weaker sex) as well as population attributes. It is an irony that under normal circumstances, naturally despite of more foetus wastage, more boys are born than girls in most of human populations and these approximate numbers are 104 or 106 boys per 100 girls [10, 11]. Even after birth deficit, the survival chances of female babies are more than boys with lesser susceptibility of childhood diseases [12].Yet; it is only difference which is not matter of concern and amazingly remains constant if no one interferes. But when it converts in to disparity under the pressure of socio-cultural factors as well as sequential progress then it becomes great nervousness [13]. The declining fertility and strong son preference along with easy access to sex diagnostic technique, nucleated family culture, parent's insecurity for girls, dowry expenses have been identified as major responsible reasons for female's absence in population composition [14,15]. In arc of countries from East Asia throughout South Asian route for the Middle East and North Africa, the son preference over daughters is deeply entrenched as a socio-cultural aspect and also appear in behavior and attitude of people [16,17] and male child is favored and always considered as earner, nurturer, only pretender of last rites and legacy receiver of the family whereas girl seems big responsibility and parents have to expand a lot of wealth to pass on this liability to next bearer i.e. her husband or in-laws [18,19,20]**.** Further, girls are always trained to be modest and obedient and in their own home they are treated as second class citizen with a sticker of 'most wasted asset' whereas sons are labeled as 'nontransferable valuable resource' and continuer of family line [21]. In addition to this, it is saying that *Put to Kappot Bhala* (it means there should be a boy whether he is rascal or irresponsible).

India and Haryana Scene of Missing Females: The issue of increasing manliness in India has converted into a serious concern [22,23,24]. In the south and East Asia including India, China and Korea, female babies are failed to avail natural higher survival possibilities than their counterpart due to infectious and non-transmissible diseases in the initial duration of infancy [25]. The growing opulence in India is the second major determinant of missing female babies in the antenatal category where educated parents prefer the lesser number of children particularly male as a security [26, 27]. Whereas during adolescence, the opposite sex ratio is supported by excess mortality of girls due to poor nutrition and medical care [28,29]. The pre and post-independence literature states that Haryana along with comprising Punjab state has a history of most of the imbalanced male-female ratio in the nation. In past, it was the consequence of the common prevalence of female infanticide and in the current, sex-selective abortions are main ground [30,31]. There are common blessings, wishing and saying of '*Dudho Nahao Putto Falho'*; '*Bhai Bathija Jivatee Rhe'; Beti Mare Bhagwan ki, Beta Mare Nirbhag Ka*' in Haryanavi culture which neglects girls. At present, it is bitter saying in Haryana that with spending time, money and distance, getting a woman is much easier than a well-bred buffalo [32]. This superiority of beast over women questions where the humanity is going and which type of nation will be without a woman?

OBJECTIVES

The present study aims at realizing the following set of objectives:

1. To examine the regional pattern and inter-district variations of sex ratio in Haryana.
2. To identify the causes and consequences of adverse sex ratio and existing bonding of diverse determinants with sex proportion.

Study Area: Haryana is a landlocked and small but progressive state of India spreading over a geographical area of 44,212 km which has shown much growth in health and service provisions after separation as a new state from Punjab on 1st November 1966. On one side, the state is admired for its economic development while on another way; it is dishonoured because of having lowest sex ratio (879 females per 1000 males) in the country as per running census.

MATERIAL AND METHOD

The present study is based on secondary sources of information. The data has been composed of different Primary Census Abstracts of India and Haryana relates to census years from 1901 to 2011 to evaluate the sex proportion of two founding segments of the population. It is the application of Pearson's correlation coefficient which measures the degree of association between sex composition and its major determining factors. The different other sources of literature (reports, editorials, blogs, observations) have been consulted to identify the basis and effects of rural-urban sex differentiation at different levels.

RESULTS AND DISCUSSION

Sequential Trends of Male-female Proportion in India and Haryana: Table 1 shows the chronological changes and discrepancy in overall and rural-urban sex ratio in India and Haryana. In 1901, the survey report put the figure at 972, 979 and 910 female per 1000 males for total, rural and urban areas correspondingly whereas for the study area this number was 867, 861 and 908 females for the same time. During this enumeration, rural India has an advantage of 69 females as compared to urban part while in Haryana; the situation is opposite to this with 47 females. The consecutive census details also traced the decline in number of females with increasing inconsistency in rural and urban areas with respect to nation whereas in the state, the difference between countryside and urban declined (47 to 8) due to abrupt falling of sex ratio (908 to 842) in urban and rural (861 to 834). It was the assessment of 1951 when in India, the number of females was 946 females per 1000 males with a great decline of 26 females in total as compared to 1901 while the sex ratio was 965 and 860 in the rural and urban area in that order with a significant difference. In the same time, Haryana had documented 871, 877 and 845 females per 1000 males in overall, rural and urban areas respectively.

