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From Editor's Desk

JIAFM

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Dear Readers,

Namaskar!

It gives me great pleasure to put the 2nd issue of this year's Journal in your hands. It has been a daunting task to send the manuscripts for review, receive the comments of the reviewers, pass them on to the authors for corrections, coaxing them to send the corrected version soon, having these re-reviewed, re-corrected etc etc .

Once the manuscripts were, as per the reviewers, OK for printing, the editorial team would then proceed with correction of language, grammar and syntax etc., in addition to rearranging the Bibliography as per the Journal pattern.

We have been slogging for 5-6 hours per day, almost daily, to complete the task in time for publication of this issue. Just understand how difficult it was to get the corrections done - of the 54 manuscripts sent for review and corrections, **12 were withdrawn** by the authors citing one reason or the other!!

The Editorial team has had immense support of the reviewers who spared time from their busy schedule to review the manuscripts again and again and send their comments till the manuscripts attained levels of their satisfaction. I, on behalf of my team, whole heartedly thank the reviewers. As a token of our gratitude, **we are publishing the names of all the reviewers along-with their affiliations, in alphabetical order.**

The "**instructions to the authors**" have been uploaded on the Journal section of the Academy's Website. They are also being published in this issue of the Journal. Henceforth, only those manuscripts which fulfill the requirements, as per these instructions, will be accepted for consideration for publication. It has now been mandated by various scientific bodies and organisations that **all Original Research Manuscripts should have clearance from the respective Institutional Ethics Committee.**

If you see any improvement in the standard of manuscripts, it is because of the combined efforts of all involved. I personally take the onus for any inadvertent lapses in the articles published.

Jai Hind & Long Live IAFM!

Dr. Dasari Harish
Editor, JIAFM

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Editorial

Medical Profession in the Present Times - "All is Not Well"

How much do you think would it cost to get a tooth extracted? Well, it could be up to rupees 1,16,777 !! That is the bill handed over to a Kolkata resident, an employee of the BSNL, Kolkata, for getting his son's tooth extracted at a private hospital. The hospital says the extraordinary charge is because the patient developed complications and had to be shifted to the ICU. The total duration of hospital stay was 10 days, the child underwent 42 different tests and was given consultation by nine different doctors.[1] Whenever a patient goes to a different hospital for a second opinion for his condition, he is asked to repeat all the investigations that he got done on the advice of the previous hospital, however expensive, the investigations may be. He is told that this is routine in every hospital, as though the equipment/ machines etc would give different results in a different hospital. The harassment does not end here. The patients are subjected to unwarranted and excessive medications, procedures, surgeries, etc, on one pretext or the other with the aim of generating money at the cost of the patient's increasing financial burden. Many a times, the quality of nursing care given is substandard and in violation of patient's human rights.[2]

One of the best examples of the greed on part of the doctors is the Infamous kidney scams. These kidney scams came to light in our country way back in 1995, when on 29th Jan 1995, police busted a massive racket in Bangalore, in which it was found that kidneys of nearly 1000 unsuspected people were removed by prominent surgeons of the city in a leading hospital; most of the alleged victims being young men.[3] Because of the illegal trade in Kidneys, a rehabilitation colony near Chennai, Villivakkam was renamed "kidney vakkam".[4] How can we forget the infamous Punjab Kidney Scam of the early 2000s which is said to be worth around \$3.5 million. The chief perpetrators of this scam were the then Principal and the HOD, Forensic Medicine, GMC, Amritsar; along with Dr. P.K. Sareen of Ram Saran Kakkar Hospital, Amritsar, the master-mind. [5]

Medical Education - The National regulatory body of medical education, the MCI, has been termed to be synonymous with corruption. Each and every step of setting up of a private medical colleges is alleged to involve huge amounts of money changing hands. The Ex-president of MCI, Dr Ketan Desai was put behind bars by the CBI, citing innumerable charges of corruption.[6] The MCI was disbanded and a "Board of Governors", was established by the Government to stem the corruption.[7] Later on, in 2013, the MCI was reconstituted; however, on the directions of the Hon'ble Supreme Court, a 3 member committee comprising of Justice (Retired) RM Lodha, Dr. Shiv Sareen of the Institute of Liver and Biliary Sciences (ILBS) and former CAG Vinod Rai was constituted on 2nd May 2016, to oversee the functioning of the MCI.[8] The mushrooming of private medical colleges has drastically brought down the quality of medical education in the country, be it UG or PG. If you cannot clear the competitive entrance exam, do not worry; you can always buy a seat – a UG seat may cost you up to 50-70 lakhs and a PG seat in some of these colleges can make you poorer by about 2-3 crores of rupees. One important question here is – where does this sort of money come from ?? No regular, "above board" practice can earn this kind of money. Again, a doctor who has shelled this sort of money to get his degrees, will enter the field with only one goal in mind – to earn the money back and with interest

Then there is the problem of "Ghost teachers" - teachers who are present on paper but never attend the college/ hospital. Recently, the President of Punjab Medical Council, Dr GS Grewal, issued an official release in which he named four medical colleges with about 400 ghost teachers, including Maharishi Markandeshwar University, Ambala; Maharishi Markandeshwar University, Solan, Adesh Institute of Medical Sciences & Research, Bathinda and Gian Sagar Medical College, Banur. Just the MMU had around 320 ghost faculty members.[9] PGI, NEET and AIPMT exams, among others, have had to be cancelled at times and the strict security measures being employed by the authorities at the centers of exam now a days only emphasizes that the so called "examinees" can go to any level to secure seat. If this is not corruption, what is ? **Government hospitals:** There is poor infrastructure and shortage of qualified personnel in most government hospitals in the country. In some of these hospitals, touts lurk in the corridors and everything from a hospital bed to investigations, surgeries, etc is up for sale and is available for a price.[10] MRIs, CAT Scans, and other costly investigations are invariably got done and from outside even when such facilities are available in-house. This is so because of the up to 30 - 40% commission that the lab gives the prescribing doctor, whether he is from a govt. setup or private..

Corporate hospitals: The corporate hospitals have completely changed the health care scenario. As per the "Network of Doctors for ethical, rational and de-commercialized Health Care", "The once God like doctors has metamorphosed into a commercial, profit oriented businessman...". "Doctors in these hospitals are given targets – admitting so many patients per day, getting so many investigations done, etc. So the minute a patient walks in, the doctor wonders how to get him admitted or prescribe more investigations / medicines than are necessary, so as to meet the targets".[11] Such hospitals also enter into a commission based contract with the doctors wherein a doctor gets a certain share of the income generated by him, thereby further motivating him

to generate more income at the expense of the patients. The doctors generating maximum income for the hospitals are rewarded in the form of cars / foreign tours etc. The actual "health care" takes a back seat in all these cases.

Pharmaceutical companies: The nexus between pharmaceutical companies and doctors is well known and frightening. According to Padma Bhushan Dr. B M Hegde, (Cardiologist, author, FRCP, FACC, FRCGP, MRCP, FAMS, B C Roy awardee, etc), "Doctor has become a menace on the society..... Unless we delink medicine from money, this medicine will kill mankind.... Today medicine is the biggest industry in the world. "Cholesterol lowering" alone is a 1.72 trillion dollar business. One company which sells cholesterol lowering drugs gets an average profit of 15-18 billion dollars. A cardiac stent is manufactured at an average cost of 10 dollars apiece, but is sold for at least 2000 dollars. The budget is - 500 dollars – doctor's hospitality and company's profit is the rest 1490 dollars per stent.... The change has to come from within and the future generations have to be taught not to be as greedy as we are now. It is the human greed that kills another human being".[12]

Some of the top doctors from reputed medical research institutes are alleged to be in nexus with various national and international drug manufacturers in getting "clinical trials" done for these companies and issuing reports in favour of the companies at the cost of the patient's lives..... "These doctors wrote that clinical trials were not even required for the drug. Is it sheer co-incidence that doctors, sitting hundreds of miles away from each other, gave opinions on a drug which is word-by-word identical?" the Parliamentary Standing Committee on health and family welfare asked.[13]

Other Instances: We are now faced with the pandemic "selective feticide". In almost every state of the country, particularly the Northern Regions, the sex ratio has dangerously tilted towards the male gender. Doctors have an all important role to play in this crime – right from determination of the gender of the fetus to aborting it. The many Acts that had to be brought into force and their failure to put an end to this declining ratio only shows that we, as doctors, have failed miserably in the eyes of the society. It is raining hospital advertisements - from pamphlets about slashed rates for check-ups, procedures and IVF - falling out of morning newspapers to sentimental, tearjerker ads about cancer treatment, surgeries, and ophthalmological procedures, replacement surgeries, etc on television and radio, day in and day out. This despite the MCI regulations forbidding a doctor to advertise.

This does not speak of the whole community of the Medical Professionals, a great majority of whom still tend to the patients with utmost sincerity and in "Good Faith". However, the scenario is changing towards the bad, day by day. The general public, on the other hand, has become demanding, aggressive and abusive towards doctors. We read and hear about numerous instances of doctors being manhandled, assaulted and even murdered by the patient's, relatives, etc on even the slightest provocation or, sometimes, no provocation at all.

All this speaks of one important fact, **"All is not well with the Medical Profession in the present times"**

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Dr Dasari Harish
Editor in Chief

Original Research Paper

Estimation of Stature from Percutaneous Length of Radius

¹Pratik R. Varu, ²Krunal N. Pipaliya, ³H. M. Mangal, ⁴Viral J. Aghera, ⁵Dipen M. Dabhi, ⁶Milind N. Patel**Abstract**

Whenever unknown or decomposed or mutilated dead bodies or dismembered body parts or skeletal remains are found, first step of police investigation is to establish identity of deceased. Determination of stature from dismembered body parts can play vital role for identification of person. Present study can be helpful there to estimate stature from percutaneous length of Radius, when isolated forearm is found. Present study was done to derive regression formula and multiplication factor to estimate stature from percutaneous length of Radius for population in and around Rajkot region of Gujarat. Total 100 male and 100 female cases were randomly selected from cadavers brought for post-mortem examination at mortuary of P. D. U. Govt. Medical College and Hospital, Rajkot. Stature was measured with measuring tape and percutaneous length of Radius was measured by Sliding caliper after breaking Rigor mortis, if developed. Collected data were statistically analysed using software like Epi info 7 and Microsoft excel 2007. There was no significant bilateral difference in percutaneous length of Radius ($p > 0.05$). Mean stature as well as mean percutaneous length of Radius were significantly higher for male than for female ($p < 0.05$). Regression formula and multiplication factor derived in present study are useful for population in and around Rajkot region of Gujarat to estimate stature from percutaneous length of Radius..

Key Words: Identification, Corpus Delicti, Stature, Percutaneous length of Radius

Introduction:

"In the social jungle of Human existence, there is no feeling of being alive without a sense of Identity" – Erik Erikson (Well-known American Psychologist) As stated above, Identification is matter of utmost importance for every human being. Even in investigation of any crime, identification plays a vital role as it is prime component of **Corpus Delicti i.e. Essence of crime**. [1] Proper identification of a body is one of the key questions to be answered when unknown or decomposed or mutilated dead bodies are found or when skeletal remains or dismembered body parts are found.

To establish identity of person is difficult task for crime investigating agencies in such cases. Autopsy Surgeon plays major role there

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as they can provide a tentative identification of unknown remains by formulating a 'biological profile', which involves the estimation of sex, stature, age and ethnicity. [2] Among this 'big four' of the biological profile, estimation of stature is considered as one of the main parameter of personal identification in forensic examinations. Stature can be measured by anatomical or Fully method and mathematical method. Anatomical or Fully method reconstructs stature by summing the measurements of the skeletal elements that contribute to stature and adding a correction factor for the soft tissues.

Mathematical method derive regression formula and multiplication factor to estimate stature from bone or body part. Anatomical method is more accurate, however, for forensic purpose, mathematical method is more useful as it can be applied even when only part of the body is available. But due to difference in body proportions between populations such as the relative lengths of the limbs and trunk, population-specific regression formula and multiplication factor should be used for this purpose. [3] Keeping this in view, present study was carried out to derive regression formula and multiplication factor to estimate stature from percutaneous length of Radius for population in and around Rajkot region.

Material and Method:

This study was carried out on 100 male and 100 female cases randomly selected from cadavers brought for post-mortem examination at mortuary of P. D. U. Govt. Medical College and Hospital, Rajkot. Age group selected for the study was more than 20 years as till the age of 20 years epiphyseal union is completed in Radius, so after 20 years of age percutaneous length of Radius do not change.[4] Cadavers with any injury, disease or anomaly that affect percutaneous length of Radius or stature were excluded from the study. The bodies that were decomposed, charred or mutilated were also excluded from the study. Measurements were taken up to nearest 0.1 cm as below after breaking rigor mortis, if developed.

Stature: The body was placed in supine position on a flat, hard surfaced autopsy table. Head was fixed in such way that Frankfort plane remains at right angle to autopsy table. Frankfort plane is defined as plane adjoining the upper margin of the ear openings and lower margin of the orbit of the eyes.[5] Knee and hip joints were kept extended, and the neck and feet were kept in neutral position. Stature (Total Body Length) was measured between the vertex of the head and the heel using a measuring tape.

Percutaneous length of Radius:

Forearm of the deceased was made extended and then pronated and supinated alternately to locate and mark head of Radius. Percutaneous length of Radius was measured as a straight distance between head of Radius and tip of Radial styloid process by sliding caliper.

Statistical Analysis:

All the measurements were statistically analysed using software like Epi info 7 and Microsoft Excel 2007. The data was analysed for male and female cases separately as well as for total cases i.e. both sexes together. Result of data analysed for total cases can be applied to estimate stature from percutaneous length of Radius, when sex cannot be identified. Pearson correlation coefficient (r) was calculated to assess the correlation of stature with percutaneous length of Radius. Independent samples T-test was applied to determine statistical significance of bilateral difference in percutaneous length of Radius as well as to determine statistical significance of gender differences in stature and percutaneous length of Radius. P-value of less than 0.05 was considered significant. Regression formula and multiplication factors were derived to estimate stature from percutaneous length of Radius.

Observations and Results:

Table-1 is showing descriptive statistics of all the cases. It is evident from the table that mean of stature and of percutaneous length of both Radius are higher for male than for female. Gender difference in stature as well as in percutaneous length of both Radius is statistically confirmed by applying t-test as shown in table-2 ($p < 0.05$). It is evident from the **Table - 1** that mean of percutaneous length of right Radius is more than mean of left Radius. However, statistically there is no significant bilateral difference in percutaneous length of Radius as shown in table-3 ($p > 0.05$).

Table-4 is showing correlation of percutaneous length of Radius with stature. Percutaneous length of Radius of both sides are showing positive and significant correlation with stature in both sexes ($p < 0.001$).

Simple regression formula when sex is known:

• For male

1. From pcl of right radius

$$\text{Stature} = 83.579 + 3.143 \times \text{pcl radius}$$

2. From pcl of leftradius

$$\text{Stature} = 87.069 + 3.042 \times \text{pcl radius}$$

• For female

1. From pcl of right radius

$$\text{Stature} = 67.773 + 3.549 \times \text{pcl radius}$$

2. From pcl of leftradius

$$\text{Stature} = 75.031 + 3.271 \times \text{pcl radius}$$

Simple regression formula when sex cannot be identified:

1. From pcl of right radius

$$\text{Stature} = 47.020 + 4.492 \times \text{pcl radius}$$

2. From pcl of leftradius

$$\text{Stature} = 50.174 + 4.409 \times \text{pcl radius}$$

Mean multiplication factor when sex is known:

• For male

1. From pcl of right radius

$$\text{Stature} = 6.36 \times \text{pcl radius}$$

2. From pcl of leftradius

$$\text{Stature} = 6.43 \times \text{pcl radius}$$

• For female

1. From pcl of right radius

$$\text{Stature} = 6.44 \times \text{pcl radius}$$

2. From pcl of leftradius

$$\text{Stature} = 6.51 \times \text{pcl radius}$$

Mean multiplication factor when sex cannot be identified:

1. From pcl of right radius

$$\text{Stature} = 6.40 \times \text{pcl radius}$$

2. From pcl of leftradius

$$\text{Stature} = 6.47 \times \text{pcl radius}$$

Table-5 is showing comparison of stature estimated by regression formula with

stature estimated by mean multiplication factor. Standard deviation (SD) measures amount of dispersion from mean value. It is evident from the table that mean stature estimated by regression formula as well as by multiplication factor are very nearer to mean measured stature. However, SD of stature estimated by mean multiplication factor are higher than SD of stature estimated by regression formula, which means stature estimated by mean multiplication factor is showing more dispersion from its mean value. So, though both regression formula and multiplication factor estimate stature nearly similar to actual measured stature, regression formula measures stature more precisely than mean multiplication factor. Moreover, there is very little difference between statures estimated from percutaneous length of Radius of right side and left side, which means that there is no need to derive side specific regression formula and mean multiplication factor.

Discussion:

The main objective of this study is to find out correlation between percutaneous length of Radius with stature and to use result of this study as a base for developing stature estimation standards specifically for population in and around Rajkot region of Gujarat. Several such studies have been carried out in past for population of different parts of India.

Hallikeri VR et al.[6] studied 300 South Indian students (150 males and 150 females) of age group between 20 to 30 years. They found positive correlation between stature and percutaneous length of Radius in both sexes ($r=0.570$ and 0.588 for right and left Radius respectively in males, $r=0.517$ and 0.477 for right and left Radius respectively in females, $p<0.001$). They did not find statistically significant bilateral difference in percutaneous length of Radius in both sexes ($p>0.05$), but they found statistically significant gender difference in stature as well as percutaneous length of Radius ($p<0.001$).

Nagesh KR et al.[7] studied 100 South Indian medical students (50 males and 50 females) of age group between 18 to 24 years. They took percutaneous length of only right Radius for the study. They found positive correlation between stature and percutaneous length of Radius in both sexes in their study ($r=0.630$ and 0.560 for males and females respectively, $p<0.05$).

Pal DC et al.[8] studied 510 Bengali adult males of age group between 21 to 50 years. They found strong correlation between

stature and percutaneous length of right and left Radius ($r=0.974$ and 0.971 respectively, $p<0.001$). They did not find statistically significant bilateral difference in percutaneous length of Radius ($p>0.05$).

Borkar MP et al.[9] studied 200 undergraduate and postgraduate medical students of age group between 20 to 30 years from western region of Maharashtra. They found positive correlation between percutaneous length of Radius and stature in both sexes ($r=0.846$ and 0.829 for right and left Radius respectively in males, $r=0.675$ and 0.642 for right and left Radius respectively in females, $p<0.05$).

From comparison of these studies, it is evident that all the studies have found positive correlation between percutaneous length of Radius and stature, which means that percutaneous length of Radius is useful parameter to estimate stature. None of the study found significant bilateral difference in percutaneous length of Radius. All the studies show significant gender difference in mean stature as well as in mean percutaneous length of Radius. Table 6 shows comparison of mean stature and mean percutaneous length of both Radius in these studies. It is evident from the table that all the studies have found different mean stature as well as mean percutaneous length of Radius except studies carried out by Hallikeri VR et al.[6] and Nagesh KR et al [7], both of which were carried out on south Indian population. This findings substantiate well known fact that different population shows difference in stature as well as in body proportions, so population and sex specific regression formula and multiplication factor are required for accurate stature reconstruction from percutaneous length of Radius

Conclusion:

In present study, mean stature estimated by regression formula as well as by multiplication factor are similar to mean measured stature in both sexes, however, regression formula measures stature more precisely than mean multiplication factor. So, regression formula as well as multiplication factor derived from present study can be used to estimate stature of deceased person from percutaneous length of Radius when dismembered forearm is found, but regression formula will give more accurate result.

There is no significant bilateral difference in percutaneous length of Radius, so there is no need to derive side specific

regression formula and mean multiplication factor.

Mean stature as well as mean percutaneous length of Radius are significantly higher for male than for female, so sex specific regression formula and mean multiplication factor should be derived. Present study has derived regression formula and multiplication factors for male and female cases separately as well as for total cases i.e. both sexes together. Regression formula and multiplication factor derived for total cases can be applied to estimate stature from percutaneous length of Radius, when sex cannot be identified. However, sex specific regression formula and multiplication factors can estimate sex more accurately.

As different population show difference in stature as well as in body proportions, results of present study are applicable to population in and around Rajkot region of Gujarat.

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Table1: Descriptive Statistics (mean \pm sd)

Parameter	Male	Female	Total cases
Stature	165.57 \pm 6.59	151.02 \pm 5.69	158.30 \pm 9.53
Pcl of right radius	26.09 \pm 1.42	23.46 \pm 0.99	24.77 \pm 1.80
Pcl of left radius	25.81 \pm 1.46	23.24 \pm 1.04	24.52 \pm 1.81

Table 2: Comparison for gender difference in stature and percutaneous length of radius

Parameter	Mean		T value	P value*
	Male	Female		
Stature	165.57	151.02	16.712	0.000 (s)
Pcl of right radius	26.09	23.46	15.196	0.000 (s)
Pcl of left radius	25.81	23.24	14.349	0.000 (s)

*p value<0.05 is significant and p value<0.001 is highly significant.

Table 3: Comparison for bilateral difference in percutaneous length of radius

Cases	Mean pcl of		T value	P value*
	Right radius	Left radius		
Male	26.09	25.81	1.350	0.178 (ns)
Female	23.46	23.24	1.538	0.126 (ns)

*p value<0.05 is significant

Table 4: Correlation of percutaneous length of radius with stature

Percutaneous length of	Pearson correlation coefficient (r)*	
	Male	Female
Right radius	0.676	0.619
Left radius	0.675	0.597

*p value is less than 0.05 for all.

Table 5: Comparison of stature estimated by regression formula and by mean multiplication factor (mean \pm sd)

Parameter	Male	Female	Total cases
Measured stature	165.57 \pm 6.59	151.02 \pm 5.69	158.30 \pm 9.53
Stature estimated by regression formula			
Pcl of right radius	165.56 \pm 4.45	151.02 \pm 3.52	158.29 \pm 8.07
Pcl of left radius	165.58 \pm 4.45	151.03 \pm 3.40	158.29 \pm 7.97
Stature estimated by mean multiplication factor			
Pcl of right radius	165.90 \pm 9.01	151.09 \pm 6.39	158.53 \pm 11.49
Pcl of left radius	165.96 \pm 9.41	151.26 \pm 6.77	158.66 \pm 11.70

Table 6: Comparison of present study with other similar studies

Author	Mean stature (mean \pm sd)		Mean pcl of radius (mean \pm sd)			
			Male		Female	
	Male	Female	Right	Left	Right	Left
Hallikeri vr et al ⁶	171.4 \pm 5.51	160.3 \pm 6.04	26.1 \pm 1.23	25.7 \pm 1.33	23.5 \pm 1.88	23.8 \pm 1.17
Nagesh kr et al ⁷	173.61 \pm 6.97	160.04 \pm 5.43	26.73 \pm 2.07	-	24.33 \pm 0.17	-
Pal dc et al. ⁸	164.2 \pm 7.50	-	25.8 \pm 1.34	25.7 \pm 1.34	-	-
Borkar mp et al ⁹	173.8 \pm 8.80	157.6 \pm 7.98	26.24 \pm 2.12	26.13 \pm 2.15	23.99 \pm 1.65	23.89 \pm 1.67
Present study	165.57 \pm 6.59	151.02 \pm 5.69	26.09 \pm 1.42	25.81 \pm 1.46	23.46 \pm 0.99	23.24 \pm 1.04

Original Research Paper

Rim and Wall of sternal rib ends, a specific approach to justify age

¹Sunil M. Doshi, ²Pratik M. Doshi

Abstract

Study of age dependent morphological changes in varieties of bones is a distinguished way to justify age, especially for ages beyond thirties. This study was carried out to discover various changes at sternal rib ends of fourth ribs with special attention to the rim and wall, as well as to correlate them with the age of an individual. Special focus was given to ascertain any bilateral variability for the same. Total 170 ribs were collected from male dead bodies out of which 140 ribs belonged to 70 cases were included as study materials. Each rib was classified according to different stages of Rim and Wall morphology. The data derived were statistically analysed. It is concluded that changes of rim and wall at sternal end of fourth ribs are age dependent. With the advancing age, Rim changes from its smoothness towards the well-defined scallops formation to ill-defined scallops and Wall changes from its appearance to its increasing thickness and then towards its structural deterioration with bony projections. There is no any significant bilateral variation seen in changes of rim and wall according to age.

Key Words: Rim, Wall, Sternal end of fourth rib, Gender, Age

Introduction:

Multiple Methods are available based on age dependent morphological changes. Popular among these are skull suture closure,[1] pubic symphysis method of Suchey-Brooks,[2] auricular surface method of Lovejoy, [3] Lamendin's dental technique[4] and Işcan et al. method for fourth ribs.[5] Age estimation from sternal end of rib is one of the emerging methods of identification as far as an anonymous dead body is concerned. Ribs have been studied in many ways to justify age. Studies involving fourth ribs for age estimation are basically divided into components method and phase method. Components method is subdivided into three parts- pit depth, pit shape and rim and wall configuration. Each of these components follows specific changes with advancing age i.e. pit depth increases, pit shape changes from 'V' to 'U' to 'wide mouth U'[6] and Rim and wall changes, but the accuracy of

predicting age by individual component is different.

It is documented that rim and wall changes are most accurate criteria for age estimation followed by pit shape. [7] Phase analysis method involves all these three criteria combined in a complex manner into each phase and classifies ribs into nine phases. So it is apparently difficult task, especially with inexperienced eyes. Işcan and loth studied metamorphosis at sternal rib end in white males and found pit shape and rim and wall configurations yielded better results than absolute pit depth alone [5] This study basically focused on age wise changes in rim and wall at sternal end of fourth ribs in males and to check for any bilateral variability.

Material and Methods:

Materials for the present study were consisted of fourth ribs from both sides especially medial ends. Rib ends were obtained from the male dead bodies brought at the mortuary for post-mortem examination. Proper history was taken in every case to exclude any chest deformity and/or hormonal disorder, which could affect the ossification at the medial end of rib. The information about the age of the deceased was obtained from the nearest relatives and investigating officer which was verified by necessary documents. Informed consent was taken in each case.

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Dissections were carried out with "I" shape incision and flaps of skin and muscular tissues were pulled by side to expose bony rib cage. After identifying fourth Ribs, two horizontal incisions were made on intercostal muscles to separate the fourth rib from others. The Ribs were removed by cutting them with rib shears, 5 to 6 centimetres away from the costo-chondral junction. After removing excessive muscular tissues, ribs were soaked in plain water in a container with identity tag for several days. All soft tissues and costal cartilage were then easily removed. In those cases where costal cartilage could not be removed easily, rib ends were boiled in plain water.

Total 170 ribs were collected from 85 male bodies of age more than 17 years. Out of 170 rib ends 30 rib ends of 15 cases were discarded due to total damage of rib ends during the process of removing cartilage. 140 rib ends were studied with special attention to morphological features of rim and wall at sternal end. The Ribs were classified according to the stages, described below. (Table 1)

Observation and Results:

Each rib was classified according to the stage as described in material and methods. Mean ages were derived for different stages along with standard deviation and standard error. One way ANOVAs test were applied to find F-ratios as well as significance value.

Table-2 shows age wise distribution of the cases. Youngest sample for age was of 17 years and oldest sample for age was of 70 years.

As per the data of **Table-3**, mean age increased as the stage increased in both sided rib ends. Maximum number of samples were found with stage 3 (45.71%) bilaterally. No any sample was found with stage 1 and stage 6 on either side. (Photograph-2 showing stage 1 and stage 6 samples were belonged to female ribs just to define appropriate stage and were not included in the present study) According to **Table-4**, F -ratio was 49.191 and p-value was 0.000 for the left sided ribs and F-ratio was 53.184 and p-value was 0.000 for the right sided ribs.

Paired T test was applied to find bilateral variations in rim and wall changes at sternal end of fourth rib according to age. The correlation coefficient was 0.999 for the same. Correlation coefficient of more than 0.8 is suggestive of strong correlation. So it is concluded that Rim and wall changes at sternal end of fourth rib according to age have no any significant bilateral variation.

Discussion:

In a study done by Iscan et.al[5] on white males, mean ages for various stages were 17.8, 24.1, 34.3, 49.5 and 58.2 years; accordingly in the present study mean ages were 20.25, 35.56, 51.43 and 66.11 years, indicates that mean ages are approximately 2, 11, 17 and 16 years older in the present study.

In a study done by Tyagi et al[7] on left sided ribs, Mean age for stage 2 was 29.00 years, stage 3 was 36.41 years, while in the present study mean age for stage 2 was 20.25 years and stage 3 was 35.56 years, indicates that mean age is approximately 9 years younger for stage 2 and approximately 1 year younger for stage 3 in the present study. Mean age for stage 4 was 43.33 years in Tyagi et al.[7] while in the present study mean age for stage 4 was 51.60 years, indicates that mean age is approximately 8 years older in the present study for stage 4.

In a study done by Tyagi et al[7] on right sided ribs, Mean age for stage 2 was 29.11 years, stage 3 was 36.23 years, while in the present study mean age for stage 2 was 20.25 years and for stage 3 was 35.56 years, indicates that mean age is approximately 9 years younger for stage 2 and approximately 1 year younger for stage 3 in the present study. Mean age for stage 4 was 45.00 years in Tyagi et al.⁷ while in the present study mean age for stage 4 was 51.43 years, indicates that mean age is approximately 6 years older in the present study for stage 4.

It is evident from the Graph-1; Changes at the rim and wall of sternal rib ends are age dependent. There are significant differences in mean ages derived from different studies, which is an indication of geographical influence over the age dependent changes at sternal rib ends.

There are various methods available for establishment of age at death, but the accuracy of the methods has an inverse relationship with the age. It is documented, greater the personal age the less the confidence quotient.[8] The final range of the age to give opinion in legal matters can be narrowed if multiple methods for age estimation applied at once. Furthermore, it cannot be assumed that a method developed from one group of population is applicable to geographically distant population.[9] Martrille et al. studied different techniques for age estimation and concluded, pubic symphysis method of Suchey-Brooks[2] was the most accurate for young adults, Lamendin's dental technique⁴ was the most accurate for middle adults and over the age of 60, all methods are highly inaccurate, although Iscan et al.[5] method for ribs gives the lowest inaccuracy.¹⁰ In

fact, no any single skeletal indicator of age is accurate for all age groups. One must consider different techniques for different age groups.

Age estimation based on this study alone can give only a gross idea regarding age, but combined with the criteria of pit shape and pit depth of sternal rib end will definitely add more accuracy. Moreover, this method of age estimation is based on qualitative assessment that cannot exclude inter-observer variations, but this can be reduced by gradual experience to identify every rib with a specific stage and to discuss minute findings and their interpretations with justification among the colleagues. Future studies should be conducted at respective regions to compare and identify geographical variations and to evolve specific standards for that region.

Conclusion:

Changes of rim and wall at sternal end of fourth ribs are age dependent. Early twenties show beginning of scallops and wall formation. Ages of third decades show well developed scallops and thick sturdy wall. At forties, scalloping of rim will decrease with thinning of the walls and at advanced ages of the fifties and sixties, rim will become sharper with structural deterioration of walls with bony projections. There is no any significant bilateral variation seen in changes of rim and wall according to age. Comparison of the mean ages with the data of previous studies indicates that geographical variations must be looked for at the time of application of this method in legal matters.

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Table-1 Morphological stages of rim and wall at sternal end of fourth ribs

	RIM	WALL
STAGE 1	Smooth rim	No wall
STAGE 2	Definite rim with beginning of scallops formation	Beginning of wall formation
STAGE 3	Well defined Scallops are present	Thick and sturdy wall
STAGE 4	Vague scallops at places	Thin and less sturdy but intact texture
STAGE 5	No scallop at all, Sharper rim with some bony projections	Thinner wall with deteriorate texture
STAGE 6	Very sharp and irregular rim with long bony projections especially at craniocaudal ends	Texture deteriorates further with porosity and friability.

Table-2 Age wise distribution of cases

Age Group in years	Total Numbers of cases
16-25	14
26-35	12
36-45	17
46-55	09
56-65	13
>66	05
Total	70

Table -3: Rim and wall staging of fourth rib and its statistical analysis.

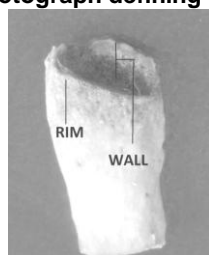
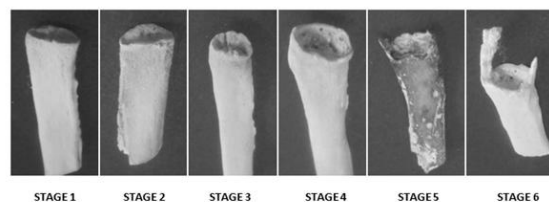
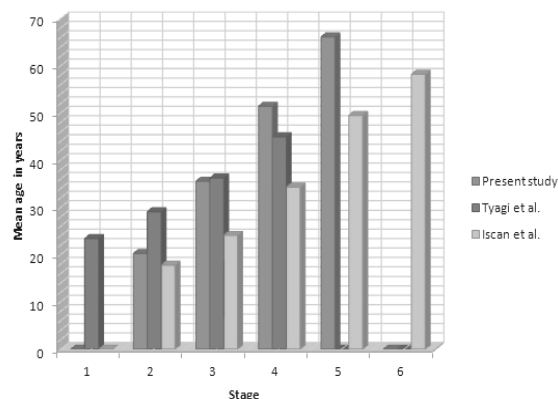
	Stage	N	Mean Age	SD	Std Err	Min.	Max.
L	1	00	-	-	-	-	-
	2	08	20.25	4.06	1.44	17	28
	3	32	35.56	10.35	1.83	19	70
	4	20	51.60	8.81	1.97	30	65
	5	10	64.30	6.77	2.14	48	70
R	1	00	-	-	-	-	-
	2	08	20.25	4.06	1.44	17	28
	3	32	35.56	10.35	1.83	19	70
	4	21	51.43	8.63	1.88	30	65
	5	09	66.11	3.82	1.27	58	70

(N=Number of samples, STD.ERROR=Standard error, L= Left, R= Right)

TABLE 4: One way ANOVAs for Rim and wall stages of fourth ribs.

		Sum of Squares	Df	Mean Square	F	Sig.
L	Between Groups	11909.225	3	3969.742	49.191	0.00
	Within Groups	5326.275	66	80.701		
	Total	17235.500	69			
R	Between Groups	12192.093	3	4064.031	53.184	0.00
	Within Groups	5043.407	66	76.415		
	Total	17235.500	69			

(Df=Degree of freedom, F=F-ratio, Sig.=significance, L= Left, R= Right)

Figure-1: Photograph defining Rim and Wall**Figure- 2: Photographs of Rim and Wall Chages at Sternal End of Fourth Rib****Graph-1: Graphical Presentation of Data Comparison**

Corrigendum

J Indian Acad Forensic Med. January- March 2016, Vol. 38, No. 1.

15. Determination of Stature by Palm Length in Central India Atul S. Keche, Prakash M. Mohite, Harsha A. Keche

Page No.55-58.

In the following tables, the **missing part** is marked in **BOLD** - present on page no. 58.

Table 2: Palm length in Central Indian population

Gender	N	Mean	Std. Deviation	Minimum	Maximum	p-value
Male	110	10.10	0.54	8.80	11.70	0.000,S
Female	120	9.10	0.53	7.80	11.10	

Table 5: Multiplication factor for palm length in central Indian population

Gender	Multiplication factor	Standard deviation	p-value
Male	16.94	0.70	Z value=5.57 p=0.000,S
Female	17.51	0.92	

Original Research Paper

Profile of Medical Negligence cases in India

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Abstract

In these present days of medical practice, patient doctor relation has deteriorated due to loss of trust and faith in medical fraternity. Increase in medical negligence cases is largely attributed to awareness of medical knowledge, rights of patient and also the rise in medical cost. In the present study 41 cases of medical negligence cases proved in National Consumer Disputes Redressal Commission/National Commission (NCDRC/NC) were studied. Objective of the study was to know the nature and pattern of deficiencies in service & related medical negligence cases. Medical negligence cases involving surgical procedure accounted for 33 cases (80%) and Medical treatment 8 cases (20%). Medical negligence cases most commonly proved in Obstetrics and gynecology i.e. 12 (29.2%) followed by Orthopedics i.e. 9 cases (21.9%) and then General Surgery 8 case (19.5%). Ophthalmology and Anesthesiology accounted for 5 cases each (12.1%). Hospitals were held negligent along with the consultants in 14 cases (34.4%) and Hospital alone in 1 case. Consultants were compositely held negligent in 10 cases (24.3%). Contributory negligence present in 1 case. 9 cases (30%) of res ipsa loquitur were found in our study. 9 cases (30%) were account for failure to take proper informed consent. Unqualified staffs were accounted for 5 cases (14.6%). In 13 cases (31.7%) medical records were not properly maintained by the hospitals. 20 Patients (48.7%) presumably died due to negligence of doctors. In 11 cases (26.2%) consultants failed to conduct the necessary investigation. In 6 (14.6%) cases consultants failed to manage postoperative complication.

Key Words: Medical Negligence, National Commission, Service

Introduction:

According to NABH (National Accreditation Board for Hospitals) ongoing study 98,000 deaths from medical injuries occur in India every year and medicolegal cases have gone upto 400 % in the Supreme Court in last 10 years according to legal resource, Manupatra.[1]

Medical negligence is the breach of a duty caused by the omission to do something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs would do, or doing something which a prudent and reasonable man would not do. The Bolam test is the standard of the ordinary skilled man exercising and professing to have that special skill. A man need not possess the highest expert skill; it is well established law that it is sufficient if he exercises the ordinary skill of

an ordinary competent man exercising that particular art.[2] The test for determining medical negligence as laid down in Bolam's case (1957) 1 W.L.R. 582 holds good in its applicability in India.[3]

The Supreme Court in Indian Medical Council v/s V.P. Shantha case[4] of 1995 decisively included the health profession under the section 2 (1) (0) of Consumer Protection Act (CPA). CPA includes all medical services offered by the private and government doctors and hospitals. It exempts only those hospitals and the medical practitioners of such hospitals, which offer free service to all patients at all times. In State of Haryana vs Santra[5] in which A woman gave birth despite sterilization operation. Apex court held "every doctor has duty to act with a reasonable degree of skill and care". In the case of Samira Kohli vs. Dr. Prabha Manchandathe(2008)[6], apex court held that Consent given only for a diagnostic procedure, cannot be considered as consent for therapeutic treatment. Consent given for a specific treatment procedure will not be valid for conducting some other treatment procedure. Failure to obtain consent for removal of the reproductive organs as performance of surgery without taking consent amounts to an unauthorized invasion and interference with the appellant's body which amounted to a tortious

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act of assault and battery and therefore a deficiency in service.

In Post Graduate Institute of Medical Education & Research, Chandigarh vs. Jaspal Singh & Ors (2009)[7], it was held that "wrong blood transfusion is an error which no hospital/doctor exercising ordinary care" would make. "Such an error is not an error of professional judgment but in the very nature of things a sure instance of medical negligence", said the Bench. Hon'ble Supreme Court in Nizam Institute Of Medical Sciences vs Prasanth S. Dhananka & Amp; Ors (2009)[8], a techie who found himself paralyzed waist down after a surgeon damaged his spinal cord during an operation to remove a tumour in the chest, was awarded Rs 1 crore in damages by the Hon'ble Supreme Court of India. This case is one of the best examples of Medical Negligence

In Poonam Verma vs. Ashwin Patel and Ors (1996)[9], the Supreme Court held that a person who does not have knowledge of a particular system of medicine but practices in that system is a quack. Where a person is guilty of negligence per se, no further proof is needed. In the case of V. Krishan Rao vs Nikhil Super Specialty Hospital (2010)[10], Petitioner wife was wrongly treated for typhoid fever instead of malaria fever, due to the wrong medication provided by the hospital. Finally, the verdict was given and Rao was awarded a compensation of Rs 2 lakhs. In this case, the principle of *res ipsa loquitur* was applied and compensation was given to plaintiff. Apex court also held that expert witness opinion should be taken in complicated or criminal negligence cases.

Corporate liability refers to deficiency of the hospital itself in providing safe and suitable environment for treatment as promised. Vicarious liability means the liability of employer for the negligent act of its employees. This principle was established in the case of Aparna Dutt vs. Apollo Hospital Enterprises Ltd (2002).[11] In a historic judgment in Nizam's Institute of Medical Sciences v. Prasanth S. Dhananka (2009)⁸ the Supreme Court held that "moreover, in a case involving medical negligence, once the initial burden has been discharged by the complainant by making out a case of negligence on the part of the hospital or doctor concerned, the onus then shifts on to the hospital or to the attending doctors and it is for the hospital to satisfy the Court that there was no lack of care or diligence".

Recently in Dr Balaram Prasad vs Dr Kunal Saha (2013),[12] the Supreme Court for first time recognized other heads of compensations: 'loss of consortium', 'punitive

damages', and ordered an unprecedented compensation of Rs 11.5 crore. Medical fraternity was surprised by this judgment in view of large amount of compensation. Rise in medical litigations and hefty amount of compensations lead to practice of defensive medicine which again raises the cost of medical treatment.

Now this is high time for introspection of medical profession to know what went wrong and how to rectify this. Our study highlights the causes for medical negligence that lead to litigation i.e. deficiency in medical service so that we can prevent these mistakes in future.

Aim: To study the nature and pattern/type of deficiency in service in med. negligence cases.

Materials and Methods:

National Consumer Disputes Redressal Commission's 100 judgments of alleged medical negligence cases from year 2009 to 2013 were selected randomly for study. After thorough study of judgments, 41 cases in which medical negligence was proved were selected for present study. NCDRC Judgments were accessed from ministry of consumer affairs, food and public distribution (Government of India) website <http://confonet.nic.in>. Various parameters such as medical subjects and consultant involved in medical negligence, hospital liability, consent, medical records, unqualified staff, investigative tests, operative skill and diagnosis, hospital facility, operative and postoperative complications, referral, advice, current update, time to attend patient, other deficiency in services etc were studied, tabulated and discussed.

Observations and Results:

Medical negligence is most common in obstetrics and gynecology (29.2%) followed by orthopedics (21.2%) and surgery (19.5%) (**Table 1**). Medical negligence is most commonly seen in surgical stream (80%) than medical stream (20%) (**Table 2**). Hospital were held negligent (corporate negligence) in 34.4 % cases (**Table 3**). Specialist were held negligent compositely in 24.3% cases (composite negligence) (**Table 4**). Among medical negligence cases 48.7% cases were deceased in which 3 cases underwent postmortem and postmortem not done in other 3 cases (**Table 5**). In 14 cases status of postmortem is not known. **Table 6** shows pattern/types of deficiency in service among medical negligence cases.

Discussions:

Medical Negligence among specialists:

Present Study shows that negligence cases were most common in Obstetrics and Gynecology specialty i.e. 12 cases (29.2%)

followed by Orthopedics i.e. 9 cases (21.9%) and General Surgery i.e. 8 cases (19.5%). The issues related to fertility and consent is likely reason for the rise in medical negligence cases observed in gynecology. Next common subject is orthopedics followed by General surgery.

The Law assumes that a medical person will always use reasonable degree of skill, care & prudence in the treatment of his/her patient. Negligence will be deduced when he/she failed to do to his patient, what his/her fellow practitioner of same standing, would not have. In our study cases involving surgical procedure accounted for 33 cases (80%) and medical cases 7 cases (20%). Cases involving surgical procedure have more likely chance allegation negligence as risk involved in these cases is also high and also require reasonable degree of surgical skill and expertise. This clearly indicating that surgical cases are more prone for patients grievances and allegations. This is probably in view of relatively more number of invasive procedures, possibility of blood loss and anticipated complications or insurgence of emergency problems.

Corporate Negligence (Vicarious liability):

Hospital were also held negligent along with consultants for negligence of its employees in 14 cases (34.4%). As patients pay very high fees for hospitality and professional services, expects high degree of care and facilities. Failure on part of corporate hospital either in providing infrastructure or employing incompetent consultants lead to negligence.

Composite Negligence:

In our study consultants were compositely held negligent in 10 cases (24.3%). Medical services specially surgical cases involve team work. Chief surgeon, Anesthetist, Assistant surgeons or as case may be involved in a surgical procedure. In such cases each negligent doctor, is jointly and severally liable to the patient for payment of the entire compensation.

Contributory Negligence:

Study revealed 1 case of contributory negligence in which patient not provided past medical history. Patients should reveal all their past medical problems, surgeries underwent, drug allergy, habits and family history to the doctors. Patients should also follow the instructions given and regularly attend and follow up.

Doctrine of Res Ipsa Loquitur:

Nine cases (30%) of Res Ipsa Loquitur were found in our study. In these cases burden of proof lies on doctors to prove they are not negligent, failing to do so, negligence is proved

against them. In case of operative deaths where relatives of patient don't know what happened inside operation theatre, so burden of proof lies on treating consultants to prove they have taken due care in performing surgery. In our study medical records itself shows negligence on part of treating doctors such as wrong diagnosis, unskilled surgery, and unqualified staff.

Consent:

In our study 9 cases (30%) were account for failure to take proper informed consent. Two or more persons are said to consent when they agree upon the same thing in the same sense. It is a known fact that examination and treatment of a patient without consent amounts to assault and also it is unethical practice. Hospital usually takes blanket consent during admission of patient which is invalid. After due information, results and consequences of treatment consent has to be taken by consultant himself or his junior staff but not by nurse or paramedical staff.

Regulation Number 7.16 of the Indian Medical Council Regulations 2002[13] mentions the criteria to be followed while taking consent before performing an operation.

Unethical Practice:

In our study 5 (14.6%) cases were accounted for unqualified staff, in which 3 doctors of AYUSH (Ayurveda, Unani, Siddha, and Homeopathy) were practicing allopathy. In one case dermatologist was practicing anesthesia which is unethical. Rural medical practitioner and compounder involved in unfair trade practice. It's unethical and illegal to practice other than our pathy. AYUSH (Ayurveda, Unani, Siddha, and Homeopathy) doctors should and must not practice allopathy or be employed in an allopathic nursing or corporate hospital. If they are allowed to practice allopathy certainly there will be increase in medical negligence cases. Again it's unethical and illegal to practice other specialties.

Medical Records:

In 13 cases (31.7%) medical records were not properly maintained by hospital. When a case of negligence is filed in a court of law, the court goes by what is written in the hospital record or clinical notes of that particular case. This record is the first hand evidence of all the details pertaining to the problems, investigations, procedures and medications advised to the patient. On many occasions it is seen that clinical notes are casually written in an illegible manner. Important positive and negative findings are not written. There is no clarity of instructions given and at times important procedures performed find no place in the records. Regulation Number

1.3 of the Indian Medical Council Regulations 2002[13] deals with how medical records should be maintained.

Diagnostic Investigations:

In 11 cases (26.2%) consultants failed to conduct proper diagnostic investigation. Regulation Number 3.1.2 of the Indian Medical Council Regulations 2002[13] clearly mentions the approach to be followed by a physician while investigating a patient. Attending patient in time and eliciting proper personal or family history is important in diagnosis of patient. Laboratory facilities must be available in hospitals.

Postoperative care and follow up and referral of Patients: In 6 (14.6%) case consultants fail to manage postoperative complication. In many hospitals, there are no appropriate recovery rooms or post-operative observation rooms. The junior medical and nursing staff is inadequate. Follow up of patients is necessary to know the progress of disease and effectiveness of treatment given. It is important duty to refer the patient to other specialists or higher center for treatment and follow their advice.

Status of Postmortem among deceased in Medical Negligence Cases:

The cause of death as established by medico legal postmortem is considered as important evidence in the Courts of law while dealing with suits of negligence. In the present study, it was found that out of 41 cases 20 patients (48.7%) had died due to negligence of doctors. In 3 cases postmortem done with clear cause of death and in other three cases postmortem not done. Postmortem status doesn't know in 14 cases. Postmortem always helps to know the cause of death and what went wrong in treatment or procedure. Certainly postmortem is beneficial to doctors as it reveals exact cause of death whether due to negligence, mishap or error of judgment.

Conclusions and Suggestions:

Authors tried to discuss the most common causes of medical negligence that is highlighting the nature and pattern/type of deficiency in service both in medical and surgical field with respect to patient care. Need of hour is to develop fiduciary relation with patients and deliver reasonable competence and expertise in treating patients to avoid medical negligence cases. Refrain from unethical practice to behold the sanctity of noble medical profession.

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Table 1: Distribution of medical negligence cases as per medical specialty

Consultants	No Of Case	%age
Obstetrics and Gynecology	12	29.2%
Orthopedics	9	21.2%
Surgery	8	19.5%
Ophthalmology	5	12.1%
Anesthesiology	5	12.1%
General Physician	2	4.8%
Ear, Nose and Throat	2	4.8%
Cardiology	1	2.4%
Radiology	1	2.4%
Neurology	1	2.4%
General Practitioner	1	2.4%
Homeopathy	1	2.4%
Rural Medical Practitioner	1	2.4%
Dermatologist	1	2.4%

Table 2: Distribution of medical negligence cases in Surgical stream and Medical stream

Negligence Cases	Surgical Cases	Medical Cases	Total
No. of Cases	33 (80%)	8(20%)	41

Table 3: Distribution of medical negligence cases in relation to corporate negligence

Speciality and Hospital	No of cases
Orthopedician and Hospital	6
Surgeon , Anesthetist and Hospital	1
Gynecologist, Hospital and Blood bank	1
Neurologist and Hospital	1
ENT Surgeon and Hospital	1
Orthopedician, Anesthetist and Hospital	1
Radiology and Hospital	1
Ophthalmology and Hospital	1
Hospital	1
Total	14 (34.4%)

Table 5: Status of postmortem among deceased medical negligence cases

No of Patient died	Postmortem done	Postmortem not done	Don't know status
20 (48.7%)	3	3	14

Table 4: Distribution of medical negligence cases in relation to composite negligence among specialists

Consultants	No of cases
Anesthetist and Surgeon	2
Gynecologist and Surgeon	2
Surgeon , Anesthetist and Hospital	1
General Practitioner and Gynecologist	1
Gynecologist, Hospital and Blood bank	1
ENT Surgeon and Anesthetist	1
Orthopedician, Anesthetist and Hospital	1
Gynecologist and Dermatologist	1
Total	10 (24.3%)

Table 6: Types/Pattern of deficiency in service in studied medical negligence cases

SI No	Deficiency in service	No of cases
1	Non reporting of Notifiable Disease	1
2	Hospital Employed BAMS Doctor as in-charge of ICU	1
3	Failure to perform screening test for infectious disease before blood transfusion (HIV-1 case and HBV-2 case)	3
4	Wrong blood transfusion	1
5	Wrong diagnosis and prescribing drug, failure to advice side effects and Diet	1
6	Failure to intubate Endotracheal tube under General Anesthesia during biopsy from larynx	1
7	Failure to manage postoperative complications	6
8	Delay in attending patient in time	1
9	Homeopathy doctor prescribing allopathic drug	1
10	Dermatologist practicing Anesthesia	1
11	Not referring patient to specialist or higher centre	3
12	Failure to follow specialists advice	2
13	Failure to conduct preoperative lab tests	4
14	Failure to update with current practice knowledge	1
15	Not Maintaining Medical records	13
16	Not recognizing foreseeable complication and necessary arrangement for treatment	1
17	Hospital equipment not working	1
18	Delay in conducting surgery	2
19	Performing surgery ignoring Contraindication	1
20	Failure to read MRI film correctly by SR, Consultant held responsible vicariously	1
21	Untrained hospital staff	2
22	Inadequate or improper sterilization of surgical instruments	1
23	Uncalled surgery / No indication for surgery-03	3
24	No facility of Lab at Hospital	1
25	Fail to remove foreign body from leg after	1
26	Failure of family planning –Cu T insertion	1
27	Failure in due care in administration of General anesthesia	1
28	Failure to take Physical fitness	1
29	Due care and skill in surgery	3
30	Operating hastily without investigation in non-emergency case	1
31	Failure to diagnose burgers disease	1
32	Failure to advise corrective surgery	1
33	Failure to follow up	1
34	Failure in due care in administering local anethesia cataract	1
35	Failure to take due care in delivery	1
36	Wrong blood transfusion	1
37	Improper consent	9
38	Unqualified staff	6

Original Research Paper

Radiological Assessment of Age from Wrist Joint in Young Adolescents

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Abstract

It's a radiological study of age assessment of 100 cases of young adolescents (Boy = 50; Girl = 50) in the age range of 14-17yrs by taking A-P view X-rays of their right wrist joint including hands. There was not a single case of fusion of lower end of ulna in male under the age of 14yrs. Fusion of lower end of radius is late in both sexes and we don't find any fusion in boys up to the 16yrs of age. It was observed that there is considerable narrowing of the range of radiological age assessed using the x-ray of the hand, from 15 years – 19 years to 14 years – 17 years in both boys and girls. The present study emphatically reveals that an adolescent either boy or girl whose secondary ossification centres of base of first metacarpal, heads of second, third, fourth and fifth metacarpals, bases of phalanges have fused could have attained the age of 17 years. This finding is quite reasonably consistent with the age from the available date of birth certificates of these students.