Table 1: Sequential Variation in Sex Ratio and Rural-Urban Differentiation in India and Haryana, 1901-2011

Census Year	India				Haryana			
	Total	Rural	Urban	Rural-Urban Differential	Total	Rural	Urban	Rural-Urban Differential
1901	972	979	910	69	867	861	908	-47
1911	964	975	872	103	835	834	842	-8
1921	955	970	846	124	844	848	811	37
1931	950	966	838	128	844	851	792	59
1941	945	965	831	134	869	879	806	73
1951	946	965	860	105	871	877	845	32
1961	941	963	845	118	868	874	842	32
1971	930	949	858	91	867	870	853	17
1981	935	952	880	72	870	876	849	27
1991	927	939	894	45	865	864	868	-4
2001	933	946	900	46	861	866	847	19
2011	940	947	926	21	879	882	873	9

Source: Census of India

During 1981, the country had registered a number of 935 females behind 1000 males in total with the rural-urban deviation of 72 females. For the same duration, the state statistics for total, rural and urban were 870, 876 and 849 females likewise. The documentation of decade 1901- 2011 showed a little improvement in the number of females per thousand males in all categories of nation and state. There is increase of 18 females in general sex ratio of Haryana against the national addition of 7 females in 2011 as compared to 2001 whereas in rural (946 females in 2001 to 947 females in 2011) and urban (900 females in 2001 to 926 females in 2011) sex ratio also increased with minimizing the rural-urban variation of 25 females from 2001 (46 females) to 2011 (21 females). Within the same instance, the rural and urban parts of Haryana also showed the rising trend of female proportion and listed 882 and 873 females per 1000 males correspondingly. In whole, the information

reveals that male's ratio has constantly high then the female's in both, country and the state. The important fact is that trivial difference in the male-female ratio in all categories independent India has converted into severe gender discrimination after independence.

Spatio-temporal Analysis of Overall Sex-ratio in Haryana: In Haryana, the continuous missing of daughters at primary level adds to severity in the problem of low sex ratio. Table 2 shows the district wise profile of overall and child sex ratio of Haryana of running, previous and before previous census years i.e. are 2011, 2001 and 1991.

Table 2: Spatial and Temporal Figures of Overall Sex Ratio in Haryana

Sr. No.	Districts/State	1991				2001				2011			
		Total	Rural	Urban	Rural-Urban Differential	Total	Rural	Urban	Rural-Urban Differential	Total	Rural	Urban	Rural-Urban Differential
1	Ambala	903	879	950	-71	868	879	849	30	885	892	876	16
2	Bhiwani	878	879	875	4	879	884	859	25	886	886	885	1
3	Faridabad	828	880	813	67	839	859	824	35	873	872	873	-1
4	*Fatheabad*	*DNA*	*DNA*	*DNA*	*DNA*	884	885	879	6	902	902	899	3
5	Gurgaon	871	867	886	-19	873	876	861	15	854	878	844	34
6	Hisar	853	851	859	-8	851	853	844	9	872	877	861	16
7	*Jhajjar*	*DNA*	*DNA*	*DNA*	*DNA*	847	854	823	31	862	861	865	-4
8	Jind	838	834	859	-25	852	851	857	-6	871	868	881	-13
9	Kaithal	853	849	878	-29	853	853	856	-3	881	880	887	-7
10	Karnal	864	857	887	-30	865	865	862	3	887	886	890	-4
11	Kurukshetra	879	883	867	16	866	873	848	25	888	899	862	37
12	Mahendergarh	910	911	901	10	918	824	883	-59	895	896	890	6
13	*Mewat*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	907	907	907	0
14	*Panchkula*	*DNA*	*DNA*	*DNA*	*DNA*	823	798	853	-55	873	863	881	-18
15	Panipat	852	850	871	-21	829	837	819	18	864	860	868	-8
16	*Palwal*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	*DNA*	880	880	883	-3
17	Rewari	928	941	859	82	899	910	851	59	898	907	873	34
18	Rohtak	849	832	884	-52	847	839	862	-23	867	852	887	-35
19	Sirsa	885	887	876	11	882	884	876	8	897	898	896	2
20	Sonipat	840	832	873	-41	839	836	847	-11	856	850	869	-19
21	Yamunanagar	883	885	880	5	862	866	855	11	877	882	871	11
	Haryana	**865**	**864**	**868**	**-4**	**861**	**866**	**847**	**19**	**879**	**882**	**873**	**9**

Source: Primary Census Abstract, Haryana**,** 1991, 2001 and 2011.