Key Words: Radius, Ulna, Carpal, Metacarpal, X-ray, Ossification, Radiological assessment

Introduction:

Age is an important parameter for medico-legal cases. Many times doctors are called upon to give opinion about age of a person. This is not only in criminal cases but also sometimes in civil cases too. For this, objective methods of age determination are required. Age of epiphyseal union is an objective important method of age determination. But these ages varies with racial, geographic, climatic and various other factors as mentioned in some textbooks.[1-3] These variations have suggested the need of separate standards of ossification for separate regions. The present study was carried out to study the epiphyseal union at the wrist joint including metacarpals in the age group of 14 to 17 years in a Higher Secondary School, suburban Chennai, Tamil Nadu.

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Materials and Methods:

Present study was conducted among students from mixed socio-economic status in a higher secondary school; North Chennai, Tamil Nadu. We selected 100 students (Male = 50; Female = 50) in the age range of 14-17yrs and A-P view X-rays of their right wrist including hands were taken by an expert radiologist after explaining the whole procedure and absence of risk factors, etc. to the students, teachers and parents.

The proforma of all the students who participated in this study was prepared and filled up with the details provided by the students and their parents along with their radiological finding. Height, weight, general physical development and diet were recorded in all cases and the menstrual history of girls was also accounted for. The criteria for fusion were:- (a) There should be no gap (or) defect in the epiphyseo-diaphyseal region of the bone. (b) There should be no discontinuity in the outline of the bone. (c) Presence of Epiphyseal scar is considered as 'Fused'. (d) While considering the fusion of secondary ossification centres of phalanges and heads of second, third, fourth and fifth metacarpals fusion was considered only if the fusion has been observed in respective phalanges of all fingers and in all the heads of metacarpals. We selected only those cases where there is complete fusion of epiphyses. Then accurate age, as far as possible, was determined in each case based on the radiological findings which is supported by their

statement and school leaving certificates. All findings are tabulated for easy study and comparison with the works of other authors.

Observation:

In the present study we observe that the fusion of lower end of ulna is earlier in girls as compared with that of boys. There was not a single case of fusion of lower end of ulna in male under the age of 14yrs (**Table No.1**). Fusion of lower end of radius is late in both sexes and we don't find any fusion in boys up to the 16yrs of age (**Table No.2**).

Age of fusion of base of the 1st Metacarpal is shown in **Table No.3**. In boys in majority of cases head of the 2nd to 5th Metacarpal bones fused by the age 16-17yrs (**Table No.4**) but in girls majority of the cases show fusion by the age 14yrs. : It is clear from **Table No.5** that in girl subjects for proximal row of phalanges in majority of cases in age group 14-15, 15-16, and 16-17 show near fusion, whereas in age groups 15-16, 16-17 and onwards majority of cases showed complete fusion. In cases of boys, the middle phalanges in majority of cases in age groups 16-17, 17-18 and onwards showed complete fusion (**Table No. 6**). For terminal phalanges, in majority of cases in the age groups 16-17, 17-18 and onwards there is complete fusion (**Table No.7**).

Discussion:

In the present study of 100 adolescents there are 50 boys and 50 girls with a boy – girl ratio of 1:1. This equal distribution of cases in both boys and girls obviates the gender discrimination in age assessment. Apart from enabling to narrow down the range of radiological age assessment using x-ray of the metacarpals and phalanges of the hand. In the available literature there is no mention about the gender variation in the fusion of secondary ossification centres of the metacarpals and phalanges though some textbook.[1-3] quotes the fusion of secondary ossification centres in girls would occur one to two years prior to boys.

In this study at the age of 14 years, the fusion of secondary ossification centres for lower end of ulna have occurred only in 29.17% of cases in girls, whereas in boys there is no fusion of lower end of ulna in any of them. At the age of 15 years, the fusion of secondary ossification centres of lower end of ulna has occurred only in 40.91% of cases in girls and in boys it is only 10.53%. Our findings are also consistent with the works of Bhise, et al,[4] Loobma[5] and Wankhade, et al.[6]

At the age of 16 years, the fusion of secondary ossification centres of the lower end

of ulna has occurred in 50% of cases in girls, whereas in boys it is only in 5.56% of cases the fusion have occurred. The age of fusion of base and head of Metacarpals and Phalanges ranges from 15 to 19 years which is also consistent with most of the available literature. Some of the Indian text books quote that the average age range of fusion of the 4th and the 5th metacarpals would range from 15 to 17 years in girls whereas in boys fusion of those secondary ossification centres would occur between 17 to 18 years.

In this study, at the age of 14 years, the secondary ossification centres of the lower end of radius have not fused in any of the cases in both sexes. At the age of 16 years, the fusion of secondary ossification centres for lower end of radius have occurred only in 13.64% of cases in girls, whereas in boys there is no fusion of lower end of radius in any of the cases.

In girls the bases of distal phalanges were found fused in 87.50% of cases at the age of 14 years. In girls the secondary ossification centres of the head of the 2nd, 3rd, 4th and the 5th metacarpal, bases of proximal and middle phalanges were found fused in 86.33% of cases at the age of 15 years which is also consistent with the works of S.S. Bhise, et al[4] and Ajay Balachandran, et al.[7]

In cases of boys, the secondary ossification centres of base of first metacarpal and bases of phalanges were found to have fused in more than 80% cases at the age of 17 years. The secondary ossification centres of base of first metacarpal and bases of distal phalanges were found to have been fused in 100% cases at the age of 17 years. But the second, third, fourth and fifth metacarpals were found to have fused only in 66.67% of cases at the age of 17 years. In this regard also the present study is in agreement with the previous works of other authors.[8-12]

The present study emphatically reveals that an adolescent either boy or girl whose secondary ossification centres of base of first metacarpal, heads of second, third, fourth and fifth metacarpals, bases of phalanges have fused could have attained the age of 17 years. And if the individual's secondary ossification centres of metacarpals and phalanges have not fused then those individuals are definitely below the age of 17 years.

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Table 1: Cases Distribution according to fusion of Lower end of Ulna

Age Group	Boys	Girls
14 Years	0%	29.17%
15 Years	10.53%	40.91%
16 Years	5.56%	50%
17 Years	33.3%	61.54%

Table 2: Cases Distribution According to fusion of Lower end of Radius

Age Group	Boys	Girls
14 Years	0%	0%
15 Years	0%	9.09%
16 Years	0%	13.64%
17 Years	16.67%	38.46%

Table 3: Cases Distribution according to fusion of Base of 1st Metacarpal

Age Group	Boys	Girls
14 Years	7.41%	83.33%
15 Years	15.79%	95.45%
16 Years	55.56%	100
17 Years	100%	100

Table 4: Cases Distribution according to fusion of Heads of 2nd to 5th Metacarpals

Age Group	Boys	Girls
14 Years	7.41%	62.50%
15 Years	5.26%	86.36%
16 Years	44.44%	95.45%
17 Years	66.67%	100%

Table 5: Cases Distribution according to fusion of Base Of Proximal Phalanges

Age Group	Boys	Girls
14 Years	7.41%	66.67%
15 Years	5.26%	86.36%
16 Years	38.89%	100%
17 Years	83.33%	100%

Table 6: Cases Distribution according to fusion of Base Of Middle Phalanges

Age Group	Boys	Girls
14 Years		66.67%
15 Years	5.26%	86.36%
16 Years	38.89%	100%
17 Years	83.33%	100%

Table 7: Cases Distribution according to fusion of Base of Distal Phalanges

Age Group	Boys	Girls
14 Years	11.11%	87.50%
15 Years	15.79%	100%
16 Years	55.56%	100%
17 Years	100%	100%

Original Research Paper

A Study on Gender Identification of Dry Skull by Manual Measurement of Foramen Magnum Dimensions

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Abstract

As per Krogman, the reliability of determining sex of a person from the skull is up to 92% . The main objective of the present study was to aid in increasing this percentage value. In instances like mass disasters, even a small piece of base of a skull having foramen magnum can aid in determining sex. Further research in relation to the role of foramen magnum dimensions in gender identification was thus felt needed. The present study was conducted on dry skulls from teaching collection of the Anatomy department at KarpagaVinayaga Institute of Medical Sciences and Research Centre. It was concluded that foramen magnums with length more than 3.6cms belonged to dry skulls with male features and those less than 3.5cms belonged to ones with female features. The ones with breadth more than 3.12cms belonged to males and those less than 3.08cms belonged to females. Foramen magnums with foramen magnum index more than 89.2% belonged to females and those less than 84.3% belonged to males.

Key Words: Forensic; Skull; Foramen magnum; Dimensions; Gender determination

Introduction:

A human skull is supposedly the most important bone when it comes to identification of an individual from skeletal remains. Like Pelvic (hip) bone, which has the highest weightage with relation to sex determination, femur & tibia (long bones) have the highest weightage with relation to determining *stature* from skeletal remains. But skull is the bone of choice when it comes to determining identity of an individual as a whole with relation to multiple parameters like age, sex, race, and also stature. *Krogman's* weightage for skull with relation to sex determination from skeletal remains has been 92%.[1] The main objective of the present study was to aid in increasing this percentage value. Many researches have been done with relation to sex determination of dry skull. The authors of the present study have made an attempt to contribute a little more with relation to sex determination of skeletal remains by manual examination of *foramen magnum* of a dry skull.

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Foramen magnum is a large opening in the base of skull. It is oval with greatest diameter being antero-posterior. It contains lower end of the medulla oblongata, the vertebral arteries and spinal accessory nerves.[2] Dimensions of foramen magnum are greater in males than in females, hence, they can be used to determine sex in the medico-legal conditions, especially in the circumstances, such as explosions, aircraft accidents and war fare injuries.[3] There is no denial to the fact that a skull can be sexually differentiated very well. But, analyzing the gender of a skull by foramen magnum examination has an undisputed advantage over all the other aforementioned parameters during instances like mass disasters, where, even a small piece of base of a skull having foramen magnum can aid in determining sex. Therefore the authors of the present study felt the need of further research in relation to the role of foramen magnum dimensions in determining sex. Various authors have categorized foramen magnum based on shape, like oval, round, polygonal, pentagonal.[4] During the present study, we didn't classify specifically as such. However, many foramen magnums during the study were *oval (more frequently in skulls with male features), some were polygonal and some pentagonal.*

Catalina-Herrera (1987) studied on sagittal and transverse dimensions of the foramen magnum, and inferred that the values were significantly higher in male skulls. Zaidi & Dayal studied Indian skulls on basis of shape

and dimensions of the foramen magnum and reported findings similar to those by Henríquez-Pino, et al.[5-7] whose study was based on Brazilian skulls. This proved that racial factor was *less significant* in gender identification of skull by foramen magnum dimensions. In another study, Günay&Altinkök examined the usefulness of determining the dimensions of the foramen magnum in the diagnosis of sex, and noted that the diameters were of some use, while the total area was not a good indicator. Authors of the present study also agreed with the same. Uysal, et al.[8,9] reported sexual dimorphism by analyzing the dimensions of the foramen magnum in 3D computed tomography with 81% accuracy in determining the sex, a level that was higher than that obtained by Gapert, et al. in a sample of British skulls from the eighteenth and nineteenth centuries.[10]

In this era, where it has become important to rightfully identify (with near 100% precision) the skeletal remains in medico-legal investigation, injustice due to error in identifying an individual cannot be risked. The findings of the present study were tabulated, statistically analysed and compared with various other studies like Gapert *et al.*, Routal *et al.*, Sayee *et al.*, Deshmukh, *et al.*, Suazo, *et al* [10-14].

Materials and Methods:

Material for this cross-sectional study consisted of 28 dry human skulls of known gender (skulls with male features were 15, and those of females were 13). Gender was preliminarily assessed by examining important parameters like general appearance, orbital margins, supra-orbital ridge, fronto-nasal junction, forehead shape, zygomatic arching, frontal & parietal eminences, external occipital protuberance, muscular markings on the posterior surface, mastoid process size and prominence, depth of the digastrics groove, shape & size of palatal arch, teeth morphology. All the bones were assessed to be greater than 18 years based on basi-occiput and basi-sphenoid suture fusion. The study was conducted on dry skulls from teaching collection of the Anatomy department at Karpaga Vinayaga Institute of Medical Sciences and Research Centre. *Adult, dry skulls greater than 18 years of age (confirmed by basi-occiput & basi-sphenoid fusion) of known gender were included. Dry skulls with un-fused basi-occiput & basi-sphenoid, and those exhibiting sexual dimorphism were excluded from the study.* With 29 bones available, 1 was excluded by implementing exclusion criteria. Keeping Confidence Level at 95% and Confidence Interval at 3, sample size

was determined as 28 dry skulls (**Figure 1**). [The 95% confidence level means you can be 95% certain; the 99% confidence level means you can be 99% certain. Most researchers use the 95% confidence level. Authors of the present study have used the same too. Sample size was calculated using Sample Size Calculator presented as a public service of Creative Research Systems: Survey software, '**The Survey System**'.]

Antero-posterior diameter/major axis/length (L) and transverse diameter/ minor axis/breadth (B) were the measurements that were taken (**Figure 2**).

Another parameter, Foramen magnum index (FMI), was calculated using the formula, "FMI = breadth (B)/length (L) x 100". Area of the foramen magnum orifice could have been mathematically calculated by implementing the formula for area of an ellipse, which is, $\text{Area} = 3.14(\pi) \times L/2 \times B/2$. But during the study, we encountered various shapes of foramen magnum like oval, polygonal, and pentagonal; especially in skulls with female features. Thus, the parameter, Area, had to be excluded.

Thus, we had 3 parameters of the foramen magnum to conduct the study with, amongst which, length and breadth were measured parameters of foramen magnum, and FMI, a derived parameter calculated from the length and breadth of foramen magnum. Length (maximum distance between anterior and posterior margins measured along the principle axis of the foramen magnum) and breadth (maximum distance between the lateral margins measured approximately perpendicular to principle axis of the foramen) were measured with a divider (an instrument of a school compass box). The pointed ends of the divider were placed on the appropriate points on the inner margin of the foramen magnum, and later, the distance between the 2 pointed ends was measured using a measuring scale. The study samples were divided into two groups, skulls with male features and skulls with female features.

A correlation study was also done on length and breadth of all the foramen magnum using scatter graph of linear regression type to assess if these dimensions correlated.

Observations and Results:

All the three parameters were tabulated in the form of a master-chart (**Figure 3**) and statistically analyzed for p value with unpaired t test.

Unpaired t test results with Length (L) as parameter; the two-tailed P value was less than 0.0001. By conventional criteria, this

difference is considered to be 'statistically extremely significant' (**Table 1**). The mean of males group minus females group equaled 0.29. 95% confidence interval of this difference was 0.203 to 0.384.

With Breadth (B) as parameter, the two-tailed P value was less than 0.0001. By conventional criteria, this difference is considered to be 'statistically extremely significant' (**Table 2**). The mean of males group minus females group equaled 0.2. 95% confidence interval of this difference was 0.135 to 0.265.

With Foramen magnum index (FMI) as parameter, the two-tailed P value equaled 0.2. By conventional criteria, this difference is considered to be 'not statistically significant' (**Table 3**). The mean of females group minus males group equaled 1.63. 95% confidence interval of this difference was 0.918 to 4.18

Low positive correlation was seen with scatter chart (correlation graph of linear regression type) between length (x axis) and breadth (y axis) of the 28 skulls (**Figure 4**).

Discussion:

Various authors, Gapert et al. (Britain), Routal et al. (India), Sayee et al. (India), Deshmukh et al. (India), Suazo et al. (Brazil), have studied on foramen magnum dimensions relating to gender identification, the results of which have been highlighted in **Table 4**.

Racial factor seems to be a minor issue as we can see in table 4 that the study results by Routal et al. done in India are quite similar to those of Suazo, et al. and Gapert, et al. The result of our study with regard to mean length in females is similar to that of Sayee, et al. and Deshmukh, et al.. Mean breadth value of our study is similar to that of Suazo, et al. This again diminishes the significance of racial factor in gender identification with foramen magnum dimensions.

It is quite evident from the results that males displayed larger mean values than females for all the measured variables of foramen magnum. However, in French sample [Macaluso Jr (2011)]; the length of foramen magnum did not reveal significant differences but width showed the significant results. Studies by Raghavendra Babu, et al (2012) and Radhakrishna, et al (2012) showed statistically significant differences between males and females for length and breadth on Indian population.[15-17]

Results of the present study were extremely significant in relation to the length and breadth parameters but not so with the index.

The reason is the wide variation in the shape of foramen magnums of various skulls from oval to polygonal to pentagonal. However, length and breadth parameters were comparatively higher in foramen magnum of skulls with male features, which explains the significant statistic results. The study results can be reliably used for gender identification of dry skulls in concurrence with the various other characteristic features. Unavailability of a larger sample size was the only limitation of the present study.

Conclusion:

We, the authors of the present study, believe that the study results can be reliably used for gender identification of dry skulls. Using length as parameter, we infer that foramen magnums with length more than 3.6cms belong to males and those less than 3.5cms belong to females. Using breadth as parameter, we infer that foramen magnums with breadth more than 3.12cms belong to males and those less than 3.08cms belong to females. Using Foramen magnum index (FMI) as parameter, we infer that foramen magnums with FMI more than 89.2% belong to females and those less than 84.3% belong to males.

Not very often, but we do face situations where skeletal remains sent for expert opinion might not be in their entirety. It's then our duty to aid in medico-legal investigation with whatever material available for expert opinion. Therefore, we do need adequate data to opine on bone fragments also. The present study is a step towards this goal.

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Fig. 1: Sample size of 28 dry skulls



Fig. 2: Foramen magnum dimensions

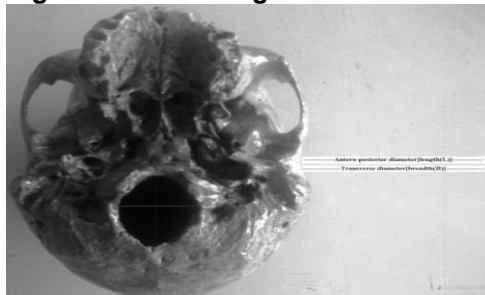


Table 1: Unpaired t test results of foramen magnum with Length (L) as parameter

Length (L)	Mean (cms)	Standard Deviation (SD)	Standard Error of Mean (SEM)	n
Male features	3.7	0.128	0.033 0.028	15
Female features	3.4	0.100		13

Table 2: Unpaired t test results of foramen magnum with Breadth (B) as parameter

Breadth (B)	Mean (cms)	Std Dev. (SD)	Std Err. of Mean	n	Result (R)	Stat. Sig. (SS)
Male features	3.2	0.085	0.022	15	P value <0.0001 >3.12cms = Male <3.08cms = Female 3.08-3.12cms = Dimorphic	Extremely Significant
Female features	3	0.082	0.023	13		

Table 3: Unpaired t test results with Foramen magnum index (FMI) as parameter

FMI (B/Lx100)	Mean (cms)	Std Dev. (SD)	Std Err. of Mean	n	Result (R)	Stat. Sig. (SS)
Male features	86.7	2.49	0.64	15	P value = 0.2 <84.3% = Male >89.2% = Female 84.3-89.2% = Dimorphic	Not Significant
Female features	88.3	3.99	1.1	13		

Fig. 4: Scatter chart (linear regression type) demonstrating low positive correlation

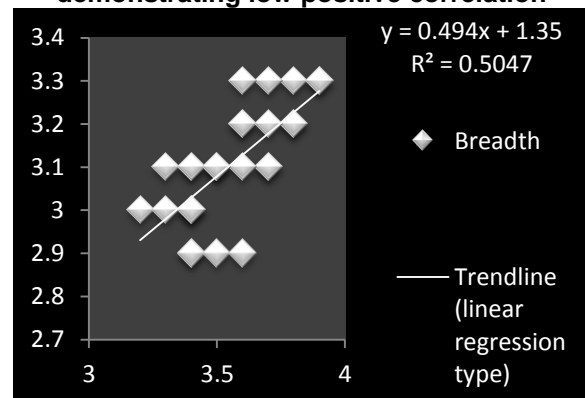


Table 4: Comparison with various studies

Results (Various studies)	Mean Length (Males)	Mean Length (Females)	Mean Breadth (Males)	Mean Breadth (Females)
Routal et al.	3.6 cms	3.2 cms	3 cms	2.7 cms
Sayee et al.	3.4 cms	3.4 cms	2.9 cms	2.8 cms
Deshmukh et al.	3.4 cms	3.4 cms	2.9 cms	2.8 cms
Gapert et al.	3.6 cms	3.5 cms	3.1 cms	2.9 cms
Suazo et al.	3.6 cms	3.6 cms	3.1 cms	3 cms
Present study	3.7 cms	3.4 cms	3.2 cms	3 cms

**** Fig 3: Master Chart on page no. 164**

Original Research Paper

Sudden Deaths due to Respiratory Diseases in a Metropolitan City of South India: A Three Year Prospective Autopsy Study

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Abstract

Forensic pathologists not only deal with criminal, accidental and suicidal deaths, but also with a wide range of deaths from natural causes. Many of them are sudden, unexpected, clinically unexplained or obscure. Very few studies exist solely focusing on sudden deaths due to respiratory diseases. Hence a 3 year duration prospective study was undertaken on sudden deaths at KIMS hospital Bangalore, India. Among these 176 sudden deaths, 42 deaths (23.8%) were due to respiratory causes. Majority of the victims (71.4%) died due to bronchopneumonia. Maximum period of survival after onset of terminal symptoms was less than 1 hour (16.6%).

Key Words: Sudden natural deaths, Respiratory diseases, Bronchopneumonia, Autopsy

Introduction:

Sudden deaths due to respiratory diseases are comparatively less among the bulk of sudden deaths due to other causes presenting at autopsies. However it stands out to be the second most important cause among sudden deaths. While dealing with sudden deaths one often observes certain definitions such as natural death, sudden cardiac death and sudden death. A natural death is one in which death occurs due to some natural disease or pathological condition, old age, or debility where death is not intended or attempted and also does not occur accidentally. Then there is a standard WHO definition of sudden death and has defined it as death of an apparently healthy individual within 24 hours from the onset of terminal symptoms with injury and poisoning ruled out.[1]

Sudden cardiac death is defined as death due to cardiac causes, in which the time and mode of death is unexpected, in an individual with or without pre-existing cardiac disease, which occurs within 1 hour of the onset of the heralding symptoms.[2] No such definition exists for sudden deaths due to respiratory diseases. Haemoptysis is said to be the most common cause of sudden death due to a respiratory disease in an apparently healthy individual. Here, death results from haemorrhage or from inhalation of blood in to the lungs. Hemorrhages may also result from a neoplasm or inflammatory lesions of the nasopharynx, bronchus or esophagus infiltrating the adjacent tissues. Inflammatory lesions such as tuberculous cavitations, lung abscess or bronchiectasis are less common causes. Bronchial asthma is another occasional cause. Respiratory tract infections also result in sudden and unexpected death but there is a period of some hours or a day or two preceding death. Common infectious diseases such as bronchopneumonia or acute purulent bronchitis superimposed upon chronic bronchitis play a vital role. Acute respiratory obstruction of the larynx due to local neoplasm, angioneurotic edema or inflammation arising locally are rare causes.[3]

It has been observed that the incidence of sudden deaths due to respiratory diseases ranges from 10-15 % to 10 to 25 % by various researchers.[3,4] In the year 1990 the National Center for Health Statistics USA, reported that the incidence of deaths due to respiratory diseases was 10 % of the total deaths. In 2010

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NCHS reported that the incidence was 9 % of the total deaths[5] Looking into the Indian scenario, a community based study was conducted from the year 2000 to 2012 and reported that the incidence of deaths due to respiratory diseases was 13% of the total deaths.[6] While these figures substantiate the general belief that sudden death due to diseases of the respiratory system makes up to only a small proportion, Gonzales et al in 1937 published that diseases of the respiratory tract accounted for 23% of unexpected deaths.[7] Further, an autopsy based study conducted in Loni, Maharashtra, India during 2000 to 2004, reported the incidence to be as high as 28 % of total sudden deaths.[8]

The incidence of sudden deaths due to respiratory diseases is rising quite alarmingly especially in the southern parts of India. On the other hand the Epidemiology of sudden deaths due to respiratory diseases in India continues to be understudied. Hence a prospective autopsy study was undertaken in the state of Karnataka, India at Bangalore to note and statistically analyze various parameters contributing to sudden death such as the frequency of sudden deaths due to respiratory diseases among the autopsies conducted, the demographic profile and their causes.

Material and Method:

A prospective autopsy study of sudden natural deaths was conducted at Kempegowda institute of medical sciences hospital Bangalore, India, for a period of 3 years, from 1st November 2010 to 1st November after obtaining institutional ethical committee clearance. Among them, cases of sudden deaths due to respiratory diseases were selected based on purposive sampling. The objectives were to assess the frequency, describe their demographic profile and to assess the causes. Before starting the post-mortem examination, history about the onset of symptoms, their duration, habits, family history, previous medical history and treatment records whenever available were obtained from the relatives and recorded on a pre-made detailed Performa. In cases where death was unwitnessed and the dead body was brought directly from site of death by the police for post-mortem examination, help of the investigating officer was sought to know the manner of death.

Using Ghon's en bloc technique, the lungs were carefully removed and examined by weighing and further dissecting it by transverse slicing technique. The whole lungs in some cases and pieces of each lung from each lobe in some cases, showing gross pathologic changes

were preserved 10% formalin and were subjected to histopathological examination along with other organs. In most cases histopathology revealed no cardiac pathology and in some cases mild to moderate atherosclerotic lesions (ranging between 30-40%) occluding the lumen of coronary arteries were reported which were considered not sufficient to cause death . Discussions were held with the clinicians who had treated the deceased persons in hospital admitted cases. On perusal of their treatment records, no clinical features suggested the possibility of overlapping cardiac symptoms.

After receiving the histopathology report, final opinion as to cause of death was given. Data was collected and analyzed statistically using appropriate statistical tools (namely Microsoft Excel 2007 and IBM SPSS V.20) with respect to age, sex, personal habits like, smoking, alcohol consumption, socio economic status, place, activity at the time and cause of death.

Observation:

During this study period, 1520 cases were brought for medicolegal autopsies out of which 176 (12.3%) deaths were sudden deaths. Out of the 176 cases, sudden cardiac deaths accounted for 63.6% of total deaths, 42 deaths (23.8%) accounted for sudden deaths due to respiratory diseases, sudden deaths due to central nervous system pathology and gastrointestinal tract pathology accounted for 10.2 % and 2.27 % of total deaths respectively [Table 1]. Among the 42 sudden deaths due to respiratory diseases, maximum numbers of cases ie.13 deaths (30.9%) were observed in the age group of 51-60 yrs, followed by 10 deaths (23.8%) in the age group of 41-50 yrs [Table 2]. Males dominated females in number of deaths by far ie. 36 cases were males (85.71%) and 6 cases were females (14.28%) [Table 3]. The Death Sex ratio of males to females was 6:1.

Majority of the deceased persons (69.04%) were street beggars and unemployed [Table 4]. 93 % of the deceased persons were from Urban Locality and only 7.14% from the rural areas of Bangalore [Table 5]. Maximum deaths were observed in the population belonging to the Lower socioeconomic class ie. 37 cases (88.09%) [Table 6]. Majority of the victims (83%) were found dead on the footpaths and road side alleys [Table 7]. While analysing the activity of the deceased persons at the time of death we observed that most of the victims (71%) died while resting [Table 8].

Further while correlating personal habits known to be high risk factors for sudden deaths due to respiratory diseases such as smoking and alcoholism, we observed that majority of the deceased persons were habituated to smoking and alcohol (83%) [Table 9]. Maximum number of deaths were due to bronchopneumonia and accounted for 71% of total deaths compared to other causes [Table 10]. Most of the deceased persons were found dead (57%) however among those who were not found dead the maximum period of survival after onset of terminal symptoms was less than 1 hour (16.6%) [Table 11].

Discussion:

The existing studies so far in the literature on sudden deaths due to respiratory diseases are mainly isolated to one type of disease. Various studies exist on sudden deaths, sudden cardiac deaths, sudden deaths due to gastrointestinal pathologies and central nervous system pathologies. Extensive studies purely focusing on sudden deaths due to respiratory diseases do not exist presumably to the best of our knowledge. Hence comparison of results of our study will be limited only to certain parameters which have been produced by other researchers on a broader spectrum. Firstly when we take into account the system wise distribution of sudden natural deaths out of the 176 medicolegal autopsies conducted at KIMS hospital Bangalore, the total number of sudden deaths due to respiratory diseases was 42 cases (23.8%). This is lesser than the observations made by Zanjad et al in 2006 and Dinesh Rao et al in 2008 where they were presented with 61 (27.23%) and 28 (27.45%) cases of sudden deaths due to respiratory diseases respectively.[9,8] However the incidence correlates with the study made by Gonzales et al in 1937 where diseases of the respiratory tract accounted for 23% of unexpected deaths.[7]

Further, it is by far more than the observations made by Virendra Kumar et al in 2006 Kuala Lumpur, Malaysia, where in sudden respiratory deaths accounted for 13% only.[10] Majority of the victims in our study fell under the 51-60 year age group, mostly males, where in the death sex ratio (M:F) being 6:1, correlated with the findings of Dinesh Rao et al and Sanjay Gupta, et al.[8,11] Majority of the deaths occurred among people of lower socioeconomic strata which was also the observation of Sanjay Gupta et al and Virendra kumar et al. Bronchopneumonia was by far the most common cause of sudden death in our study which correlates with the findings made by

Zanjad et al and Virendra kumar et al. However it does not correlate with the findings of Dinseh Rao et al who observed chronic obstructive pulmonary diseases to be the most common cause of sudden death due to respiratory diseases. Since there is no universal agreement upon the definition of sudden death we took into consideration the WHO definition which extends the period of survival up to 24 hours. Most of the victims were found dead and went unwitnessed, but among those who survived to tell a tale; survived only for 1 hour from the time of onset of terminal symptoms which accounted for 7 cases (16.66%). This finding is in agreement with the time limited by Adelson and Hoffman which was 2 hours.[12]

Conclusion:

Overall this study reveals the following

1. The incidence of sudden deaths due to respiratory diseases among the total medicolegal autopsies performed is 23.8%
2. Adults between the ages of 41-60 years are most vulnerable to sudden deaths due to respiratory diseases.
3. Males dominated females in our study with a death sex ratio of 6:1.
4. More common among people from lower socioeconomic class.
5. Smokers and alcoholics are at a greater risk.
6. Bronchopneumonia was found to be the main cause of respiratory sudden death (71%).
7. Maximum period of survival after onset of terminal symptoms was 1 hour (16.66%).

Sudden deaths due to respiratory diseases are on the rise in India especially within the southern parts. This study highlights the importance of the same in order to encourage epidemiological and preventive studies on sudden deaths due to respiratory diseases

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Table 1: System Wise Distribution of Sudden Natural Deaths.

SYSTEM	FREQUENCY	%age
Cardiovascular System	112	63.6 %
Respiratory System	42	23.8 %
Central Nervous System	18	10.2 %
Gastrointestinal System	4	2.27 %
TOTAL	176	100 %

Table 2: Cases According to Longevity

AGE GROUP (YEARS)	FREQUENCY	PERCENTAGE
11-20	1	2.38 %
21-30	3	7.14 %
31-40	5	11.9 %
41-50	10	23.8 %
51-60	13	30.95 %
61-70	8	19.04 %
71-80	2	4.76 %
TOTAL	42	100 %

Table 3 : Sex wise Incidence of Sudden Deaths due to Respiratory Diseases.

SEX	FREQUENCY	PERCENTAGE
Male	36	85.71 %
Female	6	14.28 %
TOTAL	42	100 %

Table 4: Occupation Wise Incidence of Sudden Deaths due to Respiratory Diseases.

OCCUPATION	FREQUENCY	PERCENTAGE
Student	1	2.38 %
Office employees	1	2.38 %
Labourer	8	19.04 %
Housewife	3	7.14 %
Unemployed	29	69.04 %
TOTAL	42	100 %

Table 5 : Incidence of Sudden Deaths due to Respiratory diseases based on Locality.

LOCALITY	FREQUENCY	PERCENTAGE
Urban	39	92.85 %
Rural	3	7.14 %
TOTAL	42	100 %

Table 6 : Incidence of Sudden Deaths due to Respiratory diseases based on Socioeconomic status.

SOCIOECONOMIC CLASS	FREQUENCY	PERCENTAGE
Lower Class	37	88.09 %
Middle Class	4	9.52 %
Upper Class	1	2.38 %
TOTAL	42	100 %

Table 7 : Place of occurrence of Sudden Deaths due to Respiratory Diseases.

PLACE	FREQUENCY	PERCENTAGE
Home	1	2.38 %
Work Place	1	2.38 %
Public Place	35	83.3 %
Hospital	5	11.9 %
TOTAL	42	100 %

Table 8 : Activity of the Deceased at the time of Death.

ACTIVITY	FREQUENCY	PERCENTAGE
Resting	30	71.42 %
Routine Activity	5	11.9 %
Strenuous Activity	1	2.38 %
Not Known	6	14.28 %
TOTAL	42	100 %

Table 9 : Incidence of Sudden Deaths due to Respiratory Diseases based on Personal habits.

HABITS	FREQUENCY	PERCENTAGE
Smoking & Alcoholism	35	83.3 %
Non Smokers & Teetotalers	7	16.66 %
TOTAL	42	100 %

Table 10: Incidence of Sudden Deaths due to Respiratory Diseases based on Etiological Classification

CLASSIFICATION	FREQUENCY	PERCENTAGE
Bronchopneumonia	30	71.42 %
Pulmonary Tuberculosis	3	7.14 %
Bronchial Asthma	3	7.14 %
Bronchiolitis	1	2.38 %
Secondary Haemoptysis	1	2.38 %
Atelectasis-Pneumothorax	1	2.38 %
Aspiration Pneumonia	2	4.76 %
Pulmonary Thromboembolism	1	2.38 %
TOTAL	42	100 %

Table 11 : Period of Survival After Onset of Terminal Symptoms

PERIOD OF SURVIVAL	FREQUENCY	PERCENTAGE
Found Dead	24	57.14 %
< 1 Hour	7	16.66 %
1 - 6 Hours	2	4.76 %
6-12 Hours	4	9.52 %
12-24 Hours	3	7.14 %
24-48 Hours	2	4.76 %
TOTAL	42	100 %

Original Research Paper

Socio-Demographic Profile of Unnatural Deaths: An Autopsy based study at SMS Medical College, Jaipur

¹Prathvi Raj Meena, ²R.K. Punia

Abstract

Unnatural deaths are the deaths which are caused by any means other than a disease. The data available in literature regarding the socio-demographic profile of unnatural death in Jaipur region are lacking, hence present study was conducted to evaluate the socio-demographic profile of different types of cases and to assess the manner, and cause of their death. Study setting was the Department of Forensic Medicine and Toxicology, SMS Medical College, and attached Hospitals, Jaipur (A tertiary health care centre in North-Western India) over a period of one year from November, 2013 to October, 2014. A total of 3306 medico-legal autopsies were conducted at the mortuary, out of which 3172 autopsies (96%) were concluded to be unnatural deaths satisfying the inclusion and exclusion criteria were included in the study. 78.28% were male and 21.72 % were female, Male- female ratio was 3.6 : 1. More than half of were between second to fourth decade of age. Major cause for unnatural deaths was found to be Road traffic accident. Improvement in the literacy and employment to the youth may brought down the crime and thus reduce the incidence of preventable unnatural deaths in Indian demography.

Key Words: Autopsy, Demography, Road Traffic Accident, Unnatural death

Introduction:

Death is unnatural when caused prematurely against the order of nature by injury, position or other means of violence.[1] In a developing country like ours, the number of vehicular accidents are increasing day by day. Increasing number of fast moving vehicles, unskilled or semiskilled drivers, drunken drivers and ignorance and intentional violation of traffic rules, play an important role in contributing to the increase of vehicular accidents.

The number of patients who suffer from some or other form of acute poisoning is increasing. Easy availability of poisons plays a major role in accidental, suicidal and homicidal poisoning cases. The exact incidence of this problem in India remains uncertain, but, it is reported that 1 to 1.5 million cases of poisoning occur every year, of which nearly 50,000 die.[2] Pattern of unnatural deaths is a reflection of the prevailing social set up and mental health status of the region.[3]

Increasing population, changing lifestyle and poor socioeconomic conditions; transport & technology and the increasing unrest in society;

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all play a role in the increase in the number of crimes and unnatural deaths.

Unnatural deaths are associated with intense trauma and separation distress. This study was carried out to highlight the causes, peculiarities and possible factors responsible for accidental, homicidal and suicidal deaths in Jaipur, India.

Material and Method:

Study setup

This study was carried out at the Department of Forensic Medicine and Toxicology, SMS Medical College, and attached Hospitals, Jaipur (A tertiary health care centre in North Western India).

Study design:

Descriptive observational study

Study duration:

1st November, 2013 to 31st October, 2014 (1 year)

Material:

All subjects autopsied at the mortuary of SMS Hospital, Jaipur during the study period, satisfying the inclusion and exclusion criteria were included in the study.

Inclusion criteria:

All cases of unnatural death whose attendants' furnished written informed consent prior to autopsy for the study.

Exclusion criteria:

- (i) All cases of natural death whose post mortem examination was performed due to one or the other reason.

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- (ii) All cases which were autopsied for reason of being brought dead found to be due to some disease process after post-mortem examination.
- (iii) All cases of unnatural death whose attendants did not furnish written informed consent prior to autopsy for the study
- (iv) All cases of unnatural death cases received and disposed off without post-mortem examination.

Observations and Results:

Figure 1 - More than three-quarters of the subjects were males as compared to females who constituted 21.7% of the total unnatural deaths during the study period at our institution. Majority of the unnatural deaths in this study were seen in the age groups of 20-50 years, being the active and productive group of the society. The maximum numbers of unnatural deaths in this study were seen in the third decade of life, followed by the fourth, fifth, sixth and second decades. Male- female ratio in the study population was 3.6:1.

90% of subjects are dominated by Hindus in the study population as State Rajasthan is predominately inhabited by Hindus followed by Muslims and rest of religions. Majority of the cases of unnatural deaths were from rural regions. Although the study was conducted in an urban setup; yet, ours being a tertiary care centre caters to a large numbers of referral cases belonging to nearby districts of Jaipur and adjoining states like Haryana, Uttar Pradesh and Madhya Pradesh and National Capital Region(NCR). More than 80% of study population belonged to the literate sections of the society. India is a developing country which has improved its literacy ratio in the recent years.

Figure 2 shows that maximum numbers of subjects in this study population were employed in private sectors including laborers followed by students and housewives. In 28 cases occupational status was not applicable because they were less than school going age.

Discussion:

This study was carried out at a tertiary care centre to analyze the pattern of unnatural deaths in Jaipur region. A total of 3306 medico-legal autopsies were conducted at the mortuary out of which 3172 autopsies (96%) were concluded to be unnatural deaths. Similar findings have been reported by other studies - 98% unnatural deaths,[3] 95% unnatural deaths among the total medico-legal autopsies,[4] 90.3%,[5] 92%,[6] 98.7%,[7] 88.1%,[8] 89%,[9] 90.7%.[10] But the results of present study are

quite high when compared to 82.6% unnatural deaths among all medico-legal autopsies[11] and 85.1%[12] and very high as compared to 61.4% .[13]

The subjects of un-natural deaths in the present study ranged from fetuses, new born babies to 105 years of age with a mean age of 36.69 ± 4.72 years. These findings are quite similar to studies[14] who reported a mean age of 34.7 ± 8.2 years varying between 2 to 74 years. The present study revealed that 20-50 years was the most affected age group comprising about 70% of the study population. These are the active years of human life, more engaged in all types of physical activities. Thus they are more prone to risks associated with such activities especially on roads and at workplaces. The maximum numbers of unnatural deaths were seen in the age group of 20-30 years (32.25% of all unnatural deaths); followed by 20.37% deaths in 30-40 years and 16.42% in 40-50 years. These results are similar to various other studies.[3,4,6,8,10,12,15-17] These age groups are the active and productive sections for the society and are thus susceptible to incidences resulting in untimely death.

However, the results of the present study are dissimilar from studies which reported the highest incidence between 51-60 years [18] and 31-60 years age group.[13]

About 10% of the present study population was from the 2nd and 6th decades of life each. The extremes of age group are less prone to unnatural deaths as compared to middle year age groups contributing to less than 10% in numbers.

The study population in the present study comprised of 91.8% Hindus followed by 7.09% Muslims. Other religions viz. Jainism, Sikhism and Christianity contributed to less than 0.5% proportion of unnatural deaths. Other studies also reported predominance of Hindus in their study populations.[10,12] The results of present study were contrasting to another study which suggested 95.47% Muslims, 4.25% Hindus and 14% Christians.[4] The variation is obvious as these studies have been conducted in different countries; where predominant religion being Hinduism and Islam respectively account for differences. 70.71% of the deceased in the present study were from rural regions and 27.39% were from urban regions. In remaining 1.89% cases, the domiciliary status remained unknown as they were unidentifiable dead bodies. Although, the present study was conducted at a tertiary care center situated in capital city of the state; which caters to a large magnitude of rural population of adjoining region

as a referral centre for both emergency and specialist services of patient care. Moreover, being a specialized centre, it is also the referral centre for medico-legal services in complex cases from adjoining areas. Similar results have been reported by other studies.[6,10,16,19] However, few other authors report a preponderance of urban victims in their study.[13, 20,21] The regional variation in population distribution may have resulted in these variations in different studies.

Although the study population in this study was predominantly from rural regions, yet 83.79% deceased were literate as compared to 14% illiterate population. The illiterate population also included the population of deceased less than 5 years of age on whom the educational status was not applicable.

In about 88% cases of the present study, the unnatural deaths were accidental in nature; majority of which were road accidents followed by burns, falls, electrocution, poisonings and train accidents. About 7.5% deaths occurred due to suicides and about 3% due to homicides. Also, these results are an indicator of establishment of law and order situation and peace in the region. No deaths were documented during the study period due to some armed robbery or theft which again points towards the activeness of law enforcing agencies in the region. Other studies have reported similar trends with slight variations.[4,5,13,15,20]

India being a poor country with a high unemployment and illiteracy rate, the crime rate is expected to be very high. But, the results of the present study show a negligible percentage of homicidal deaths. This perhaps, could be attributed to the religious and traditional God fearing values passed on from generation to generation.

Majority of the accidental deaths occurred due to road accidents (59.2%), followed by burns (17.1%), falls from height (8.9%), poisoning (4.5%), electrocution (4.2%), train accidents (2.7%), animal injuries (0.5%), drowning (0.3%) and firearm related accidents (0.2%). Most other studies have reported similar findings except few where burns were predominant followed by railway and road accidents[11] and, rail track injuries followed by road accidents, burns & drowning.[13]

Preferred ways of suicide in the present study were poisoning (48.5%), hanging (38.5%), burns (8%), train accidents (3.8%), cut injuries (0.8%) and falls (0.4%). In other studies hanging was the preferred mode[11,17] and poisoning was used predominantly.[18]

Homicidal deaths were majorly due to episodes of assault (64.9%) followed by burns (17%), poisonings (7.5%), gunshot injuries (5.3%), strangulation (2.1%), fall from height (2.1%) and railway track injuries (1.1%) respectively. Our results are similar to other studies.[9,18]

Homicidal deaths were majorly due to episodes of assault (64.9%), burns (17%), poisonings (7.5%), gunshot injuries (5.3%), strangulation (2.1%), fall from height (2.1%) and railway track injuries (1.1%) respectively. Our results are similar to various other studies with slight variations.[4,18]

Conclusion:

Its real unfortunate that we autopsy surgeons can do very little to trim down unnatural deaths. However, in an attempt to at least try to decline its toll the following suggestions by us can be made:

- Strict implementation of traffic rules and proper sensitization of general public regarding traffic rules so that mayhem of road traffic accidents can be reduced to some extent. Special attention and proper legal action should be taken against drunken drivers, unskilled or semiskilled drivers. Reckless and rash driving should be discouraged and properly penalized.
- Public enlightenment, good road maintenance and safe driving culture as well as sustainable security for life and property would reduce the incidence of these preventable deaths.
- Encroachment of roads by shopkeepers and hawkers should be dealt with strictly.
- Stray animals should be removed from the roads and placed in govt. cattle sheds.
- By improving the literacy rate and providing employment to the youth, crime rate and more so the number of homicidal and suicidal deaths can be brought down.
- Various socio-economic reforms should be planned for reducing the mental stress faced by individuals which will definitely reduce the high incidence of suicides. These policies should be properly and honestly implemented.
- Empowerment of the women by encouraging education of women and planning proper implementation of regulations which will discourage.

Ethical Clearance:

Ethical clearance for the study was obtained from Institute Ethics Committee of SMS Medical College, and attached group of Hospitals, Jaipur.

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Figure 1: Sex and Age wise distribution of cases

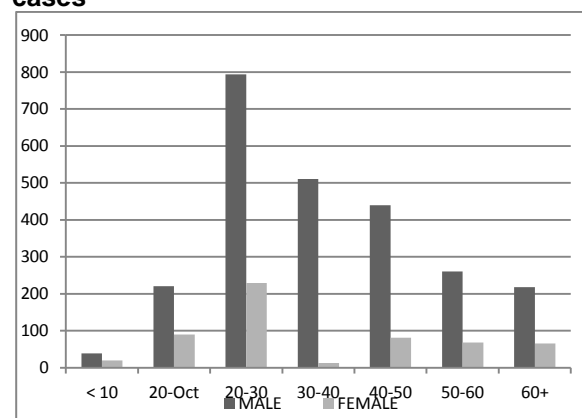


Figure 2: Distribution of cases according to Occupational Status

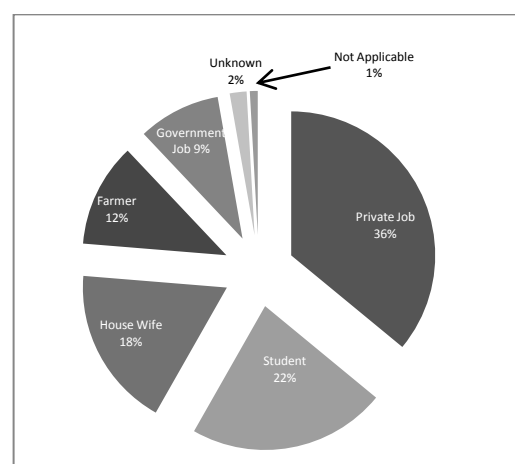


TABLE:1 Distribution of Cases according to Sex & Cause of Death (N= 3172)

Cause of death	Male	Female	Total
Road Traffic accidents	1450	204	1654
Thermal injury deaths	226	288	514
Deaths due to poisoning	205	62	267
Deaths due to Fall from Height	210	44	254
Electrical & lightning injury deaths	112	06	118
Asphyxial deaths	69	39	108
Railway injuries	85	19	104
Other Accidental Deaths	54	12	66
Deaths due to Assaults - Sharp & Blunt Trauma	54	07	61
Mortality related to animate injuries	09	07	16
Fire Arm and explosion deaths	07	01	08
Suicidal sharp cut Injury related deaths	02	00	02
Total	2483	689	3172

TABLE:2 Distribution of cases according to Age & Cause of Death (N= 3172)

Cause of Death	Age Group (in Yrs.)							Total
	<10	10-20	20-30	30-40	40-50	50-60	>60	
Road Traffic accidents	36	157	505	322	303	179	152	1654
Thermal injury deaths	10	53	213	129	60	23	26	514
Deaths due to poisoning	04	35	84	54	43	34	13	267
Deaths due to Fall from Height	04	10	51	48	46	42	53	254
Electrical & lightening injury deaths	01	14	55	20	14	11	03	118
Asphyxial deaths	01	16	48	25	12	04	02	108
Railway injuries	01	10	28	17	24	12	12	104
Other Accidental Deaths	02	05	17	17	13	06	06	66
Due to Assaults - Sharp & Blunt Trauma	00	08	17	12	04	11	09	61
Mortality related to animate injuries	00	02	00	02	01	03	08	16
Fire Arm and explosion deaths	00	01	04	00	01	02	00	08
Suicidal sharp cut Injury related deaths	00	00	01	00	00	01	00	02
Total	59	311	1023	646	521	328	284	3172

Table:3 Distribution of subjects according to Cause & Manner of Death (N= 3172)

Cause of Death	Accidental	Suicidal	Homicidal	Undetermined	Total
Road Traffic accidents	1652	00	00	02	1654
Thermal injury deaths	477	19	16	02	514
Deaths due to poisoning	125	116	07	19	267
Deaths due to Fall from Height	248	01	02	03	254
Electrical & lightening injury deaths	118	00	00	00	118
Asphyxial deaths	08	92	02	06	108
Railway injuries	76	09	01	18	104
Other Accidental Deaths	66	00	00	00	66
Due to Assaults - Sharp & Blunt Trauma	00	00	61	00	61
Mortality related to animate injuries	16	00	00	00	16
Fire Arm and explosion deaths	03	00	05	00	08
Suicidal sharp cut Injury related deaths	00	02	00	00	02
Total	2789	239	94	50	3172

**** Contd from Page No. 155****Figure 3: Master-chart****MASTER-CHART**

S. no	Length (males) in cms	Mean Length (males)	Breadth (males) in cms	Mean Breadth (males)	FMI (males) %	Mean FMI (males)	Length (females) in cms	Mean Length (females)	Breadth (females) in cms	Mean Breadth (females)	FMI (females) %	Mean FM (females)					
1	3.6	3.69cms	3.2	3.2cms	88.90	86.70%	3.2	3.4cms	3	3cms	93.80	88.30%					
2	3.8		3.3		86.80		3.4		2.9		85.30						
3	3.7		3.1		83.80		3.3		3.1		93.90						
4	3.6		3.2		88.90		3.4		2.9		85.30						
5	3.5		3.1		88.60		3.4		3		88.20						
6	3.7		3.1		83.80		3.5		2.9		82.90						
7	3.8		3.2		84.20		3.4		3		88.20						
8	3.7		3.3		89.20		3.4		3.1		91.20						
9	3.8		3.2		84.20		3.3		3		90.90						
10	3.6		3.3		91.70		3.4		3.1		91.20						
11	3.9		3.3		84.60		3.5		3.1		88.60						
12	3.6		3.1		86.10		3.4		3		88.20						
13	3.7		3.2		86.50		3.6		2.9		80.60						
14	3.5		3.1		88.60		FMI = Foramen magnum index = Breadth (B)/ Length (L) x 100										
15	3.9		3.3		84.60												

Original Research Paper

Sex Determination by using Maximum Length of Femur Bone: A Study of 100 Cases

¹O. Gambhir Singh, ²Sundarrapandian

Abstract

Present study was conducted by selecting 100 normal South Indian adult femora from the skeletal collection of the Anatomy department, S.R.M. Medical College & Research Institute, S.R.M. Nagar, Potheri, Tamil Nadu, India. For the present study the maximum length means the maximum vertical distance between upper end of head of the femur and the lowest point of the femoral condyle. All measurements were done using osteometric board and values were expressed in millimeters. The maximum length of right male femur varied from 394mm to 506mm and in case of the left femur the maximum length varied from 396mm to 505mm. However, in cases of females the maximum length of right femur may vary from 375mm to 474mm and the left femur from 380mm to 470mm. The difference in femoral length in male and female was highly statistically significant with $P < 0.001$ on both side. However, no statistical difference was found between the right and left side for the mean values computed for both genders ($P > 0.05$).

Key Words: Sex determination, Femur, Maximum length, South Indian population

Introduction:

One of the most important aspects in identification either from skeletal remains, decomposed or mutilated bodies is the determination of sex of the individual because this almost exclude 50% of the search area as half of the other sex population is excluded. According to Krogman and Iscan[1] standards of morphological and Morphometrical attributes in the skeleton may differ with the population samples involved. Data concerning the sexing potential of the femur is available in the literature and it is well known that this data varies a great deal according to the population sample from which they have been taken by Holliday and Falsetti [2]; Alunni-Perret V, et al [3], Asala S [4] and Kranioti, et al.[5] These studies all contribute to demonstrate that there is considerable intra- and inter-population variability in femoral dimensions as reported by Lavelle[6] and no single standardized formula can be used within all population groups for sexing individuals as reported by Alunni-Perret, et al.[3] So, the present study was taken to establish the standard numerical values of the sexual identification from the maximum femoral length in the South Indian population.

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Material and Method:

The present study was conducted with the collaboration of Anatomy Department, S.R.M. Medical College & Research Institute, S.R.M. Nagar, Potheri. We selected 60 male (35 right side femurs and 25 left side femurs) & 40 female (25 right side & 15 left side) normal complete adult femur bones from the available skeletal collection. Bones showing obvious pathology, fracture or any defects were excluded from the study. These bones were collected from the anatomy cadavers in the region of Andhra Pradesh & Tamil Nadu.

All the bones were cleaned following the standard procedure. Maximum length was measured with the help of Osteometric board. For the present study the maximum length means the maximum vertical distance between upper end of head of the femur and the lowest point of the femoral condyle. For each and every bone measurement was done three times and it was repeated by a second independent observer so as to minimize inter personal error. All the measurements were noted in millimeters and the data collected was tabulated and studied statistically.