Note: NA- Data not Available

The summary reveals that figures of sex ratio for total, rural and urban were 865, 864 and 868 females in 1991 census which changed with the numeral of 861, 866 and 847 for the same time and space in 2001. The minor rural-urban difference of 4 females in 1991 became wider with the number of 19 in 2001. In general sex ratio, district Rewari is on top with a number of 928 females per 1000 males. In Faridabad district, the overall sex ratio is lowest (828 females per 1000 males) with a rural-urban difference of 67 females.

In rural, Rewari district is again on first position with highest advantage of females (82) over urban sex ratio among all districts and further this category is followed by district Mahendergah (911), Sirsa (887), Yamunanagar (885) and Kurukshetra (883) with rural-urban difference of 10, 11, 05 and 16 females respectively. In urban sex ratio, districts Ambala and Mahendragarh dominate with 950 and 901 females correspondingly whereas lowest urban sex ratio has been found in Faridabad (813 females) district.

In 2001, in the overall category, the highest sex ratio has been traced in district Mahendragarh (918 females) followed by Rewari (899 females) and Fatehabad (884 females) districts whereas overall lowest proportion of females is observed in Districts Panchkula and Panipat i.e. 823 and 829 females per 1000 males in that order. In countryside, district Rewari recorded highest 910 females with a significant decrease of 31 numbers as

compared to 1991 whereas district Panchkula (798 females) lies in bottom with lowest rural sex ratio pursued by Mahendragarh district which amazingly turned to underside from top with great fall of 87 females in 2001 (824 in 2001 from 911 in 1991) whereas in urban class just described district (Mahendragarh) has ceiling figure of sex ratio (883 females) in the state and district Panipat is first from last with 819 females. The same census witnessed the highest rural-urban difference in Mahendragarh and Rewari (59 females) followed by Panchkula and Faridabad districts while the least difference has been seen in Karnal, Kaithal (3 in each), Jind and Fatehabad (6 in each) districts. There is a slight addition of 18 females in total and 879 females per 1000 males have been confirmed in latest population enumeration of 2011. Both rural and urban parts have also shown an increase of 16 and 26 females respectively as compared to the previous census and rolled on 882 and 873 females per thousand males likewise. The rural-urban discrepancy also decreased from 19 in 2001 to 9 females in 2011 in the state. The Muslim dominate Mewat district achieved the first position in all three categories of total, rural and urban sex ratio with the same number of 907 females for each. In rural, the district Rewari has also joined to Mewat district for first with the same figure of 907 females whereas the lowest value of 850 females have been given by Sonipat district for rural. In urban class, district Gurgaon has been titled with lowest sex ratio with a numeral of 844 females. The previous census first and second order district of Mahendragarh and Rewari minimized the differentiation in pastoral and town said areas in 2011 while district Kurukshetra gave the highest figure (37 females) of variation in both same areas with Rohtak district (35 females). With cypher, district Mewat finished the difference in rural and urban sex ratio chased by Bhiwani, Faridabad and Sirsa districts.

Choro-chronological Variations in Child Sex Ratio in Haryana: The number of females per 1000 males of 0-6 year's age group is termed as child sex ratio or CSR [33]. In many areas, the biological variation is disturbed by the human being that results out as low CSR. In Indian society many times, female children are failed to rupture the *chakravyuha* of birth and their death is designed in mother's womb like *Abhimanyu*, a legendary character of Mahabharata [34]. Unfortunately, like overall sex ratio, Haryana has worst CSR in the country. In 1991 enumeration, CSR was recorded 879 which skewed to 819 in 2001 and 834 in 2011. During 1991, the highest CSR has been registered in Gurgaon (895) district accompanied by Rewari (894), Yamunanagar (889) and Bhiwani (886) district whereas in rural class, this position was sequenced by Gurgaon (897), Mahendragarh, Rewari and Yamunanagar district with the same number of 892 females.