Observations & Results:

FOR MALE:-

(1) Right femur: The maximum length of right male femur varied from 394mm to 506mm (Mean: 450 & S.D.: 23.90) as in **Table No.1**.

(2) Left femur: The maximum length of left male femur varied from 396mm to 505mm (Mean: 450.50 & S.D.:23.54).

FOR FEMALE:-

(1) Right female femur: The maximum length varied from 375mm to 474mm (Mean: 424.50 & S.D.: 20.34) as shown in **Table No.2**.

(2) Left female femur: The maximum length varied from 380mm to 470mm (Mean: 425 & S.D.: 21.05).

We observed that the mean value of the maximum length was higher in male as compared to female. The difference in femoral length in male and female was highly statistically significant with $P < 0.001$ on both side. However, no statistical difference was found between the right and left side for the mean values computed for both genders ($P > 0.05$). By demarking points, definite sexual classification in male right bone (>476.50) was 15.50 % and in female right bone (<379.50) was 6.35%.

Discussion:

As a rule male bones are longer and massive and this difference is reflected by the greater values of the mean maximum femoral length in male on both the sides. The maximum length of right male femur varied from 394mm to 506mm (Mean: 450 & S.D.: 23.90) and the left male femur varied from 396mm to 505mm (Mean: 450.50 & S.D.: 23.54). In case of female also there is some variation in femoral length. From the above data analysis it was observed that the mean value of the maximum femoral length was higher in male as compared to female. Calculated P value showed that the difference in the mean maximum length in male and female was highly statistically significant with $P < 0.001$. Comparison between the present study and other studies has been shown in **Table: 3**. There is wide difference in the mean femoral length both in male & female in different studies by Purkait & Chandra, India; [7] Dittrick J & Suchey M., California; [8] Dibernardo & Taylor American White [9] who had conducted at different places of the world. This could be due to multiple factors like genetic constitution, geographical variation and other environmental and nutritional factors.

The mean maximum male femoral length value in present study was 450 cm (right) & 450.50 cm (left). Similar findings were also reported by Dittrick J, et al [7] and Dibernardo & Taylor. [9] The mean maximum length of femur amongst the Thai population was 429.4 cm (with SD 21.38) as reported by King C.A., et al. [11] However, Dibernardo & Taylor [9] observed 450 cm (with SD 24.4) as the mean maximum femoral length in cases of American blacks. This difference in the mean femoral length amongst the different populations may possibly be due to multiple factors like genetic constitution, dietary

habits, nutritional status, environmental & socio-cultural factors. Our study is also consistent with the works of Singh S. P. and Singh S; [11] Leelavathy N, et al, [12] Steyn M. & Iscan M. Y [13] and Pandya, et al. [14] Based on these calculated range, we can statistically fix a measurement above which no female bone can be found and another measurement below which no male femora can be seen, measurements can be termed as demarking points.

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Table No.1: Maximum length of femur in cases of Male

Statistical Value	Right Femur	Left Femur
Range	394-506	396-505
Mean	450	450.50
S.D. Value	22.45	22.54
P-Value	$P < 0.001$	$P < 0.001$

Table No.2: Maximum length of femur in cases of Female

Statistical Value	Right Femur	Left Femur
Range	375-474	380-470
Mean	424.50	425
S.D. Value	20.34	21.05
P-Value	$P < 0.001$	$P < 0.001$

**** Table No 3 on Page no. 175**

Original Research Paper

A study of sudden natural deaths in Imphal from 2010-2014

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Abstract

Sudden death is defined as death occurring within 24 hours of the onset of terminal symptoms. It is frequently associated with allegations of foul play. A retrospective study of sudden deaths in Imphal from 2010-2014 was conducted from the post mortem cases done at Regional Institute of Medical Sciences, Imphal. Out of a total of 1559 post mortem cases, 105 cases were of sudden deaths. Males constituted 91% and females only 9% of the cases. Maximum incidence was seen in the 30-40 year age group followed by 40-50 years. 30% were found dead, 25% had preceding illness, 30% were of collapse/unconsciousness, 15% died during sleep, 25% had preceding illness and 30% suddenly collapsed and died. Regarding the causes, maximum were related to the cardiovascular system (49.5%) followed by alimentary (25.7%), respiratory (14.3%), genitor-urinary (3.8%) & central nervous systems (1%) whereas the rest were miscellaneous causes (5.7%). Statistics on sudden deaths are useful to inform policy makers and scientists about its global burden and the need for prevention efforts, including screening protocols, identification of risk-stratification tools and availability of public-access first-aid measures and implementation of primary prevention strategies. Spreading awareness is important to clear the mystery surrounding a sudden death.

Key Words: Sudden death, Forensic autopsy, Natural death, Cardiovascular system

Introduction:

Death is said to be sudden or unexpected when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness.[1] Sudden death of a young, apparently healthy person is not only a great tragedy but is frequently associated with allegations of foul play. While the odds that any given person will die suddenly are very small (with estimates ranging from 1 in 50,000 to 1 in 300,000 over 10 years), each sudden death that does occur is devastating to family, friends and community. The large majority of these sudden natural deaths are related to underlying cardiac conditions that were undiagnosed prior to the lethal event.[2,3] Spreading awareness is important to clear the mystery surrounding a sudden death.

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Material and Method:

A retrospective study of sudden deaths in Imphal from 2010-2014 was conducted from the post mortem cases done at a tertiary care teaching hospital at Imphal. Circumstances surrounding the death were analyzed from the police report and clinical data. Cases with poisoning, trauma or decomposition have been excluded. The cases were analysed with regard to annual incidence, age and sex incidence, marital status of the victims, external injury present on the body, area of body injured, type of injury, circumstances and cause of death and type of diseases causing the deaths. The findings are compared with similar studies done in other parts of the world and the various causative factors are analysed to formulate preventive measures.

Results:

Sudden and unexpected natural deaths constituted 6.74% of medico legal autopsies (**Fig 1**). As shown in **Table 1**, the year-wise incidence gradually increased from 2010 (19.4%) to 2013(27.6%) with a sudden dip in 2014 (15.23%). The mean age of the studied population was 40.86 years. Male to female ratio was 10.6:1. Maximum incidence was reported above 30 yrs of age, with peak incidence between 30–50 years (**Table 2**). 27(26%) cases had trivial external injuries while 78(74%) cases

had no injuries (**Fig 2**). Regarding the circumstances of death, 31(29.5%) were found dead, 16(15.2%) died during sleep, 26(24%) died following illness and 29(30%) were found unconscious or comatose (**Table 3**). It is evident from Table 4 that cardiovascular pathology with 66.67% contributed to major cause of sudden and unexpected deaths followed by gastro intestinal diseases with 27(25.7%), respiratory pathology with 15(14.2%) and the least was contributed by the central nervous system disorders with 1(0.9%). Among the cardiovascular causes, sudden cardiac death due to coronary insufficiency was responsible in 75% of the cases, cardio-myopathy in another 13.46%, and viral myocarditis in 7.69% and cardiac tamponade in 3.85% of the cases. Among the gastro intestinal diseases and hepato-biliary conditions, cirrhosis was responsible in 55.56% of the cases and among the respiratory diseases; pneumonia was responsible in 40% of the cases while it was tuberculosis in 26.67% and interstitial pneumonitis in 33.33% of the cases. CNS was involved in 1 case with intraventricular haemorrhage. Among the miscellaneous causes, bleeding disorder caused the death in 1 case (**Table 5**).

Discussion:

The pattern of sudden unexpected natural deaths varies in different parts of the world. In a study by in Nigeria,[4] the mean age of the victims of sudden natural unexpected deaths was 43.1 with a male female ratio of 2.1:1. 54.1% were above 40 years while 45.9% were below 40 years. In another study by Rao DS and Yadukul,[5] the mean age was 35 years, and the maximum number of cases was observed in 45-65 years age groups. Interestingly, in our study, male cases outnumbered females throughout the study period (11: 1). The reason could be that males are more prone to stress. As regards the age incidence, maximum was seen in the 30-40yr group (33%) followed by 40-50yr (30.5%).

In the present series, even though external injuries were present in 74% of the cases, all these injuries were trivial surface injuries and did not contribute directly to the deaths.

Regarding the circumstances of death, 31(29.5%) were found dead, 16(15.2%) died during sleep and 29(30%) were found unconscious or comatose. The suddenness of these deaths led to suspicions as to the nature and cause of deaths in these cases.

Cardio-Vascular System (CVS) involvement with 52(49%) cases was the major cause of death followed by diseases of the alimentary system (25.7%), Respiratory System (RS) (14.2%) in our study. This is slightly different from the findings of the other studies where cardiovascular conditions were followed by diseases of the respiratory system.[4,5]

The most commonly detected disease in Sudden Cardiac Death (SCD) victims over 35 years of age is coronary artery disease (CAD).[6,7] In the younger population of less than 35 years of age, cardiomyopathies or a morphologically normal heart are the most frequent findings.[8] These findings may be compared with the findings of our study.

Alimentary system conditions were the second leading cause of sudden natural deaths in our study. This finding differs from the findings of the other studies in other parts of the world where respiratory system conditions followed the cardiac conditions.[4,5] This may be due to the difference in the geographical location and also on the environmental factors. Among the alimentary system conditions, cirrhosis was responsible in 55.56% of the cases in our study. The heart is one of the most adversely affected organs in patients with liver disease. The risk for arrhythmia and sudden death is influenced by factors such as cirrhotic cardiomyopathy, cardiac ion channel remodelling, electrolyte imbalances, impaired autonomic function, hepatorenal syndrome, metabolic abnormalities, advanced age, inflammatory syndrome, stressful events, impaired drug metabolism and co morbidities.[9] On the other hand, perforated duodenal ulcer remains a major life threatening complication of chronic peptic ulcer disease.[10] In our study, 2 cases died due to duodenal perforation probably resulting from chronic peptic ulcer. In a study on deaths due to acute pancreatitis (AP), Patients with AP died significantly earlier than a control autopsy population of 38,259 patients. Pulmonary edema and congestion were significantly more prevalent in this group.[11] These were seen in our study too.

Among the respiratory diseases, pneumonia was responsible in 6 cases, tuberculosis in 4 cases and interstitial pneumonitis in 5 cases. Pneumonia affects approximately 450 million people globally per year (7% of the population) and results in about 4 million deaths. Although pneumonia was regarded by William Osler in the 19th century as "the captain of the men of death,"[12] the advent of antibiotic therapy and vaccines in the 20th century has seen improvements in survival.[13]

Nevertheless, in developing countries, and among the very old, the very young, and the chronically ill, pneumonia remains a leading cause of death.[13,14] Tuberculosis is a widespread, and in many cases fatal, infectious disease caused by various strains of mycobacterium. One-third of the world's population is thought to have been infected with *M. tuberculosis*, and new infections occur in about 1% of the population each year. More people in the developing world contract tuberculosis because of a poor immune system, largely due to high rates of HIV infection and the corresponding development of AIDS.[15]

Central nervous system was involved in 1 case with intraventricular haemorrhage. There are a number of central nervous system (CNS) disorders, which are responsible for sudden death and are often associated with cardiac involvement. The most well-known of these CNS-disorders are epilepsy, stroke, subarachnoid bleeding, bacterial meningitis, and head injury.[16] In the present case stroke was responsible for the bleeding and sudden death. Because of the single instance of CNS disorder in our study, a detailed analysis of the role of central nervous system in sudden death could not be done.

Genitor-urinary system involvements were glomerulosclerosis and chronic pyelonephritis with 1 and 3 cases respectively. Glomerulosclerosis is an important cause of kidney failure in adults. Severe cases of pyelonephritis can lead to pyonephrosis, sepsis, kidney failure and even death[17] which may have been the case in this study.

Among the miscellaneous causes, bleeding disorder caused the death in 1 case. Coagulopathy may cause uncontrolled internal or external bleeding. Left untreated, uncontrolled bleeding may cause damage to joints, muscles, or internal organs and may be life-threatening. People should seek immediate medical care.[18] Timely intervention could not be done in our case and hence the sudden death.

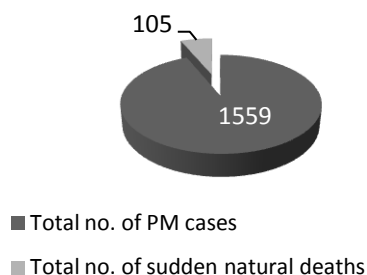
Conclusions:

Sudden cardiac death is the main cause of sudden death in this part of the country. Although prediction of "Sudden cardiac death" remains difficult and traditional cardiovascular risk factors are of greatest importance, this knowledge might guide future directions to prevent sudden cardiac death in persons with subclinical cardiac dysfunction. Statistics on sudden deaths are useful to inform policy makers and scientists about its global burden and the need for prevention efforts, including

screening protocols, identification of risk-stratification tools, availability of public-access first-aid measures and implementation of primary prevention strategies. A detailed autopsy and histopathological examination of the major organ systems is highly recommended for all cases of sudden deaths, especially in the young.

References:

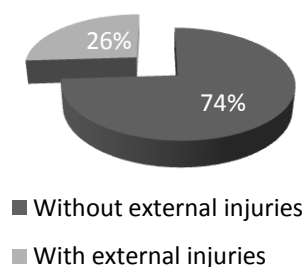
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Fig 1. Sudden natural deaths brought for autopsy during 2010 to 2014**Table 1: Year-wise incidence**

Year	No. of cases of sudden natural deaths	%
2010	20	19.04
2011	21	20
2012	19	18.09
2013	29	27.6
2014	16	15.23

Table 2: Age-group incidence

Age-group	No. of cases	%	Male	%	Female	%
0-10	0	0	0	0	0	0
10-20	4	4	3	3	1	1
20-30	15	14.2	15	14	0	0
30-40	35	33	32	30.5	2	2
40-50	32	30.5	29	27.5	3	3
50-60	13	12.3	12	11	1	1
60-70	4	4	4	4	0	0
70-80	2	2	1	1	1	1
>80	0	0	0	0	0	0
total	105	100	97	92	8	8

Fig 2: External injuries**Table 3: Circumstances of death**

Circumstances	No. of cases	%
Found dead	31	29.5
During sleep	16	15.238
Preceding illness	26	24.76
Collapse/unconscious	29	30
total	105	

Table 4: Cause of death

System	No. of cases	%
CVS	52	49.52
Respiratory system	15	14.28
GIT	27	25.7
Genitor-urinary system	4	3.8
CNS	1	0.952
misc	6	5.7

Table 5: Types of diseases

System	Disease	Cases	Total
CVS	Coronary insufficiency	39	52
	Cardiomyopathy	7	
	Viral myocarditis	4	
	Cardiac tamponade	2	
GIT	Hepatitis	8	27
	Cirrhosis	15	
	Fatty liver	1	
	Duodenal perforation	2	
	Acute haemorrhagic pancreatitis	1	
Respiratory system	Pneumonia	6	15
	Tuberculosis	4	
	Interstitial pneumonitis	5	
Genitor-urinary system	Glomerulosclerosis	1	4
	Chronic pyelonephritis	3	
CNS	Intraventricular haemorrhage	1	1
Misc	Bleeding disorder	1	6
	Asphyxia	1	
	Unknown	4	
Total		105	105

Original Research Paper

Dactylographic Pattern in relation to Blood Group & Iris Colour

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Abstract

Finger ridge patterns, blood group, iris colour - all three are very important tools of identification. Aim of present study was to find out any significant relationship of dactylographic pattern with ABO-Rhesus group & iris colour. The study was conducted among 251 medical students of semi-urban area of West Bengal. Loop was mostly observed followed by whorl, arch & composite type. In ABO system, O type was most prevalent, followed by B, A & AB group. 98% of study population was Rhesus positive. There were statistically significant association between finger ridge patterns with ABO group & ABO-Rhesus considered together as p values < 0.05 in both observations. But there was no significant relation found between dactylographic pattern & Rhesus blood group as p > 0.05. Distribution of primary finger print pattern was same for A+ve, B+ve, AB+ve and O+ve individual, i.e. loop was most predominant, followed by whorl, arch & composite type. But in B-ve group, whorl (60%) was more than loop (40%) & in AB-ve group, loop (80%) was followed by arch (20%). This study population showed almost no variation in iris colour. It may be concluded that these tools of identification should be used independently to obtain best result.

Key Words: ABO-Rhesus blood group, Finger ridge pattern, Iris colour

Introduction:

The focus of this study is to find out statistically significant relationship of dactylographic pattern with blood group & iris colour. Dactylography or Fingerprints form the most reliable criteria for identification & an inevitable tool in the study of forensic medicine. A fingerprint is an impression of papillary or friction ridges of the finger tips.[1] Fingerprint patterns are genotypically determined and remain constant throughout lifetime until destroyed by decomposition after death. They are very much individualistic, even identical twins do not have the same pattern of finger ridge impressions. Common major types of patterns are loop, whorl arch & composite. From forensic perspective, the significant fact is that finger prints are abundantly[1] found at the scene of crime from which the presence of accused or suspects or victim or any other individual can easily be established..

Dactylographic patterns are kept in criminal records of investigating authority. So far, 33 major blood groups have been recognised by International Society of Blood Transfusion (ISBT 2012) which vary in their frequency of distribution amongst various races of mankind.[2] Clinically, only ABO & Rhesus types are of main importance. 'ABO' system is further classified as A, B, AB, O blood group types & 'Rhesus' system into 'Rh +ve' and 'Rh -ve'. And scene of occurrence of crime without any traces of blood is almost a non entity.

Eye colour is a polygenic phenotypic character determined by 2 distinct factors: the pigmentation of iris and the frequency-dependence of scattering of light by turbid medium in stroma of iris.[3,4] The Martin-Schultz scale[5] is a standard color scale commonly used to establish more or less precisely the eye colour of an individual; the scale consists of 16 colours (from light blue to dark brown-black) that correspond to the different eye colours observed in nature due to the amount of melanin in the iris.

In the present study, if the result shows any statistically significant relationship of fingerprint with blood group & iris colour, we can to some extent predict blood group & iris colour of a person based on fingerprint pattern available & vice versa. Accuracy of prediction may be enhanced by conduction of similar

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studies on a larger sample size in future. This may ultimately help to establish a link between crime & criminals.

Relationship between fingerprint pattern and blood group status are studied several times in several ways in different corners of India & abroad as found in literature

A previous study in Karnataka by Desai, et al[6] showed that loops dominated in all blood groups of both Rh positive and Rh negative individuals but whorls were found more in O negative blood. In another study at Mangalore by Rastogi, et al[7] done among medical students, they found that loops are predominant in blood group A, B, AB and O in both Rh positive and Rh negative people with exception of O negative where whorls are more frequently detected.

Almost similar findings are observed in a Nigerian research work done by Eboh.[8] He found that within the particular ABO-Rhesus blood type, loop pattern had higher percentages compared to arch and whorl, but in O negative person whorl has higher percentage of occurrence.

In another Indian study conducted on medical students of Ajmer by Bharadwaja A, et al[9] it was observed that frequency of loops was maximum in both the Rh-positive and Rh-negative individuals of ABO blood groups except AB group where the incidences of whorls were more than loop.

In a very recent Indian study of Maled V, et al[10] again it was found that loops were most frequently found in both Rh positive and Rh negative persons of ABO system followed by whorls and arches, with the exception of AB blood group where whorls predominate followed by loops and arches.

A Libyan study by Fayrouz I.N, et al[11] showed that in Rh+ve cases for both blood group A and O, loops were maximum followed by whorls, while in blood group B, whorls were majority in both Rh+ve and Rh-ve cases.

According to Kshirsagar S.V, et al[12] blood group O showed maximum frequencies of arches, whereas blood group AB showed lowest frequencies of whorls.

In another Indian article of Mehta A.A, et al[13] it was seen that whorls, loops and arches were highest in B, O and AB blood group respectively. Arches were higher in Rh negative blood group.

In a 2014 Indian study by Deopa D, et al[14] it was observed that loops are predominant in all blood groups except in 'A' positive blood group where whorls are slightly more. Whorls were highest in A & AB positive blood group and loops were highest in O & B blood group. Arches were least in all blood groups.

We have tried a lot to find out any research work done on relationship between fingerprint pattern & colour of iris, but failed to obtain any information on this regard.

Aims and Objectives:

Firstly to find out if there is any statistically significant relationship exists between fingerprints pattern of a person with his/her blood group and iris colour

Secondly to determine or predict with some degree of accuracy, the blood group & iris colour of an individual from fingerprint pattern available & vice versa.

Material and Methods:

This was a cross-sectional descriptive study and study design is randomized single blind. The study was conducted among the students of three batches of a semi-urban medical college of West Bengal in July-August 2015. Total 251 subjects were studied out of 277 available.

Study was conducted after getting clearance from Institutional Ethics Committee. Students of the medical college were provided with protocol and their informed consents for participation in the study were asked for. Data collection method was thoroughly explained to the participants.

Exclusion criteria: Those who did not give the consent, those with permanent scars on their fingers or thumbs, with any hand deformities due to injury, birth defect or disease, those having worn fingerprints, extra, webbed or bandaged fingers.[7] Total 26 of the available students were excluded from the study.

Procedure for data collection: After brief introduction about the work, consent form & information brochure was distributed among the students. Data were collected from all the students of three batches who gave the consent to participate. It was of single blind procedure, no identification was recorded to reduce bias.

Each subject was asked to wash hands thoroughly with soap and water and dry them using a towel.

Each subject was asked to press his fingertip on the ink pad and then to the unglazed paper to transfer the fingerprint impression. This technique was followed for all ten fingers of both hands. In this way, the fingerprints of all the ten fingers were taken separately on the respective areas on the same sheet of paper. Care was taken to avoid sliding of fingers to prevent smudging of the print.

Photographs of both eyes were obtained by using cell phone camera in a well-illuminated room.

After the fingerprints & photographs were acquired, details such as sex, age were noted. Their blood group were taken from college id-cards. Each subject was assigned a serial number.

The fingerprint patterns were studied with the help of a magnifying lens and identified as: Loops, Whorls, Arches & Composites based on the appearance of ridge lines according to Henry-Galton system of classification. This system assigns each of the fingers a specific numeral according to sequence of position in hand, starting with right thumb as '1' up to left little finger as '10'. [7] The distribution of fingerprint patterns in both hands of individuals and its relationship with the different ABO and Rh blood groups & the eye colour were evaluated and analysed statistically.

Instruments used: Magnifying glass, ink pad, unglazed white paper, cell phone, statistical software, Martin-Schultz scale [5] etc

Source of finance: funded by researchers.

Plan of analysis: Data were analyzed by percentage & tests of significance using statistical software. For comparisons, chi-square test was used to determine significance at $p < 0.05$. After analysis data were presented by tables.

The data obtained from current study is compared with similar studies available in literature.

Ethical consideration: Extreme caution was taken to maintain confidentiality, and free voluntary consent was taken from the participants before trial. The proposal for study was submitted in month of March 2015 for ethical clearance from institutional ethics committee and approval was received before commencement of actual research work.

Confidentiality: Identity of the students cannot be revealed from the collected information. Participants' signatures were taken on informed consent forms only, which were completely separated sheets from the data collection sheets. This study will only be used for academic purpose not for commercial purpose.

Observations and Results:

The present study was conducted on two hundred & fifty one medical students. So a total of 2510 fingers are examined for ridge pattern. More than half of the fingers have loop pattern (~59%), followed by whorl with only 30% frequency. Composite pattern is least available. **(Table No. 1)**

O blood group is most predominantly found, followed by B type. 98% of study population is Rhesus positive. Considering two

systems together, O+ve blood group is on the top of the list, and there is none with A-ve blood group. **(Table No. 2)**

Within respective blood group type of ABO system, loops are found in higher frequencies as compared to whorl, arch and composite type of finger ridge pattern. There is a statistically significant association found between finger ridge patterns and ABO blood group as $p < 0.05$. **(Table No. 3)**

Within respective blood group type of Rhesus system, loops are found in higher frequencies as compared to whorl, arch and composite type of finger ridge pattern. Not a single composite pattern is found in Rh-ve blood group. There is no statistically significance found between finger ridge patterns and Rhesus blood group as $p > 0.05$. **(Table No. 4)**

Within respective blood group type of ABO-Rhesus system, loops are found in higher frequencies as compared to whorl, arch and composite type of finger ridge pattern with few exceptions from the usual order of frequencies i.e. loop, whorl, arch, composite. In blood group B-ve, percentage of whorl is more than that of loop. In AB-ve blood group, percentage of arch is more than that of whorl, as the later is found none. There is a statistically significant association found between finger ridge patterns and ABO-Rhesus blood group considered together as $p < 0.05$. **(Table No. 5)**

Regarding iris colour, out of 251 subjects, 250 have dark brown to black iris (Martin-Schultz scale 14-16) & only 1 subject has hazel iris (Martin-Schultz scale 10). No variation of ethnicity among student population may be the justification of this observation

Discussion:

In present study, loop was mostly observed (59%), followed by whorl, arch & composite type with incidence of 30%, 7%, and 4% respectively. Almost similar observations with minor variations in proportion of loop, whorl & arch are found in most of the Indian or foreign research articles, [6-10, 13, 14] though composite pattern is not considered in most cases except observation of Maled V, et al. [10]

Sequence of occurrence of blood group in this study is as follows: O (39%), B (35%), A (19%) & AB (9%). Furthermore, 98% of the study population is Rh positive, only 2% is Rh negative. There is no AB negative individual found. Few research works [6, 7, 9, 10] have shown similar results i.e. blood groups according to frequencies: O > B > A > AB & Rh+ve >> Rh-ve. There are few exceptions. Eboh [8] observed almost similar frequencies in both A & B blood

group. Mehta A.A, et al[13] & Deopa D, et al[14] found blood group B more in number than O group.

In present study, there is a significant association between finger print pattern and ABO blood group as p value is < 0.05. That is not match with Eboh's study conclusion. [8]

Incidences of different finger print pattern are alike for all ABO blood groups i.e. loop is most predominant, followed by whorl, arch & composite in descending order. This observation is in accordance with most of the research works[6-9, 12-13] except study of Maled V, et al[10] which shows frequency of whorl is more than that of loop in AB blood group, composite pattern is more than arch in B blood group and equal number of arch & composite type in A blood group.

Present study shows that there is no significant association between finger print pattern and Rhesus blood group as p value is more than 0.05 which is in discordance with the findings of Eboh[8] on Nigerian study population.

The general distribution of primary finger print pattern is the same for Rh positive & Rh negative persons i.e. loop > whorl > arch > composite in descending order of frequencies. Composite pattern is not found in Rh negative groups. That sequence of finger print pattern in both Rh positive & Rh negative persons is agreed by most of the researchers.[6-10,13]

In our study, there is a significant association between finger print pattern and ABO-Rhesus blood group as p value is less than 0.05. Similar observation is obtained in Nigerian research work done by Eboh.[8]

The distribution of primary finger print pattern is the same for A+ve, B+ve, AB+ve and O+ve individual, i.e. loop is at the top, followed by whorl, arch & composite type. However, in B-ve group, whorl (60%) is more than loop (40%), and no arch & composite type are found. In AB-ve group, loop has the highest percentage (80%), followed by arch (20%), and there is no whorl or composite type. In O-ve group, loop (80%) is followed by whorl (20%) but arch & composite pattern are not seen.

Also in most of the previous studies,[6-9, 11,14] the distribution of primary finger print pattern different blood groups of ABO-Rhesus system is as follows: loop> whorl> arch> composite in descending order of frequencies. There are some exceptions from this usual finding. Desai et al^[6], Rastogi et al[7] and Eboh[8] found that the number of whorls was more than loops in O negative individuals. In few more occasions, whorls are more frequently seen than loops; in blood group AB-ve by Bharadwaja A et al[9], in both B+ve & B-ve blood

groups by Fayrouz I.N, et al[11], in blood groups A+ve & AB+ve by Deopa D, et al.[14]

In our study population, almost no variation was observed in iris colour other than dark brown to black. Out of 251 subjects, 250 have dark brown to black iris (Martin-Schultz scale 14-16) & only 1 subject has hazel iris (Martin-Schultz scale 10). Whole the student population belong to same ethnicity may be the reason behind this observation. A thorough search is made to find out any research work done on relationship between fingerprint pattern & colour of iris, but failed to obtain any literature on this aspect.

Conclusion:

As observed in the study, it is may be concluded that prediction of Rhesus blood group of an individual is not achievable depending on the fingerprint pattern available. However, the prediction of ABO group and ABO-Rhesus blood group together of someone is possible based on the finger ridge pattern of the person. Therefore, fingerprints and Rhesus blood groups can only be used separately to identify a person.

Acknowledgement:

This study was a part of a project of ICMR STS 2015. We are indebted to medical students of the institute who voluntarily participated in this study.

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Table 1: Distribution of primary finger print pattern of all fingers (n= 251 x 10)

Pattern	Frequency (Percentage)
Loop	1476 (58.8 %)
Whorl	758 (30.2 %)
Arch	182 (7.25%)
Composite	94 (3.75%)
Total	2510 (100%)

Table 2: Distribution of subjects according to blood groups status (n=251)

Blood group	Rh positive	Rh negative	Total
A	48 (19.12%)	0 (0%)	48 (19.12%)
B	83 (33.07%)	1 (0.4%)	84 (33.47%)
AB	21(8.37%)	1 (0.4%)	22 (8.77%)
O	94 (37.45%)	3 (1.2%)	97 (38.65%)
Total	246 (98%)	5 (2%)	251 (100%)

Table 3: Distribution of finger ridge patterns within ABO blood groups

Pattern of Finger ridge	ABO Blood Groups				
	A	B	AB	O	Total
Loop	303 (63%)	509 (60.6%)	110 (50%)	554 (57.1%)	1476 (58.8 %)
Whorl	135 (28%)	256 (30.48%)	85 (38.64%)	282 (29.1%)	758 (30.2 %)
Arch	25 (5%)	53 (6.34%)	13 (5.91%)	91 (9.38%)	182 (7.25%)
Composite	17 (4%)	22 (2.62%)	12 (5.46%)	43 (4.43%)	94 (3.75%)
Total	480 (100%)	840 (100%)	220 (100%)	970 (100%)	2510 (100%)

Chi-square = 27.899 with 9 degrees of freedom; p= 0.000

Table 4: Distribution of finger ridge patterns within Rhesus blood groups

Pattern of Finger ridge	Rhesus Blood Groups		
	Rh positive	Rh negative	Total
Loop	1440 (58.54%)	36 (72%)	1476 (58.8 %)
Whorl	746 (30.33%)	12 (24%)	758 (30.2 %)
Arch	180 (7.32%)	2 (4%)	182 (7.25%)
Composite	94 (3.82%)	0 (0%)	94 (3.75%)
Total	2460 (100%)	50 (100%)	2510 (100%)

Chi-square = 4.814 with 3 degrees of freedom; p= 0.248

Table 5: Distribution of finger ridge patterns within ABO - Rhesus blood groups

Pattern of Finger ridge	Blood Groups								Total (%)
	A+ve	A-ve	B+ve	B-ve	AB+ve	AB-ve	O+ve	O-ve	
Loop	303 (63%)	0	505 (61%)	4 (40%)	102 (49%)	8 (80%)	530 (56%)	24 (80%)	1476 (58.8 %)
Whorl	135 (28%)	0	250 (30%)	6 (60%)	85 (41%)	0	276 (29%)	6 (20%)	758 (30.2 %)
Arch	25 (5%)	0	53 (6.4%)	0	11 (5%)	2 (20%)	91 (10%)	0	182 (7.25%)
Composite	17 (4%)	0	22 (2.7%)	0	12 (5%)	0	43 (5%)	0	94 (3.75%)
Total	480	0	830	10	210	10	940	30	2510

Chi-square = 51.757 with 18 degrees of freedom; p= 0.000

****Contd from page no. 166**

Table No.3: Comparison of maximum femoral length by other authors

Authors	Male			Female		
	Mean	S.D.	Identified (%)	Mean	S.D.	Identified (%)
Present Study	450	22.45	80%	424.75	22.69	76%
Purkait & Chandra, India [7]	451.47	23.38	84.50%	403.69	19.79	91.30%
Dittrick J & Suchey M., California [8]	450	20.1	79.5%	420.6	17.2	79.55%
Dibernardo & Taylor, Ame. White [9]	450	20.4	80%	423	22.1	71.00%

Original Research Paper

Case Based Learning as an Educational Strategy to Enhance Active Learning in Forensic Medicine

¹Vinay Kumar MS, ²Mirza Nisar Hussain Baig

Abstract

Since the time immemorial there have been many innovations in teaching and learning methods and the greatest challenge to any educational system is to involve students actively in learning. This study was undertaken with the objective to introduce case based learning and to study the effectiveness of the same in comparison to traditional didactic lectures in Forensic medicine. A group of 50 second year medical students were considered for this interventional study and were divided into two groups namely Group 1 and Group 2 of twenty five students each randomly allocated by lottery method. Group 1 was exposed to traditional lectures and Group 2 was exposed to case based learning. Group 2 was again subdivided into five subgroups. Post intervention test was conducted for both the groups at the end of four sessions lasting for 60 minutes each. Statistical analyses was made using SPSS software version 19 and inferential statistics obtained is unpaired t test for analyses. The mean scores of test of group 1 was 3.56(SD 0.58) and group 2 was 5.88(SD 0.75). $t = 12.15$, $p < 0.001$. Case based learning is learner centred, promotes active learning among students and increases their analytical skills as compared to traditional lectures.

Key Words: Case based learning, Medical students, Lectures, Forensic Medicine

Introduction:

Since the time of Gurukul system to the present day modern education system there has been many innovations and modifications in teaching and learning methods. Over a period of time it has been strongly realised that the learning takes place better if it is made as an active process. Active learning means creating an environment where students are forced to interact with peers, instructors or any concerned members and come out with new ideas based on existing as well as past experiences rather than only receiving knowledge passively from the teacher. [1 -3] Case based learning is one of the many active learning methods where a case is constructed in such a way that it simulates real life situations and stimulates learner's critical thinking. It has many traits by which higher domains of cognition can be addressed .It not only keeps students engaged throughout the sessions but also makes them come up with solutions for the given case scenarios. [4-6]

Forensic Medicine is taught in Indian medical schools during the second year of the course and it is usually by didactic lectures and practical classes. There is a need to introduce some newer educational strategies to promote active participation of the students so that they can retain the subject for a longer time and also would be able to apply the learnt subject in real life circumstances .This research study is undertaken to evaluate case based learning with the following objectives.

Objectives:

1. To introduce Case Based Learning (CBL) in Forensic Medicine.
2. To study the effectiveness of Case Based Learning (CBL) in comparison to traditional didactic lectures in Forensic Medicine.

Materials and Methods:

A group of 50 second year medical students were considered for this interventional study in the department of Forensic Medicine and Toxicology at Prathima Institute of Medical Sciences, Karimnagar from April 2015 to October 2015. They were given an orientation class about CBL and informed consent was taken along with clearance from the ethical committee of the institution. They were divided into two groups namely Group 1 and Group 2 of twenty five students each randomly allocated by lottery method. Group 1 was exposed to traditional didactic lectures and Group 2 was

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exposed to CBL. Group 2 was again divided into five subgroups and each subgroup was allotted case material. Instructors facilitated subgroups in case solving. Topics were displayed month before and resource materials were distributed to students.

Cases for CBL were constructed considering educational objectives and real life situation simulation and were validated by peer subject experts. The topic was on injuries which included types, interpretation, medico legal relevance and others. Post intervention test was conducted at the end of four sessions each lasting for sixty minutes duration for both the groups in the form of written (short answers, MCQ's), and practical examination. The assessment was made using a standard checklist. Statistical analyses was made using SPSS software version 19 with the help of statistician. Inferential statistics used is unpaired t test for analyses. P value of less than 0.05 is considered significant and P value less than 0.001 are considered highly significant.

Results and Observations:

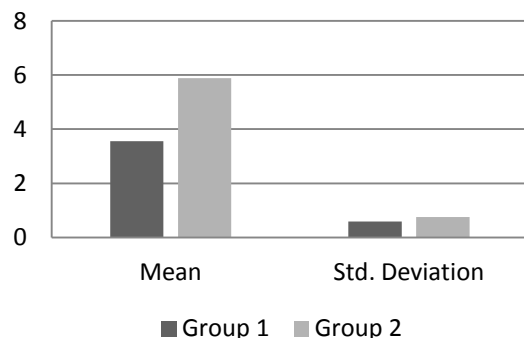
Group	Mean	Standard Deviation
1	3.5600	0.58310
2	5.8840	0.75756

t = 12.15

p < 0.001

There was a statistically significant difference between the two groups with a t value of 12.15 and P value < 0.001.

Post intervention scores across the groups



The mean scores of post intervention test of group 1 which was exposed to traditional didactic method was 3.56(SD 0.58) whereas group 2 which was exposed to CBL the mean scores was 5.88(SD 0.75).

Discussion:

Those students who were exposed to traditional didactic lectures were passive listeners with almost negligible interaction among themselves and with the teacher. The students were only receiving the content of the

topic delivered either through power point presentation or chalk board or a combination of both. There was little scope for generation of new ideas, usage of previous knowledge, analysis and application of the received content. In other words the higher levels of cognition were addressed to a meagre extent. [7, 8] These types of lectures required lesser preparation and also had the luxury of continuing with the same routine practice and being in the so called comfort zone resisting the change and innovation.

In contrast case based learning method provided the students an environment where they could express their views, communicate with the peers, apply their previous knowledge, do analysis for the given case and come out with solutions. This apart from enhancing the understanding of subject matter also helped the students acquire and build on communication skills, collaborative skills and also have fun during the entire process. [9-12] These types of innovative learning methods requires adequate preparation for the faculty as they need to construct cases in such a way that it simulates real life situation and at the same time takes care of educational objectives which needs to be achieved. The students need to come prepared for these types of sessions as teachers or instructors act only as facilitators for learning.

The slow learning students face some degree of inconvenience as they are forced to think and give suggestions. In this scenario since the students are exposed close real life situations they are able to retain the knowledge for a longer period and are able to tackle the real life circumstances in better manner. [13-16] The challenge for these types of newer methods would be motivation of the faculty to accept change and also student's mindset as they are used to conventional lectures for a long time.

Coming to assessment of students, those who were exposed to case based sessions were able to perform better as compared to their peers who underwent traditional lecturing. Here I need to stress the very fact that factual knowledge which is considered as lowest level in cognition according to Bloom where students tend to remember and reproduce was actually better among students who attended didactic lectures but once the higher domains of cognition was tested like understanding, applying, analysis definitely the CBL students outperformed other group. Therefore assessment tools which we adopt based on educational objectives to be achieved has a say in implementing the educational

strategy be it CBL or conventional lecture or any other newer method of learning.

Similar study was conducted by Ciraj, et al in department of microbiology which produced similar results where the students exposed to CBL not only scored better but also CBL had a significant positive impact on academic performance among the students .[1]

Conclusion:

Case based learning is learner centred, promotes active learning among students, increases their analytical skills as compared to traditional lectures and makes students perform better in exams. Apart from this, CBL also helps students develop communication and collaboration skills and enhances their ability to tackle real life situations. Usage of CBL along with traditional lectures will certainly help to attain the educational objectives better.

Suggestions:

The curriculum development committees along with subject experts at University and institutional levels should frame a curriculum which not only includes the content to be delivered but also should provide guidelines regarding the educational strategies which is to be adopted.

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Original Research Paper

Study of Poisoning Cases in Chitradurga District

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Abstract

Poisoning is one of the main contributor to the mortality and morbidity in both develop and developing countries. The present study consists of poisoning cases admitted to and autopsied at the Department of Forensic Medicine and Toxicology, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka. Out of the 161 Medico-legal cases autopsied during study period of 18 months from November 2012 to June 2014, 51(31.7%) were that of poisoning. The cases were analysed on various parameters to find out the trends and other significant feature of poisoning in this region of Karnataka.

Poisoning is a common method of suicide and one of the common causes of death in developing countries, particularly in agricultural workers. The emphasis was given to age, sex, residence, marital status, survival period, type of poison and manner of death. Organophosphate compounds were the most commonly used substances; 74.1%. The common reason of poisoning was ill health 20 cases (39.2%) in both males and females.

Key Words: Poisoning pattern, Suicide, Organophosphate compounds, Rural

Introduction:

Poisoning, both accidental and intentional is a significant contributor to mortality and morbidity throughout the world. According to WHO, 3 million acute poisoning cases with 2, 20, 000 deaths occur annually throughout the world. Out of these 90% of fatal poisoning occur in developing countries particularly among agricultural workers.

Pattern of poisoning in any region depends on variety of factors such as availability of poisons; socio-economic status of population, religious beliefs and cultural influence. In the Indian context, the exact incidence of poisoning is uncertain, due to lack of data at central level, as majority of cases go unreported, and mortality data are poor indicators of incidence of poisoning. In India, the common poisons used usually are insecticides and pesticides. The reason for this is agriculture based economics, poverty and easily availability of highly toxic pesticides. In India, organophosphates form the largest bulk of pesticide poisoning.[1,2]

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Materials and Methods:

This prospective study was carried out at department of Forensic Medicine and Toxicology, Basaveshwara Medical College and hospital, Chitradurga. All the cases brought to the Department for Medico-legal autopsy with history of poisoning were selected.

We used standard proforma to obtain data from the records to ensure consistency for the whole sample. Information collected includes age, sex, residence, marital status, type of poison, survival period, motive of poisoning and manner of death. We also extracted, if present, any other relevant information, such as history of psychiatric illness, drug or substance. All collected data was analysed.

Observations and Results:

A total of 161 cases of Post-mortem, poisoning constituted 51 cases (31.7%), during the study period, November 2012 to June 2014. The age of the victims varied from 11-70 years. Most common age observed was 21-30 years (35.3%) [Table no.1]. Males (78.4%) outnumbered the females (21.%) [Table no.2].

Most of the victims were married (72.6%), which is same for both male and female victims [Table no.3]

In rural areas, poisoning cases were the most predominant, (98%) [Table no.4]. Most common motive of poisoning was ill health (39.2%), followed by financial constraints (21.6%) [Table no.5]

Total 51 cases were hospitalised for various durations, of which 31.4% of the victims survived only for 6-12 hours, 25.5% for 0-6 hours, 13.7% for 12-24 hours, 11.8% for 1-3 days, 7.8% for 4-7 days and 9.8% for more than 7 days. [Table no.6]

Unknown poison 47.1% cases, followed by Insecticides, (39.2%), were the most common encountered in this region irrespective of sex, followed by snake bite (9.8%). [Table no.7]

Suicide was the most common manner of poisoning (82.4%), followed by accidental pattern (17.7%). No homicidal poisoning cases were detected during the study period. [Table no.8]

Discussion:

Committing suicide is one of the oldest ways of sacrificing their life by consuming different poisonous substances which are easily accessible, compared to hanging or other methods. Maximum number of cases was found in the young adults of age group 21-30 is consistent with other studies.[3-15] The reasons for the trend may be that young adults are more susceptible to frustrations caused by highly competitive society, unemployment, love affairs, scolding by parents etc.

The gender comparison, males (78.4%) outnumbering females (21.6%), tallied with other studies.[3-5,10,11] this is so because males, being the daily bread winners of the family, are exposed to stress and strain of day to day life, occupational hazards and easy availability of pesticides. In our study, out of 51 cases of poisoning, 37 were married and 14 unmarried. Early marriages in rural community, family conflicts, social customs, and poverty may lead to married to consume poison than unmarried. This finding is consistent with previous studies. [3-7,11-13,15]

It was observed in the present study that maximum cases were from rural area.[3-5,12-15] This may be due to illiteracy, easy availability and complete dependence on the fate of their crop both in the field and market. The incidence of snake bite is also more common in rural area as compared to urban areas. Most common motive of poisoning was ill health (39.2%), followed by financial constraints (21.6%), unemployment (9.8%) and family conflict (7.8%). This finding is in contrast with previous studies.[6] Among the ill health, in majority of cases evidence of chronic illness like gastrointestinal disorders, bronchial asthma, tuberculosis, diabetes, hypertension, and

gynaecological problems as procured through the history and hospital records, on Autopsy corroborated with autopsy findings. Among financial constraints the reasons were excessive debts, poverty, not able to pay the loan, engaging in activities in an urge to achieve instant richness was the prominent financial causes noticed.

According to survival period, total 51 cases were hospitalised for various durations, of which (31.4%) of the victims survived only for 6-12 hours,.... as already described. This finding is similar with other studies.[16] The reasons is due to the fact that highly toxic poison could have been consumed, individual's responses to the type of poison consumed, much added delay occurred in transportation and shifting the victims to the nearby hospital from the site of incident and in hospital due to the short comings in treatment played a key role in (49%) of the victims culminating in death without receiving treatment.

From the study it was observed that in 47.1% of cases, the type of poison is not known, followed by Insecticides 39.2%, Snake bite 9.8% and Alcohol, 2%. This finding is similar to other studies.[6,17-19] The types of the poison were known based on the history furnished by the police and relatives of the deceased. With reference to the manner of poisoning, suicidal poisoning was the most common manner of poisoning followed by accidental; and homicidal poisoning was not reported in this study.[3-5,8,11] The Manner of death that were concluded as suicide were based on the history furnished by the police and the relatives of the deceased, Suicide note, circumstantial Evidence and on the Post-mortem examination.

In our study, among the 9 cases recorded as accidental death, 5 were due to the Snake bite and 1 died due to consumption of alcohol, while the remaining 3 have due to ingested poison.

Conclusion:

It is advisable to create awareness among victims to carry the container of the poison consumed or at least to carry the label of the container or to carry strips of tablet consumed while coming to hospital for treatment and show it to the concerned physician so that it will be easy to identify the poison on spot and initiate treatment according to the type of poison. Proper implementation of social and economic projects aimed for the upliftment of rural, poor and the downtrodden. Education campaign should be organized with regards to proper storage, use of pesticide and the basic treatment

to be instituted in cases of poisoning should be known to the general public, which in turn can help in reduction of mortality from insecticide poisoning.

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Table 1: Distribution of the Study Population According to Age

Age Group (years)	Number	Percentage
11-20	09	17.64
21-30	18	35.29
31-40	6	11.76
41-50	8	15.68
51-60	9	17.64
61-70	1	1.96
TOTAL	51	100

Table 2: Distribution of the Study Population According to Sex

SEX	Number	Percentage
Male	40	78.43
Female	11	21.57
Total	51	100

Table 3: Distribution of the Study Population According to Marital Status

MARTIAL STATUS	Number	Percentage
Unmarried	14	27.45
Married	37	72.55
Total	51	100

Table 4: Distribution of the Study Population According to Locality

Locality	Number	Percentage
Rural	50	98.04
Urban	1	1.96
Total	51	100

Table 5: Distribution of the Study Population According to Reason

Reason	Number	Percentage
Financial	11	21.59
Family Conflict	04	7.84
Love-Failure	01	1.96
Ill-Health	20	39.21
Unemployment	05	9.80
Uncertain	10	19.60
TOTAL	51	100

Table 6: Distribution of the Study Population According to Survival Period

SURVIVAL PERIOD	Number	Percentage
0-6hrs	13	25.49
6-12hrs	16	31.37
12-24hrs	7	13.72
1-3days	6	11.76
4-7days	4	7.84
>7days	5	9.82
TOTAL	51	100

Table 7: Distribution of the Study Population a According to Alleged History of Poison Consumed

TYPE OF POISON	Number	Percentage
Unknown	24	47.07
Insecticide	20	39.24
Alcohol	1	1.96
Snake Bite	5	9.83
TOTAL	51	100

Table 8: Distribution of the Study Population According to Manner of Death

MANNER OF DEATH	Number	Percentage
Suicidal	42	82.35
Accidental	09	17.65
Homicidal	0	0.00
TOTAL	51	100

Original Research Paper

A Study of Pattern of Poisoning cases admitted to Maharaja Institute of Medical Sciences, Vizianagaram, South India

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Abstract

As no material is available on medico-legal issues on poisoning cases in this locality, we have decided to research on this subject. Hence, a prospective medico-legal study of 100 poisoning cases admitted to the Maharajah's Institute of Medical Sciences hospital (Vizianagaram) between 2010 – 2015 was undertaken. In this study we found that 72% of cases were due to insecticidal poisoning. Out of total 11 deaths, 8 were due to organophosphates. One of the important findings of this study was that there was no female mortality. We concentrated on medico-legal factors as age, sex, socio-economic conditions etc. hoping that such data would be available to future researchers as reference material.

In the concluding paragraphs we have mentioned some applications based on the study. These include the restriction of sale of insecticides for general population and strengthening of treatment facilities at District head quarters hospitals in high risk districts. This would lessen the number of cases and deaths.

Key Words: Intentional poisoning, Insecticides, Targeted intervention

Introduction:

In the great Kerala tragedy of 1958,[1] more than 100 people were killed due to accidental contamination of food grains with Follidal (parathion). Since then pesticides have been responsible for large number of intentional and un-intentional deaths. Further, each year an estimated three million cases of severe poisoning, with 2, 20,000 deaths occur worldwide, of which 90% cases are reported from developing countries like India; while Western countries like United Kingdom report 1% of poisoning deaths due to pesticides, the same figure ranges between 20% and 70% in developing countries like India.[2] Insecticides in general and organo phosphates, in particular, are seen as the villain.

To verify the burden of poisoning cases in general and organophosphates in particular we have undertaken this prospective study in Maharajah's Institute of Medical Sciences, Vizianagaram. In our study we have incorporated relevant clinical and medico-legal issues.

Aims & objectives:

To study the trends and patterns of intentional and accidental poisoning cases involving medico-legal issues such as causes, age, sex, mortality etc in North Andhra Pradesh with emphasis on Organophosphates. To make some suggestions for reducing morbidity and mortality.

Materials and Methods:

We included 100 poisoning cases admitted serially to this hospital from 2010 – 2015, in association with the department of General Medicine. Ninety five targeted cases out of 100 cases of poisoning and all the 45 targeted cases of Organophosphate poisoning are from North Andhra Pradesh only. Poisoning cases due to stings and bites were excluded.

Observations and Results:

The follow up of 100 cases of poisoning at Maharajah's Institute of Medical Sciences medical college are summarized in **ables 1 to 4**

Discussion:

Table no: 1: From this table it is clear that the insecticidal group is the trend setter (72 out of 100 cases of poisoning), in the present

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day. The traditional use of such poisons as arsenic, opium, datura, abrus, strychnine, strong corrosives have all but disappeared except for five cases of oleander poisoning. The case ratio of poisoning between males & females is roughly 2: 1, as compared to a previous study 2.5: 1.[3]

Out of 10 cases of accidental poisoning due to Organophosphates, 3 were children of tender age who were not able to know the nature of the substance and 2 were due to spray operations without adequate safe guards. Rest five cases are due to mistaken use of these compounds. Rest 6 cases due to other poisons have no impact on this study.

Table no: 2: The major cause of suicidal poisoning is family and financial problems with 50% cases. Physical and mental illness along with drug abuse amount to 19% of case load. Suicide with insecticide poisoning due to crop loss is not found in our study.

Table no: 3: Age and sex factors for the purpose of our study have been divided into six age groups; depending on the sensitivities and perceptions of each age group. In children under 10 years of age, forming the first group, the poisoning is almost always accidental in nature. The second age groups consisting of 11 to 20 years are adolescents and young adults. These victims are impulsive in nature due to physical and physiological changes. Provocations in this group like rebuke, quarrel, failure in exams, love issues leads to instant consumption of the poison readily available at home. In the next three groups, the triggering factors for suicide revolve around family quarrels, domestic torture, fidelity issues and financial crisis. This is the most vulnerable group. In the last age group (> 50 years) neglect, physical and mental illnesses are the causes. In the extremes of age (pediatric and geriatric), the burden of poisoning cases is only 9%.

Table no: 4:

1. History of consumption of insecticide with production of the bottle.
2. Exhibition of Signs & symptoms Organophosphate poisoning.
3. Estimation of plasma cholinesterase levels at the time of admission.
4. Response of the patient to atropine and oximes.

The epidemiology of the insecticides in North Andhra Pradesh indicated that, the victims involved were predominantly from marginal agricultural community. There are also few cases from the urban community. People consume insecticides because they believed that death would be comparatively painless,

quick and certain. Moreover these poisons are cost effective and are easily available in the open market with no restrictions on their sale. Besides these drugs are purchased and kept in readiness at home every year during agricultural season by the farmers.[4] The left over are also not discarded. This entire scenario is repeated each year in full view of the family members and any member or even a non member can easily access these drugs and can consume it, mostly in the home surroundings or in the fields nearby. Acute self poisoning with insecticide is a major public health problem in much of south India.[5] The same is true with our study. Poisoning constituted 33 to 34% of preferential method of suicide in India and the death ratio is 2 (M): 1 (F).[6] In our study however the case ratio is 2 (M): 1 (F), but the death ratio is 11 (M): 0 (F), which suggests that women in this area are not under stress to commit suicide.