Table 3: Sequential Variations in Child Sex Ratio (CSR) in Haryana

Sr. No.	Districts/State	1991				2001				2011			
		Total	Rural	Urban	Rural-Urban Differential	Total	Rural	Urban	Rural-Urban Differential	Total	Rural	Urban	Rural-Urban Differential
1	Ambala	879	884	881	3	782	770	808	-38	810	795	832	-37
2	Bhiwani	886	884	891	-7	841	844	827	17	832	835	814	21
3	Faridabad	884	874	895	-21	847	893	824	69	873	834	847	-13
4	*Fatheabad*	*NA*	*NA*	*NA*	*NA*	828	834	896	-62	854	858	836	22
5	Gurgaon	895	897	889	8	807	813	797	16	830	801	845	-44
6	Hisar	867	865	867	-2	832	839	806	33	851	855	843	12
7	*Jhajjar*	*NA*	*NA*	*NA*	*NA*	801	800	804	-4	782	778	794	-16
8	Jind	858	855	875	-20	818	828	775	53	838	839	833	6
9	Kaithal	854	854	857	-3	791	796	769	27	828	829	825	4
10	Karnal	875	873	873	0	809	813	792	21	824	829	810	19
11	Kurukshetra	867	869	865	4	771	773	766	7	818	818	820	-2
12	Mahendergarh	892	892	896	-4	818	821	795	26	775	774	783	-9
13	*Mewat*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	907	908	890	18
14	*Panchkula*	*NA*	*NA*	*NA*	*NA*	829	839	813	26	863	871	856	15
15	Panipat	881	880	907	-27	809	810	807	3	837	826	849	-23
16	*Palwal*	NA	NA	NA	*NA*	NA	NA	NA	*NA*	866	874	830	44
17	Rewari	894	892	911	-19	811	810	816	-6	787	782	799	-17
18	Rohtak	876	864	878	-14	799	807	781	26	820	822	818	4
19	Sirsa	883	885	874	11	817	823	801	22	862	869	838	31
20	Sonipat	879	876	893	-17	788	792	775	17	798	800	794	6
21	Yamunanagar	889	892	889	3	806	814	789	25	826	828	823	5
	Haryana	**879**	**877**	**884**	**-7**	**819**	**823**	**808**	**15**	**834**	**835**	**832**	**3**

Source: Primary Census Abstract, Haryana, 1991, 2001 and 2011.

Note: NA- Data not Available

In urban, district Panipat dominates with 907 females but sadly, the rural-urban difference is also highest (27) in the same district. In this decade, except Panipat, the not single district in all three categories touched the value of 900 in CSR. The situation becomes worse in 2001 and with a vast descending of 60 females, CSR reached at the lowest level of 819. The rural and urban not only witnessed this downfall but also increased in differentiation in both classes. In the rural category, the highest CSR of 893 was recorded in Faridabad whereas in urban, this first position was occupied by district Fatehabad with 896 CSR. Some improvement has been noticed in CSR in 2011 survey and with the addition of 15 females, it reached to 834, 835 and 832 in total, rural and urban respectively. Highest CSR of 908 is observed in rural Mewat district whereas in Mahendragarh district, CSR in rural and urban is found lowest i.e. 774 and 783 likewise. In urban, utmost CSR of 890 is documented in Mewat district followed by Faridabad (847) and Gurgaon (845) in that order (Table 3). The uppermost rural-urban differentiation has been traced in Gurgaon and Palwal (44 in each) districts followed by Ambala (37) and Sirsa districts (31). The analysis reveals that difference in rural-urban parts is declined in going census but another important thing is that in both areas CSR is not improved much and till now eleven districts out of twenty-one are below the state average (832) which itself is not a good value.

Association of Sex Ratio with its Determinants: The population's aspects can only explicate the falling sex ratio, not the continual progressive turn down of females of near about a century period [35]. Here poor nutrition and health care, early marriage and excess maternal mortality, son preference, prenatal sex diagnosis, illegal abortions and female feticides are other explanations which contribute to sustaining the low sex ratio at various levels [36,37].

The matrix in Table 4 reveals the association of sex ratio with its determinants. It has been observed that overall sex ratio has the strong positive relationship with general rural and urban sex ratio (.891 and .721 respectively), BPL families (.518) whereas it is negatively associated with female literacy (.578), urbanization (.575) and dowry deaths (.456) and female marriage below eighteen years. Surprisingly, the literacy rate of females puts a negative impression on all types of observed male-female sex ratio. Except for women education, urbanization and dowry death, rural sex ratio is positively coupled with all variables either strongly or weakly.