In the Organo chlorine group Endosulfan and endrin caused 2 deaths. Amongst the carbamates baygon spray was the culprit. Pyrethroids did not have much impact in this study. All these insecticides which caused death were categorized as WHO class - I poison.[7] The minimal lethal dose of these poisons is 3 ml or less than 1 tea spoon full of the concentrate or 3 tea spoons full of a 25% solution for a man weighing 60 kg. Of the moderately toxic O.P; trizophos, WHO class – II, has a lethal dose requirement of 30 to 300 ml. From this it is apparent that patients consuming class – II poisons stand a chance if adequately treated in time as seen in a Bangladesh study (0.7 / 100,000).[8] The risk of death from slightly toxic poisons WHO class – III is negligible. Refer Table no 4.

Treatment protocols:

The patients who were admitted to the wards were immediately given a gastric lavage, atropine, oxygen and in cases of O.P. poisoning the first dose of pralidoxime was given. Acetylcholine esterase levels were quickly assessed and further adequate doses of pralidoxime were continued. For the more serious cases positive pressure ventilation, emergency intubation, besides anticonvulsive therapy and other symptomatic treatments were under taken.

Treatment outcome:

Out of 100 cases of poisoning, the percentage of death due to organo phosphate poisoning is 12.5 where as out of 45 cases of organo phosphates poisoning the percentage of deaths is 18%. Two deaths due to organo chlorines and one death due to carbamates are not elaborated.

The factors which influenced survival chances are following:

1. Consumption of a second line (WHO class - II), slightly toxic or relatively toxic (WHO class - III) poisons.
2. Critical time interval between poisoning and admission (within 1 -2 hours).
3. Adequacy of treatment

In our study we have seen that, death occurred in 4 cases due to delay of 2 – 14 hours in admission. Excessive dose caused 5 deaths and 2 deaths were due to inadequate treatment.

Conclusion:

This study has revealed that consumption of insecticides is the commonest mode of suicidal poisoning in North Andhra. Death and disability is resulting in some cases. The most commonly effected age group is the productive age group of 21 to 50 years. The case ratio of males to females is 2:1 in all poisoning cases, where as the case ratio in deadly Organophosphates poisons is 3.5:1. Interestingly there are no female deaths in the entire study. By and large females have a better role in this society.

Ten cases of accidental Organophosphate poisoning which included three children have occurred due to careless storage of these compounds. So keeping in mind above facts the application of this study has been considered in the following manner.

1. Targeted interventions like banning or restricting use of WHO class-1 poisons can reduce death rate by 50% as per Sri Lanka

experience.[9] This action has to be contemplated by Government of India.

2. The sale and availability of these insecticides should be regulated. The person who uses these insecticides needs to be registered and made accountable for storage, use etc. In case of death or disability the consumer must be prosecuted under the provisions of the penal law.
3. In high risk districts the District Head quarters' hospitals should be equipped and manned appropriately to manage cases of acute Organophosphate poisoning.

With the above efforts surely the burden of insecticidal deaths will come down.

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Table no: 1 Poisoning trends of 100 cases

S. No	Poison Group	No of cases		Accidental cases		Suicidal Cases		Deaths (All males)
		Male	Female	Male	Female	Male	Female	
1	Organo phosphates	35	10	8	2	27	8	8
2	Carbamates	1	1	0	0	1	1	1
3	Organo Chlorines	7	6	0	0	7	6	2
4	Pyrethroids	9	3	1	0	8	3	0
5	Rodenticides	2	2	0	1	2	1	0
6	Herbicides	1	0	0	0	1	0	0
7	Weak corrosives	3	2	1	0	2	2	0
8	Oleander	0	5	0	0	0	5	0
9	Chloroquine	3	1	0	1	3	0	0
10	Others	3	1	1	0	2	1	0
11	Unknown	1	4	1	0	0	4	0
	Total	65	35	12	4	53	31	11

Table no: 2 Causes of suicidal poisoning (84 cases)

Cause	Mental illness	Epilepsy & chronic illness	Family & financial problems	Failure in love & exam	Drug abuse	Neglect & humiliation	Un identified
Number	6	6	46	2	8	4	12

****Table no. 3 & 4 on page no. 196**

Original Research Paper

A Five Years Retrospective Study of Head Trauma cases showing the Rarity of Multiple Site Extradural Haematoma

¹Tapan Das, ²Raihan Uddin Ahmed

Abstract

Extradural haematomas constitute about 3% of all head injury cases and the frequency of extradural haematoma occurring at more than one site in a particular victim is even lower. During a five year retrospective study of extradural haemorrhage cases discovered at autopsy we found that multiple site extradural haematomas constituted 13% of all extradural haematomas observed. The incidence and the pattern of extradural haematoma and its association with fracture of the skull are given emphasis in this study.

Key Words: Extradural haematoma, Rarity, Multiple sites

Introduction:

An intracranial hematoma occurs when a blood vessel ruptures within the brain or between the skull and the brain. The collection of blood (hematoma) compresses the brain tissue and is known as extradural hematoma (EDH) when such collection occurs between the dura mater and inner table of the skull. It is seen that extradural hematoma occurs usually at a single site and is generally associated with fracture of the skull. Presence of extradural hematoma at multiple sites or bilateral, is rare.[1,2]

Source of EDH: The vessel injured depends upon the site of trauma and although commonly of arterial origin, may arise from trauma to the veins.[3]

1. A blow over lateral convexity of head may injure middle meningeal artery (usually the posterior branch)
2. A blow over forehead involves the anterior ethmoidal artery.
3. Blow over occiput, or low behind the ear may tear transverse sigmoid sinus and produce posterior fossa hematoma.
4. Blow over vertex may cause hemorrhage from sagittal sinus
5. Venous extradural hemorrhage accompanies fracture of the skull (usually occipital) and is due to bleeding from diploic

veins. In some cases the bleeding is both from arteries and veins.[3]

Most extradural haematomas are associated with fracture of the skull. About 15% extradural haematoma are seen in intact skull.[4] The usual site of extradural hemorrhage is the parieto-temporal area and it is usually unilateral, caused by rupture of the middle meningeal artery. It is seen that the middle meningeal artery is transected by a fracture line. According to some authors, almost all ruptures of the middle meningeal artery occur where the artery is completely roofed over in a bony tunnel so that it is unable to escape damage from a fracture. Accumulation of 100 ml of blood as extradural hematoma is the minimum amount associated with fatalities. The clinical signs of an extradural hemorrhage are classically those of lucid interval, as there may be recovery from the initial phase of concussion before sufficient blood accumulate to cause raised intracranial pressure and consequent relapse into unconsciousness. Only 27% of cases show this lucid interval.[4]

Approximately 70-80% of epidural hematomas (EDH) are located in the temporoparietal region where skull fractures cross the path of the middle meningeal artery or its dural branches. Frontal and occipital epidural hematomas each constitute about 10%, with the latter occasionally extending above and below the tentorium. Association of hematoma and skull fracture is less common in young children because of calvarial plasticity.[5] The factors responsible for high mortality rate in extradural haematoma are the following:

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1. Failure to alert all physicians to the problems involved. It is necessary that all physicians be inculcated with a high index of suspicion that extradural haemorrhage may exist in any head injury.
2. Failure on the part of physician to suspect the presence of extradural haematoma in case of an apparently minor injury.
3. Failure to understand the significance of a temporal lobe or tentorial pressure cone, and too great reliance on changes in the vital signs and state of consciousness.
4. Failure to consider that massive and fatal extradural haemorrhage may occur without significant change in vital signs because of continuous profuse otorrhea or rhinorrhoea.[6]

Double acute extradural hematoma (EDH) was rarely detected before the introduction of computed tomography (CT). Roy (1884) reported the first case of bilateral EDH.[7] Only isolated cases were described prior to 1980 and most of these were diagnosed at autopsy.[8] Double extradural haematoma may be unilateral or bilateral. The incidence varies from 2 to 25% of all extradural haematomas in different series and its presence at more than two sites is rare.[9] Acute symmetrical bilateral epidural hematoma is rarely reported.[10]

Material and Methods:

This study was conducted at the Department of Forensic Medicine, Assam Medical College and Hospital, Dibrugarh from May 2010 to April 2015. It is a retrospective study, data obtained from the history, given by the police and relatives, records retained in the department after postmortem examination.

Records included copy of the inquest report, requisition form, photographs at scene of the incident by the police, copy of CT scan report, copy of post-mortem report and other relevant documents preserved as record.

Inclusion criteria:

1. All cases with findings of head injury during autopsy.
2. All cases with findings of intracranial haemorrhages at autopsy.

Exclusion criteria:

1. All cases of clinically diagnosed intracranial haemorrhages without corresponding finding during autopsy.
2. All cases of clinically diagnosed intracranial haemorrhages which were operated upon and drained.

Observation and Results:

During the study period, a total 5534 medico-legal autopsies were conducted, out of

which head injury constituted 778 cases (14%). **(Table 1)** Of these, extradural haematoma constituted 23 cases (3% of total head injury cases). **(Table 2)** The number of cases associated with fracture of skull bone was 21 (91.3%) and 2 cases were found with intact skull. **(Table 3)**

Number of extradural haemorrhage at multiple sites constituted 3 cases (13% of total extradural hemorrhage cases). All the three (100%) cases had fracture of temporal and frontal bones. **(Table 4)**

In our study we observed the presence of EDH occurring bilaterally in two cases, and in one case multiple EDH was observed to have occurred on the same side of the skull. In one case where EDH was presented bilaterally, three sites were found to be involved-bifrontal and temporal on the left side. **(Table 5)**

Discussion:

We found that the total number of EDH to be 3% of all head injury cases. Extradural haematoma at more than one site was detected in 13 % of cases and bilateral extradural haematoma in 66.7% of cases of EDH. M.F. Huda et al found extradural haematoma at more than one site in 4.5 % of cases and bilateral extradural haematoma in 84.78 % cases.[11] Ramzan A, et al found the incidence of extradural hematomas at more than one site to be 13.3%.[12] while M.L. Babu, et al found the incidence of extradural hematoma at more than one site in 6.9 % of cases.[13]

Various theories have been put forward regarding the mechanism of occurrence of bilateral and multiple hematomas. It has been suggested that dura is detached from two or more locations by a single directed force. Stripping of dura can occur at site of impact by inbending or outbending of skull or due to motion of skull, further aggravated by the negative intracranial pressure found at the antipode of the compression force. In bilateral hematomas direction of force tends to be anteroposterior rather than lateral, besides it can also occur due to extension of fracture line across midline, leading to bilateral extradural hematomas under fracture line.[14] It has also been suggested that the force of impact to the head could produce bilateral hematomas, which is more predominant in the anteroposterior direction than from the lateral direction. This is probably the reason for a higher frequency of EDH in the frontal region.[15]

Conclusion:

It was seen that the results of our study are almost similar to the previous studies

regarding the number of EDH, number of skull fracture associated with EDH and number of cases of EDH at multiple sites. However further studies are required at clinical level to assess the severity of presentation and consequent fatality of EDH at multiple sites in comparison with EDH at single site. This will help the clinician to act promptly after diagnosing the multiplicity of sites of EDH. Also effort should be made to find out the correlation between different age groups and prognosis of EDH.

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Table 1: Total number of head injury cases

Total number of autopsies	Total number of head injury cases	Percentage of head injury cases
5534	778	14.05

Table 2: Total number of extradural haematoma

Total number of head injury cases	Total number of extradural haematoma	Percentage of extradural haematoma
778	23	3

Table 3: Extradural hematoma associated with fracture of skull bones

Total number of extradural haematoma	Number of extradural haematoma with fracture of skull bones	Number of extradural haematoma without fracture of skull bones
23	21 (91.3%)	2 (8.7%)

Table 4: Total number of extradural haematoma at multiple sites

Total number of extradural haematoma	Total number of extradural haematoma at single site	Total number of extradural haematoma at multiple sites
23	20 (86.95%)	3 (13.04%)

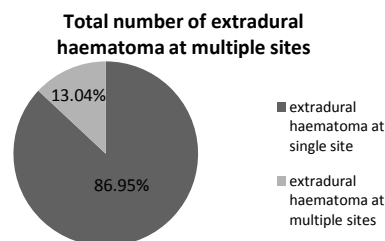


Table 5: Total number of extradural haematoma present at multiple sites

Total number of EDH cases	Total number of extradural haematoma present unilaterally	Total number of extradural haematoma present bilaterally
23	1 (4.35%)	2 (8.70%)

Figure 1: Photograph showing bilateral extradural haematoma at both frontal regions.



Figure 2: Photograph showing extradural hematoma over both frontal regions and right temporal region



Figure 3: The photograph showing the extradural hematoma along with depressed fracture of the skull



Original Research Paper

Personality disorders in Alcohol Dependence Syndrome Individuals

¹Vijayanath V, ²Anitha MR

Abstract

This was a clinic based cross sectional descriptive study. The study consisted of 1000 alcohol dependent patients. The main aim of the study was to find out the personality profiles in alcohol dependent patients. The mean age of the sample was 30.74 years and majority of the patients were below 40 years. Majority of the patients were males (92%), married (88%) & Hindus (92%). They had 8 mean years of education. The majority were from below class II socioeconomic class.

Ninety two percent of the cases had comorbid personality disorder, 29% had more than one personality disorder. The predominant personality disorders were Dissocial, Anankastic, Emotionally unstable impulsive and Dependent. The predominant personality trait in the sample was neurotic. Majority of the patients were ambiverts. Significant number of patients (8%) had scored high on the lie score. The results of the present study indicate the need for routine assessment of alcohol induced psychosis, personality traits and personality disorders in alcohol dependent individuals. This will help in a better understanding of the addictive behavior in the individual patient and facilitate the best strategy for tailoring standard interventions to the individual need requirements.

Key Words: Alcohol, Personality, Society

Introduction:

Alcohol is being used and abused throughout the history of mankind. The old Testament prescribed the use of wine in religious rituals.[1] Alcoholic beverages have been used since the dawn of civilization. The common use of alcohol is well documented in the earliest writings of Mesopotamia & Egypt. In those writings descriptions of drunkenness were frequent, as were prescribed remedies.[1,2] Ancient Cuneiform and Hieroglyphic inscriptions describe both the normal and abnormal use of alcohol.[1] The wide spread use of alcoholic beverages was characteristic of all early civilizations, the oriental, the Greek and the Roman although the attitudes towards the drunkenness varied widely from place to place.[1]

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Objectives:

To study the personality profile & personality disorders of alcohol dependent individual.

Materials and Methods:

The sample subjects who fulfilled the criteria for "Alcohol Dependence Syndrome" were selected from those who are seeking psychiatry help.

Sample size: -1000 patients from the community.

Sample selection: consecutive patients who fulfilled inclusion criteria.

Type of study: Cross sectional.

Inclusion criteria:

1. Patients who meet ICD-10 Criteria for "Alcohol Dependence Syndrome"
2. Age group: - 18-55 years.

Exclusion criteria:

1. Chronic physical illnesses: Hypertension, Diabetes Mellitus Endocrine & Neurological disorders except peripheral neuropathy.
2. History of psychotic illness prior to Alcohol use.
3. Co-existing other drug abuse/ dependence.

Procedure: Patients in the community who fulfilled the ICD-10 diagnostic criteria for Alcohol Dependence Syndrome were screened for inclusion and exclusion criteria. Those who qualified for inclusion and gave consent for the

study were interviewed. The study was conducted in three different places with same geological and economical zone. The general information was collected using a pre-designed general information sheet. Socioeconomic status was determined using Classification of Social Class by Prasad.[3] International Personality Disorder Examination was administered to patients and their attendants were reliable and who had atleast stayed with patient to diagnose personality disorders as per ICD – 10. They were administered Eysenck Personality Inventory to know the personality profile.[4]

Observation & Discussion:

Socio demographic details (Table 1 & 2)

Age: The mean age of the sample was 37.64 ± 12.23 years, when it was split into different age groups majority (80%) were below 40 years of age, while about 52% were between 30-40 years. The large number of patients in the age group between 30-40 years may be due to the emergence of alcohol related problems and the need to seek help in that age group. The pressure from the family members, peers and superiors might force this group to seek medical help as it is in this group.

Gender: Though the study was open to both genders, predominance was of male population. Female patients were few. This may be due to socio-cultural factors prohibit females from drinking and probably, there may be some genetic factors too.

Marital Status: Preponderance of married persons (88%) is in agreement with many studies. This may be due to the age at which treatment is sought is part marriageable age and majority people get married. It may also be due to the family perception that marriage may bring responsibility on the person and others.

Religion: Ninety two percent of the subjects belonged to Hindu religion and 8% were Muslims. This is in accordance with the ratio of the respective religions in the general population.

Education: The mean education of the sample was 8.04 ± 3.40 years, about 76% of them had less than 10 years of education. This may be due to the fact that present sample is from rural and semi-urban background where educational opportunity is less and motivation for education is less.

Occupation: Thirty two percent of the subjects were agriculturists, 28% were laborers and rest were either employed or businessmen which is understandable from the sample which had rural and semi-urban population.

Social Class: Forty percent of the candidates belonged to Class II and 52% were from lower income group. A higher representation of these groups suggests that individuals with higher socioeconomic status are more aware of the consequences of their behavior and therefore makes healthier choice. It may also be possible that alcohol consumption may lead to a lower income, occupation and educational status in some of the people.

Initiation, Duration of alcohol intake and dependence of alcohol (Table 3)

The total sample mean age at initiation of alcohol consumption was 19.32 ± 5.44 years. Age at initiation of alcohol consumption was 19.96 ± 5.3 and 27 ± 8.55 in males and females respectively. Among the 1000 Alcohol Dependent Subjects, 680 subjects had started consuming alcohol below the age of 20 years, among them all were males. Whereas, 240 subjects had started consuming alcohol in the age group of 20- 30 years; again all of them were male subjects. All 80 female subjects of the study had initiated consuming alcohol in the age group of 30 to 40 years.

The mean duration of alcohol intake of the total sample was 15.24 ± 9.17 years and it was 13.7 ± 5.99 & 24.5 ± 15.73 years for males and females, respectively. When total duration of consumption of alcohol was taken into consideration, 520 subjects of the study sample had consumed alcohol for a period of 10 to 20 years while, 36 subjects had consumed alcohol for less than 10 years. 120 subjects of the study sample had consumed alcohol for more the 20 years.

The duration of consumption of alcohol prior to becoming dependent for the total sample was 6.32 ± 4.71 years. It was 6.14 ± 4.87 years for males and 8.5 ± 1.60 for females. Among the male subjects, 640 became alcohol dependent after consumption of alcohol for 1-5 years and 240 subjects became dependent in about 5-10 years. The duration of alcohol consumption prior to becoming dependent was 10-15 years in 40 subjects and 15-20 years in 80 subjects. All these cases were male subjects. Among the female subjects all 80 subjects became alcohol dependent after consumption of alcohol for 5-10 years.

Personality disorder (Table 4) Among 1000 subjects 920 had personality disorders and 80 had no personality disorders.

92 % of the sample having the personality disorder in the present study is very high when compared to the following studies.

Personality disorders in ADS As per IPDE (Table 5) As per IPDE the personality disorders

in alcohol dependent patients in order of frequency was: Dissocial 760 (82.6%), Anankastic 600 (65.21%), Emotionally unstable Impulsive & Dependent 560 (60.86%), Emotionally unstable Borderline 480 (52.17%), Schizoid 440 (47.82%), Paranoid 320 (34.78%), Histrionic 240 (26.08%) and 120 (13.04%) were having Anxious personality disorder.

Rounsaville and Nace, et al,[4] reported 57 % of the prevalence rate of personality disorder. Grilo CM, et al,[5] in their study on 117 consecutive inpatients found that 47% of the sample had personality disorders. Numborg, et al,[6] found 64% personality disorder in outpatient alcoholics. The differences are partly accounted for a sample characteristics such as sex and age, treatment setting and whether substance related disorders are excluded from diagnosis. Another important source of variation results from the specific diagnostic criteria employed.

Personality Disorders in ADS (Table 6) In the 92% of the sample 8.69% of cases were having single personality disorder and 28.26% cases were having co-occurrence of more than one personality disorders and 63.04% subjects were having more than 3 personality disorders.

In the study by Numborg, et al,[6] 44% had paranoid, 20.5% had antisocial, 20% avoidant, 18% passive aggressive and 16% borderline. Grant BF, et al,[7] reported 7.85% obsessive compulsive personality disorder, 4.41% paranoid, 3.63% antisocial personality disorder, schizoid 3.31%, avoidant 2.36%, Histrionic 1.84%, in the general population. De Jong, et al,[8] reported 34% histrionic, 29% dependent, 19% obsessive compulsive, 19% avoidant, 17% schizotypal, 17% borderline, 14% passive aggressive, 14% paranoid, 7% narcissistic, 5% antisocial, 4 % schizoid. Studies looking at all the personality disorders are scanty. In the study sample of Grilo CM, et al,[5] 15 % had borderline, 13 % avoidant, 13 % dependent, 9 % schizotypal, 6 % schizoid, 6 % narcissistic, 6 % passive aggressive, 4 % histrionic, 2.5% paranoid and 2 % obsessive compulsive.

Co-morbid Personality Disorders (Table 7) 340 out of 370 psychotic subjects had personality disorders. Only 3 cases of psychosis did not have any personality disorder. Among the non psychosis, 330 out of 360 cases had personality disorders and 3 cases from this group were without any personality disorder. Among the 270 cases of pure ADS, 250 had personality disorders while 2 did not.

In our sample, 82.6% had Dissocial, 65.21% Anankastic, 60.86 % had emotionally unstable impulsive & dependent personality disorder, 52.17% had emotionally unstable borderline, 47.82% schizoid, 34.78% paranoid, 26.08% Histrionic and had 13.04% anxious personality disorder.

In our study, 65.2% with personality disorders had antisocial personality disorder. This finding in our sample is in consonance with most of the studies of high prevalence. Rounsaville, et al[4] reported 27%, Hesselbrock, et al,[9] 41%, Zimmerman, et al,[10] 14 % and Tousignant,[11] 22.7% of antisocial personality disorder in their studies. De Jong, et al [8] reported a lower prevalence of 5 % in their study.

The high prevalence of Dissocial personality disorder may be because of its high prevalence in clinical settings. It is the most commonly diagnosed personality in both inpatient and outpatient setting. Another reason may be that alcohol use can contribute to problems of affective instability, impulsivity and interpersonal problems which are the features of the borderline personality disorder. Another explanation may be that one condition may be the consequence of the other. It is possible that once comorbidity develops, each disorder serves to maintain the other.

Distribution as per Eysenck Personality Inventory (Table 8) On the Eysenck Personality Inventory scale, 40 cases had extroversion traits and 30 cases had introversion traits. 760 cases had neurotic traits. 80 cases having scored high on lie score had not given reliable information. In the present study, single personality disorder was present in 8.7%, while 28.3% had 2 - 3 personality disorders and 63 % had multiple personality disorders. In the study of De Jong, et al,[8] 50% of the patients met the criteria for at least two personality disorders and an average number of two personality disorders was 2.3% per patient with at least one personality disorder. This finding would suggest that in alcoholism personality disorder overlap. It also suggests that categorical approach for classification of personality disorders in alcoholism may be questionable for its usefulness.

Personality Traits In Alcohol Individuals. (Table 9) The findings of 3% and 4 % introversion and extroversion results suggest that most of the alcoholics are ambiverts. Though on clinical criteria patients had alcohol induced psychosis but on neuroticism trait dimensions more number of alcoholic patients had neurotic traits. This may be due to the fact that diagnoses of the cases depend mostly as

perception of attendants and clinicians. Whereas the trait measurement is determined by the self understanding of the patient.

About 8% having lie score; may be because the alcoholic patient may not be forthcoming with proper answers.

Conclusion:

Most of the subjects (52%) were between the ages of 30 to 40 years, a majority of whom started alcohol intake in the twenties, which may suggest that it takes time to develop alcohol related problems and reporting for treatment. A majority had an education till S.S.L.C or below (56%) and most of the subjects were agriculturists. In the literature there is a correlation between lower level of educational, occupational and economic status and alcohol consumption. The results of the present study suggest that education and occupation are important factors related to alcohol related problems. Personality disorders is a condition in significant number of alcohol related problems. Which points to the importance in considering the personality factors in the assessment and management of alcohol dependent individuals. Predominant among the personality disorders were Dissocial i.e., 82.6%, Anankastic i.e., 65.2%, and 52.2% were emotionally unstable impulsive & Dependent. The predominant personality traits in the sample were neurotic 82.6%. Out of the patients having personality disorders, 63% had more than one personality disorder. The routine assessment of personality traits and personality disorders among alcohol dependent individuals will help in a better understanding of the addictive behavior in the individual patient and facilitate the best strategy for tailoring standard interventions to the individual needs and requirements.

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Table1: Socio-demographic details of the sample

Characteristics	Sample N=1000
Age - Mean & SD (Years)	37.64 ± 12.23
< 30 Years.	280
30-40 Years.	520
40-50 Years.	120
> 50 Years.	080
Sex - Male	920
- Female	080
Marital Status- Married	880
Unmarried	120
Religion Hindu	920
Muslim	080
Education status	
Mean & S.D	8.04±3.40
Nil	200
Upto S.S.L.C	560
PUC to Degree	240
Occupation Household	040
Agriculture	320
Business	200
Employed-G	040
Employed-P	120
Coolie	280
Social Class I	080
II	400
III	240
IV	200
V	080

Table 2: Socio-Demographic Details: Gender wise distribution of Sample

Characteristics	Sample N=1000	Male N=920	Female N=080
Age:			
Mean & S.D 20-30 Years	37-64± 9.10	35.81±7.69	51.5±2.18
30-40 Year	28	280	—
40-50 Years	52	480	040
>50 Years	12	120	—
	08	040	040
Marital Status			
Married	880	800	080
Unmarried	120	120	—
Religion			
Hindu	920	840	080
Muslim	080	080	—
Education Status			

Mean & S.D	8.04±3.40	8.73±4.88	--
Nil	200	120	080
Up-to S.S.L.C	560	560	--
PUCto Degree	240	240	--
Occupation			
Agriculture	320	320	--
Business	200	200	--
Employed-G	040	040	--
Employed-P	120	120	--
Coolie	280	240	040
Household	040	--	040
Social Class			
I	080	080	--
II	400	360	040
III	240	200	040
IV	200	200	--
V	080	080	--

Table 3: Age at initiation, Duration of consumption and duration of consumption prior to dependence and alcohol disorders.