Table 4: Matrix Correlations

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
X_1	1	.891**	.721**	0.229	0.329	0.118	-.578**	.518*	0.232	-0.109	-.575**	-.456*
X_2	.891**	1	0.378	0.137	0.161	0.116	-0.428	0.421	0.19	-0.063	-0.426	-0.266
X_3	.721**	0.378	1	0.369	.515*	0.167	-.662**	0.401	0.145	0.016	-.560**	-0.351
X_4	0.229	0.137	0.369	1	.939**	.896**	-.534*	-0.166	-0.195	0.25	0.135	-0.151
X_5	0.329	0.161	.515*	.939**	1	.781**	-.652**	0.044	-0.03	0.156	-0.132	-0.18
X_6	0.118	0.116	0.167	.896**	.781**	1	-0.387	-0.283	-0.291	0.253	0.277	-0.249
X_7	-.578**	-0.428	-.662**	-.534*	-.652**	-0.387	1	-0.417	0.145	-0.393	.698**	0.107
X_8	.518*	0.421	0.401	-0.166	0.044	-0.283	-0.417	1	.567**	-0.069	-.758**	-0.042
X_9	0.232	0.19	0.145	-0.195	-0.03	-0.291	0.145	.567**	1	-.562**	-0.27	-0.071
X_{10}	-0.109	-0.063	0.016	0.25	0.156	0.253	-0.393	-0.069	-.562**	1	-0.032	0.327
X_{11}	-.575**	-0.426	-.560**	0.135	-0.132	0.277	.698**	-.758**	-0.27	-0.032	1	0.067
X_{12}	-.456*	-0.266	-0.351	-0.151	-0.18	-0.249	0.107	-0.042	-0.071	0.327	0.067	1

Note: *** Correlation is significant at the 0.01 level (2-tailed).*

** Correlation is significant at the 0.05 level (2-tailed).*

Note: *X_1= Overall sex Ratio(OSR) 2011, X_2= Overall Rural Sex Ratio(ORSR) 2011, X_3= Overall Urban Sex Ratio(OUSR) 2011, X_4= Overall Child Sex Ratio(OCSR) 2011, X_5= Overall Rural Child Sex Ratio (ORCSR) 2011, X_6= Overall Urban Child Sex Ratio (OUCSR) 2011, X_7= Female Literacy Rate 2011, X_8= Having BPL Card in Percent, X_9= Percentage of SC Population, X_{10}= Percentage of Females marriage below 18 years, X_{11}= Urbanisation, $X_{12=}$ Dowry Deaths.*

The very high positive attachment of overall child sex ratio has been seen with pastoral and urban CSR with a value of 939 and 896 in that order. The urbanization has affected negatively to sex ratio mainly due to exposure of easy and frequent accessibility of prenatal sex determination, illegal abortions and small family culture whereas with regard to these facets, rural area can be said in the slight comfort zone as compared to urban.

CONCLUSION

The preceding discussion results out that continuous passing off girls are not the only result of more affection of traditional society with a boy but technological development is equally responsible for this. The effortless accessibility of skilled or unskilled prenatal sex diagnose and illegal abortion of female foetus by ignoring ethics of medical profession are persistently helping in missing girls from child populations whereas in adolescence, high mortality rate, especially maternal, due to poor nutrition, honour killing in some socially backward areas of the state, safety of girls, dowry expanses makes the problem more complicated. Of course, whole Haryana is facing the emergency of absenting girls but in some districts like Mahendargarh, Rewari, Jhajjar and Sonipat the situation is more critical. It leads to intricate social changes and increases the incidents of trading girls as wives, dishonour of females etc. Though recent census has shown some upgrading in the ratio of females yet there is a long way to ahead. So there is an urgent need to aware the people about irreparable consequences of ignoring such significant counterpart of the society without which there is no human existence. Of course, a woman is an incarnation of many relations rather than a single identity. Therefore it is the necessity to propose and implementations of strict rules to upgrade the female's numbers through administration and other socio-cultural groups but every plan demands individual support for success. In précised, at the household level, if a person starts to deem that daughters are a pride rather than a trouble, definitely an ideal and balanced civilization will take place automatically.

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