	Total N=1000	Psychosis N=370	Non-Psychosis N=360	Only ADS N=270	Significance
Age at Initiation Mean & S.D (Years)	20.52 ±5.89	19.95 ±4.59	20.42 ±6.18	21.44 ±7.08	F= 0.50 df=2,97 P>0.05 Not Significant
Duration of Alcohol intake Mean & S.D (Years)	15.24 ±9.17	14.68 ±5.87	14.89 ±10.2	13.94 ±8.27	F=0.33 df=2,97 P>0.05 Not Significant
Dependence of Alcohol Mean & S.D (Years)	6.32± 4.71	5.95± 3.79	6.64± 5.43	6.40± 4.97	F=0.20 df=2,97 P>0.05 Not Significant
Bonferroni Test Not Significant					

Table 4: Personality disorder in ADS

Diagnosis	Sample N=1000
ADS with Personality Disorder.	920
ADS without Personality Disorder.	080

Table 5: Personality disorders in ADS as per IPDE

Personality disorder	Frequency
Paranoid	320 (34.78%)
Schizoid	440 (47.82%)
Dissocial	760 (82.6%)
Emotionally unstable Impulsive	560 (60.86%)
Emotionally unstable Borderline	480 (52.17%)
Histrionic	240 (26.08%)
Anankastic	600 (65.21%)
Anxious	120 (13.04%)
Dependent	560 (60.86%)

Table 6: Number of Personality Disorder in ADS

Personality Disorder	Sample N=920
Single	080 (8.69%)
Co occurrence 2-3	260 (28.26%)
Co occurrence >3	580 (63.04%)

Table 7: Comorbid Personality Disorder with other alcohol disorders

Diagnosis	Psychotics N=370	Non - Psychotics N=360	Only ADS N=270
Presence of Personality Disorder N=920	340	330	250
No personality disorder N=80	030	030	020

Table 8: Distribution according to Eyesenck Personality Inventory

Personality Inventory	Sample N=1000
Extroversion	040
Introversion	030
Neurotic	850
Lie	080

Table 9: Individual Personality Disorder

Personality disorder	Present Study	Numberg ⁶ et al	Grant B F ⁷ et al	De Jong ⁸ et al	Grilo CM ⁵ et al
Paranoid	34.78 %	44 %	4.41 %	17 %	2.5 %
Schizoid	47.82 %		3.31 %	4 %	9 %
Dissocial	82.6 %	20.5 %	3.63 %	5 %	--
Emotionally unstable Impulsive	60.86 %	--	--	--	--
Emotionally unstable Borderline	52.17 %	16 %	--	17 %	15 %
Histrionic	26.08 %	--	1.84 %	34 %	4 %
Anankastic	65.21 %	--	7.85 %	19 %	2 %
Anxious	13.04 %	20 %	2.63 %	19 %	13 %
Dependent	60.86 %	18 %	--	29 %	13 %

Original Research Paper

A Descriptive Study of Medicolegal Cases to Determine the Impact of Violence on Society

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Abstract

In India, with rapid urbanization and migration of people, frustration, greed, intolerance and urge to achieve much in a short span has resulted in escalation in number of cases of assault in emergency department. Violence in any form, be it intentional or non intentional, results in morbidity or disability leading to financial losses or decrease in quality of life. So, in the present study, an attempt has been made to know the disability quotient resulting due to intentional violence in Amritsar district. The medico-legal study was conducted in the emergency department over the period of 2 years during which disability rate & average number of wounds per person per intentional violent act was calculated. We have also found that if a sharp weapon has been used then there are more chances of repeated attack i.e. they attack the victim with sharp edged weapon more than once and majority of the victims are at a great risk of receiving grievous injury.

Key Words: Assault, Violence, Intention, Disability, Sharp, Repeated attack, Grievous injury

Introduction:

The world Health organisation defines violence as the intentional use of physical force or power, threatened or actual, against oneself, another person or against a group or community, which either results in injury, death, psychological harm, maldevelopment or deprivation.[1] In the past two decades, India has witnessed rapid development in all fields. With revolution in technology, traditional ways of living and working are being altered. All these factors resulted in escalation in the cases of violence and it may occur in our daily life through youth violence, domestic violence, violence at work place. Violence is a major social and health problem for all who experience and witness it. It may arise due to frustration, greed, anger, revenge, exposure to violent media, violence in the home or neighborhood or as a tendency to see other people's actions as

hostile even when they're not. The impact of nonfatal violence related injuries are difficult to quantify. So prevention, acute and long-term care, and rehabilitation are the major challenges faced today.

Information from around the world indicates that injuries account for more than half the deaths in the age group of 5–44 years.[2] Every year, injuries contribute to a significant number of deaths, hospitalizations (for short and long periods), emergency care, disabilities (physical, social and psychological), amputations, disfigurement, pain, suffering and agony.[3] In addition, injuries also result in disruption of several activities leading to loss of work, income, education and other social activities, causing long-term suffering among survivors and families. In all intentional violent non-fatal injuries person has to spend a lot at different levels—first of all for transport, treatment, admission, medication, investigation, interventions and also for medico-legal formalities etc. Work absenteeism leads to loss of productivity and indirect losses to the employer.

The extent of economic loss is yet to be recognized due to lack of systematic research. There is exigency to describe the impact & morbidity due to violence to regulating it. Though to regulate crime is solely under the control of the government, but we are of the opinion that this study will definitely play a significant role to divert the attention of government agencies in

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taking better actions for maintaining law and order in the nation.

Material and Methods:

All the Medico-legal cases of Intentional violence which came to emergency in my duty hours over a period of two years were included in the study. After taking the Informed consent, preliminary data regarding name, age, sex, occupation, address, the patient was examined for injuries. As per the hospital stay, the average duration per case or the disability rate which is the average number of days of disability per person in intentional violence related injury cases was calculated as following.[4] Disability of intentional violence related injury cases:-

$$\frac{\text{Total duration of stay in hospital of all}}$$

$$\frac{\text{Total no. of cases}}$$

Mean Number of wounds per person was calculated as following:- [4]

$$\frac{\text{Total no. of wound}}$$

$$\frac{\text{Total no. of cases}}$$

Exclusion Criteria:- Cases of violence under the effect of drug or any abusive substance were excluded from the study.

Observations and Discussion:

In the present study, out of the total cases observed during a period of two years, 88.2% were males and only 11.8% were females. As shown in **table no.1**, maximum number of cases had blunt weapon injuries only, i.e. 38.5%, followed by cases in which both blunt and sharp weapons were used, 36.1%. Firearm was used in only 2.8% of cases. Corrosive substance was used in 0.9% of cases and thermal burns were present in 0.2%. In 1.7% cases, weapon was undetermined as it was subjective complaints e.g pain. Similarly, Gawryszewski et al[5] observed that the most common mechanism for injury was blunt object in 46.2% of cases followed by sharp object in 27.1% of cases. Firearms were used in 14.7% of cases. Akdur et al[6], too in their study, observed that sharp instruments were used in 2.7% of cases; thump (Hand fist) was used in 56.2% of cases and blunt object was used in 19.2% of cases. Mitchell et al[7] estimated persons aged ≥ 60 years were treated in U.S. hospital EDs for nonfatal assault--related injuries observed that the majority of older adults (83.7%) were injured as a result of being struck by/against, most often by a body part (20.3%), followed by a blunt object (17.1%), push (14.4%), and an undetermined cause (31.8%).

As depicted in the **table no 2**, out of the total injuries (i.e. Incised wounds, lacerated wounds, Stab Wounds, Swellings, Bruises, Abrasion and fractures) 35.4% were present

over the arms, 34.3% were over head and face, 15.1% were over the legs and 7.7% were on the back. Minimum no. of injuries were present over neck, chest & abdomen i.e. 1.5%, 2.3% & 3.7% respectively. But Akdur et al[6] observed that head & neck injurers were the most common (67.1%) followed by abdomen, then upper and lower extremities. Similarly, Waldies et al[8] also observed that Cranio-cerebral injuries were the most common (72%), followed by injuries to extremities (10%), thorax (5%), and abdomen (3%). Whereas, in the present study arms were the most affected parts by injuries, followed by Head & Face. The reason for such disparity which strikes our minds is that in the studies by other authors viz.; Akdur et al[6] and Waldies et al[8], the victim were caught unaware & head being the presenting part of the body became vulnerable to violence commonly in comparison to the present study where limbs were mostly involved & perhaps the victim tried to protect himself/herself from the attack. Another unique finding in the present study was that the bones being relatively on the surface of the limbs were injured by fabricating the injury, adding to the number of injury cases on the limbs.

Out of the total incised wounds, 47% were present on arms, 31% on head & face, and 12% on legs. Abdomen, neck, chest & back were involved in only 9.8% incised wounds. 67% lacerated wounds were present on head & face, 16.2% on the arms & 12.2% on legs. Neck, chest, abdomen & back were least effected by lacerated wounds i.e. 4.4% cases. Out of total stab wounds, 40% stab wounds were present on back, 33.3% & 26.5% on the front of abdomen and chest respectively. In the category of abrasions, 39% abrasions were present over the arms, 19.9% on the legs, 16.4% on the head & face, 11.5% on the back. On the neck, chest & abdomen only 13.1% abrasions were present.

Out of total swellings, 45% swellings were present on the head & face, 35.3% on the arms & 19.6% on the legs. 28.9% bruises were present over the back, 24% over the head & face, 21.7% over the arm & 16.9% over the legs. On the neck, chest & abdomen 8.4% bruises were present. Out of total 166 Fractures, 45.2% were present on arms, 37.9% on the head & face & 15.7% on the legs. On the chest & back 1.2% fractures were present.

Table no. 3 shows that on an average, there are chances of one incised wound, 0.9 abrasions, 0.6 lacerated wound, 0.4 bruises, 0.4 fractures and 0.03 stab wound on a person per violent act. To the best of our knowledge no other author had studied this aspect of injuries.

As depicted in the **table no 3**, out of total cases, 2.4% cases had "dangerous to life injuries", 34.8% were having grievous hurt & 30.21% were found having simple hurt. These were as per description of simple, grievous as described in Indian Penal Code U/S - 320 IPC for grievous injury & Dangerous to Life injuries.[9] No other author had studied this aspect of injuries i.e. Nature of injury according to the laws prevailing in their country to the best of our knowledge.

Morbidity has been defined as any departure, subjective or objective, from a state of physiological well being. [10] According to WHO expert Committee on Health Statistics the morbidity could be measured in any of the 3 units as: a) persons who were ill; b) the illnesses (period and spell of illness) that persons experienced; c) the duration of these illnesses (Days or Weeks). [10]

As depicted in **table no.4**, out of total intentional violence related injury cases who were admitted in the hospital, majority of them stayed in hospital for 0-7 days i.e. 73.7 % of cases, followed by 8-14 days i.e. 14% of case. Out of total cases, 2 (0.44%) were declared dead. Average 6.2 man's working days were lost per person due to intentional violence related injuries as per the formula mentioned in the Material and Methods. As depicted in **table no. 5 & 6** Hospital stays varied significantly ($p < 0.001$) among different nature of injuries. However there was no significant difference of mean days of hospital stay among pending and simple injuries ($p = 0.988$). No similar study is available for comparison to the best of our knowledge.

Conclusion:

In our present study we found that:

- 1.Arms are the most common target in any violent act.
- 2.Maximum numbers of fractures are present on the arms.
- 3.Most of the incised wounds are also present on the arms.
- 4.Also there are the chances of one incised wound per person per violent act.
- 5.Most commonly used weapon is blunt but if in any fight, sharp weapon is used then there are more chances of repeated attack on victim.
- 6.Regarding nature of injury; most commonly grievous injuries are reported as Sec 320 IPC.
- 7.On an average, each person suffering took around 6.2 days for injuries due to intentional violent act.

Early recognition of victims of violence; enhancing health and social support systems;

promoting counselling mechanisms in hospitals, schools, colleges and workplaces; limiting access of weapons and alcohol to young people; and imposing meaningful restrictions on depiction of violence (and sex) in the media can reduce violence. We need to promote violence reduction programmes in the community by creating greater awareness, facilitating conflict resolution techniques at the family and interpersonal levels, enhancing educational and employment opportunities for women and children (especially in rural areas), and reducing gender inequalities across society which will go a long way in reducing violence in India.

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Table 1:- Showing the type of weapon used

Type of Weapon used	No. Of Cases	% age
Sharp only(SW)	90	19.7%
Blunt only(BW)	176	38.5%
Sharp & Blunt(S,BW)	165	36.1%
Firearm(F)	13	2.8%
Corrosive Substance (Cr.)	4	0.87%
Thermal Burns(H)	1	0.21%
Undetermined(UD)	8	1.7%
Total	457	100%

Table 2: Showing the distribution of injuries over the body parts

Part of the Body	Incised Wound (I)		Lacerated Wound (L)		Stab (Is/Ls)		Abrasion (Ab)		Swelling (S)		Bruise (B)		Fracture (F)		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Head & Face	137	31	186	67	--	--	61	16.4	23	45	40	24	63	37.9	510	34.3
Neck	6	1.3	1	0.4	--	--	15	4.03	--	--	1	0.6	--	--	23	1.5
Chest	6	1.3	9	3.2	4	26.5	7	1.9	--	--	8	4.8	1	0.6	35	2.3
Abdo	17	3.8	1	0.4	5	33.3	27	7.2	--	--	5	3	--	--	55	3.7
Arms	208	47	45	16.2	--	--	145	39	18	35.3	36	21.7	75	45.2	527	35.4
Legs	53	12	34	12.2	--	--	74	19.9	10	19.6	28	16.9	26	15.7	225	15.1
Back	15	3.4	1	0.4	6	40	43	11.5	--	--	48	28.9	1	0.6	114	7.7
Total	442	29.7	277	18.6	15	1	372	24.9	51	3.4	166	11.1	166	11.1	1489	100
Mean	1	---	0.61	--	0.03	--	0.9	--	0.12	--	0.4	--	0.4	---	3.7	---

Table No. 3 Showing the nature of injuries

Nature of injury	No. of cases	% age of cases
Simple(Si)	138	30.2
Grievous(G)	159	34.8
Dangerous(D)	11	2.4
Undeclared	149	32.60
Total	457	100

Table 4:- Showing the stay of intentional violence related cases in the hospital

No. of days of admission in the hospital	No. of patient	% of cases
0-7 days	337	73.7
8-14 days	64	14
15-21 days	36	7.8
22-28 days	16	3.5
>28 days	2	0.4
Death	2	0.4
Total	457	100

Table 5:- Statistical correlation between the nature of injury and hospital stay (days)

Nature of Injury	N	Hospital Stay (days) Mean \pm SD	ANOVA
Undetermined (Pending)	149	3.20 \pm 2.91	F = 185.364; P < 0.001; Highly significant
Simple	138	3.04 \pm 2.19	
Grievous	159	11.16 \pm 6.25	
Dangerous	11	24.36 \pm 4.99	

Table 6:- Multiple comparison using post-hoc tukey hsd test (p values)

	Simple	Grievous	Dangerous
Pending	0.988NS	<0.001**	<0.001**
Simple	-	<0.001**	<0.001**
Grievous	-	-	<0.001**

NS: p > 0.05; Not significant; **p<0.001; Highly significant

**** Contd. From page no. 184**

Table no: 3 Age and sex wise incidence of insecticidal poisoning cases. (72 cases)

Poison group	< 10 years		10 - 20 years		21 - 30 years		31 - 40 years		41 - 50 years		> 50 years		Sub total		Total	Deaths
	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
Organo phosphates	0	3	4	4	15	2	8	1	5	0	3	0	35	10	45	8
Carbamates	0	0	0	1	1	0	0	0	0	0	0	0	1	1	2	1
Organo Chlorines	0	0	2	0	2	5	1	1	1	0	1	0	7	6	13	2
Pyrethroids	0	0	4	0	2	2	2	1	1	0	0	0	9	3	12	0
Grand Total	0	3	10	5	20	9	11	3	7	0	4	0	52	20	72	11

Table no: 4 Burden of Organo phosphate poisoning

S. No	Name of the compound	cases	Deaths	WHO Toxic rating	Plasma Cholinesterase levels
1	Mono crotophos	9	3	1	Varied from 980 to 1700 units/liter in death cases.
2	Chloropyriphos	15	3	1	
3	Quinalphos	3	1	1	
4	Methylparathion	3	1	1	
5	Triazophos	6	0	2	
6	Malathion	1	0	2	
7	Others	8	0	Not known	

Original Research Paper

Time Passed since Death from Degenerative changes In the Skeletal muscle

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Abstract

Time since death is made out from gross postmortem changes like cooling of the body, postmortem staining, rigor mortis, decomposition etc. In the present study Histological changes in the skeletal muscle were studied at various postmortem intervals in the human body died due to road traffic accidents. This study was conducted in the Department of Forensic Medicine in collaboration with Department of Pathology, G.S.V.M. Medical College, Kanpur, U.P. A total of 45 cases belonging to both sexes i.e. 36 males and 9 females were studied. These were of different age groups.

All road traffic accidents were taken into account. In this study control could not be taken because the histological changes of tissue after death were influenced a great deal by atmospheric temperature and humidity besides other external and internal factors. Therefore these must be taken into account in all studies of postmortem interval whether histological, biochemical or physical. In this study, the sequence of various microscopic changes in different organs and tissues were compared with those of gross changes. The microscopic changes were observed last in skeletal muscle after liver, lung and kidney. It is observed that the microscopic changes in skeletal muscle assessed by grading varied with temperature and post mortem interval.

Key Words: Time since death, Histological changes, Road traffic accidents, Skeletal muscle, Atmospheric temperature, Humidity, Post mortem interval, Fasciculi, Nuclear fragmentation.

Introduction:

Estimation of time since death is one of the most important object of post-mortem examination. Time passed since death continues to be a major problem for the Forensic pathologist and its determination plays an important and vital issue in medico-legal cases because of the fact that Forensic experts are very often required to answer questions relating to time of death in the courts of law. The traditional methods of ascertaining the time since death based on naked eye observations of the gross changes in a dead body do provide a rough approximation of post mortem interval, but

at best, would appear to be still the closest approximation of the time passed since death in a given case.

These various gross changes in the body after death are changes in eye, cooling of the body, post mortem hypostasis, rigor mortis, decomposition and other putrefactive changes. Some clue of time of death is also gathered from the condition of food in stomach, intestine and urine in bladder. Attempts have also been made to determine time passed since death by studying biochemical changes in blood, CSF and intraocular fluids. The biochemical methods have been found to be of not much use once the decomposition changes start.

The problem worsens when body is mutilated, skeletonized or invaded by animals. Time bound histological and histo-chemical study of degenerative changes in various organs and tissues may be a good solution.[1-3] Forensic pathologists throughout the world are trying to establish time passed since death by studying degenerative changes in organs and tissues at different intervals but definitive conclusion is still waiting.

The histological studies on various tissues after death have been mostly confined to single organ or tissue by individual workers at

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different atmospheric conditions.[4]

Moreover scientific work based on histological study on post mortem tissue changes, to determine time since death appear to have been undertaken by very few experts in India and more so in Uttar Pradesh. Since only a single organ was studied by most workers, any comparative evaluation of the varying rate of decomposition of the different organs and tissues cannot be made out.

Material and Method:

Material for the present study was the skeletal muscle, taken directly from the dead bodies during post-mortem examination.

Only those cases where the time of death was known and verified either by the doctors or by relatives & friends present at the time of death and also supported by postmortem changes, were taken for the study.

Thus, bodies found unnoticed were not studied, precautions were also be taken to exclude cases having pathology affecting the cellular architecture or biochemical constituent of the material. Such tissues thus collected, were sliced and fixed in 10% formalin for histological study. Total 45 cases, in which 36 males and 9 females were studied. These were of different age and sex. All road traffic accidents were taken into account.

Collection of Organs:

These organs were then kept in 10% formalin for 24-48 hrs for fixation. Small pieces or blocks of tissues each 1-2 mm thick were taken for histological examination and were processed by the routine methods of processing for histological studies by fixation, dehydration followed by embedding in paraffin wax.[4-6]

The paraffin sections of tissues were labeled during the process of block making was done in the following manner:

Sections were cut at 4-5 μ thickness with a rotating microtome from the skeletal muscle blocks, These were then placed in warm water at 50°C in a tissue floatation bath for spreading out and were then mounted on glass slide smeared with albumin glycerin solutions. The slides were stained by reactive haematoxylin and eosin stain. The stained slides were examined under light microscope for studying the various histological changes that take place in skeletal muscle tissue at different time intervals after death.[7-9]

Plan of Study:

In this study total 45 cases of road traffic accidents were taken.

The environmental temperature and

humidity was recorded from newspaper from which average temperature was drawn. The average temperature ranged between 20°C to 35°C, humidity between 45% to 92% and duration range was 7-34 hrs. Now this temperature range and Duration was divided in 4 and 5 groups respectively (Table 1 & 2)

The effect of temperature and duration on these cases was studied. First gross changes in skeletal muscle were studied. Then they were preserved in 10% formalin for microscopic study.

Table 1: Temperature Range

Group	Temperature	Cases
I	20°C	9
II	21-25°C	6
III	26-30°C	11
IV	31-35°C	19
Total		45

Table 2: Duration Range

Group	Temperature	Cases
I	Up to 12 hrs	5
II	13-18 hrs	13
III	19-24 hrs	14
IV	25-30 hrs	9
V	31-34 hrs	4
Total		45

Observations:

All cases were divided in groups according to temperature and duration as discussed earlier.

Degenerative Changes in Skeletal muscle : (Figures 1- 5)

As mentioned earlier, in this study all cases of road traffic accidents were taken into account. In case of trauma, some degenerative changes occurred in the muscles.

1. Compression – The compression of muscle in a person, deeply unconscious, for many hours eg: drug addict, chronic alcoholic, attempt suicide, may lead to vascular insufficiency and may produce histological picture resembling polymyositis in which segmental necrosis of muscle fibres and cellular infiltration occurs.
2. Pan necrosis – Ischemia, toxins and blunt trauma may all cause pan-necrosis of large muscle. The necrotic tissue soon loses its normal staining qualities and stain a uniform pink colour with H/E. Within 24 hrs inflammatory cells invade the affected area, spread inwards from the periphery and may take many days or weeks to reach the central area.

The points which are taken for grading:

Striations – Edema, thickness of fibers, loss of striations, pattern of fasciculi.

Nuclei – Normal, fragmentation, fading

Grading of degenerative changes is done as follows—

- Go:** No change.
- G1:** Mild changes (Pattern maintained, less edema, loss of striation is focal)
- G2:** Moderate changes (Pattern maintained, more edema, loss of striation is diffuse)
- G3:** Severe changes (Pattern is disturbed, marked edema)
- G4:** Very severe changes (Complete loss of pattern)

Discussion on Microscopic Observation:

In this study, the sequence of various microscopic changes in different organs and tissues were compared with those of gross changes. In some cases there were some differences between gross and microscopic changes. These microscopic post-mortem changes were studied in different organs and tissues at an average temperature of 21-25°C, 26-30°C and 31-35°C with duration of up to 12 hours, 13-18 hrs, 19-24hrs, 25-30hrs and 31-34 hrs.[10] The earliest microscopic changes were observed in liver followed by lungs, kidney (as can be referred from my other publications)[11-13] and skeletal muscle. The findings which were observed are as follows:-

In Skeletal muscle: (Table 3-5)

In this study, it was seen that microscopic changes were observed late in skeletal muscle. At temperature of 20°C and duration 13-18 hrs G2 changes were seen. With increase in duration of 31-34 hrs G2 and G3 changes were seen.

At temperature of 21-25°C and increase in duration G0 and G1 changes were seen.

At temperature of 26-30°C and increase in duration of 19-24 hrs G2 and G3 changes were seen.

At temperature of 31-35°C and increase in duration G1, G2 and G3 changes were seen.

A study was conducted by Stacy BA et al[11] on canine cadavers to observe histologic changes in traumatized skeletal muscle exposed to sea water. In this study, muscle was traumatized at different time intervals postmortem and was submerged in artificial sea water and 0.9% saline separately for different periods of time before fixation and microscopic observation.

It was seen that extent of histologic changes like discoid and segmental disintegration and loss of cross striations and development of contraction bands varied depending on the time of traumatization postmortem and time of exposure to artificial sea water or 0.9% saline.

In this study it was observed that muscle traumatized at 0.5h postmortem and treated with

artificial seawater for 10 days, the histologic changes and cellular details were appreciated as compared to muscle traumatized at 6.5h postmortem under similar conditions where the cellular detail and staining were not appreciated due to autolysis. Also the involvement of tissue was more widespread with incisions created during the later Post mortem interval than early. More studies are required to be conducted to make conclusions on time since death on the basis of degenerative changes.

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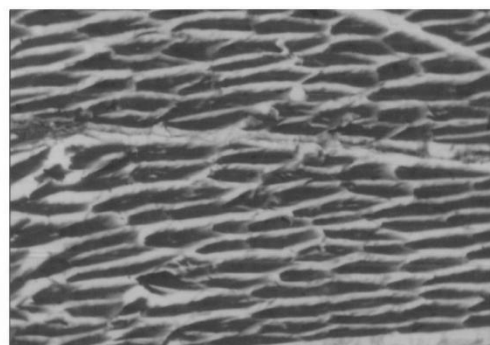


Fig. 1 : Skeletal Muscle. (H & E; HP) At temp. 30°C; duration 15 hours. Maintained Fascicular pattern, Slight loss of striations, Loss of Sarcolemmal nuclei, deep eosinophilia

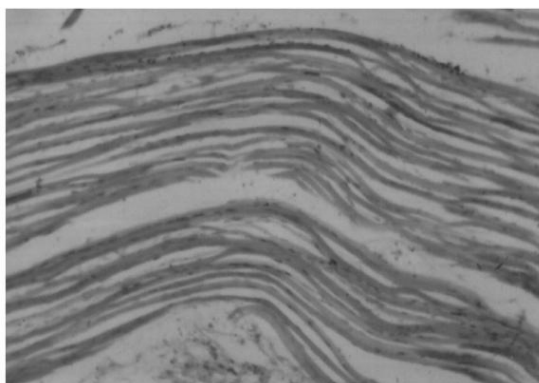


Fig. 2 : Skeletal Muscle, (H & E; LP) At temp. 20°C, duration 21 hours. Maintained Fascicular pattern, Thinning and Collapse of striations. Nuclei well defined.

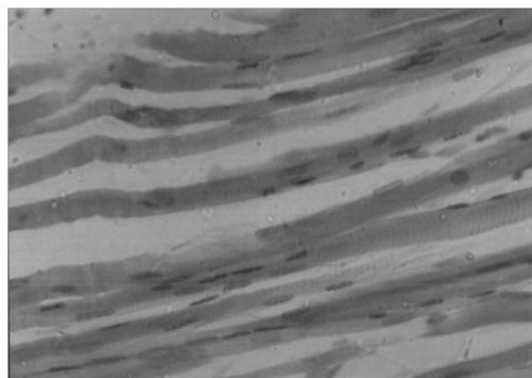


Fig. 3b : Skeletal Muscle, (H & E; HP) At temp. 17°C, duration 24 hours. Thickness of muscle fibers decrease. Thinning, Separation, Collapse & Loss of striations. Crowding of Nuclei.

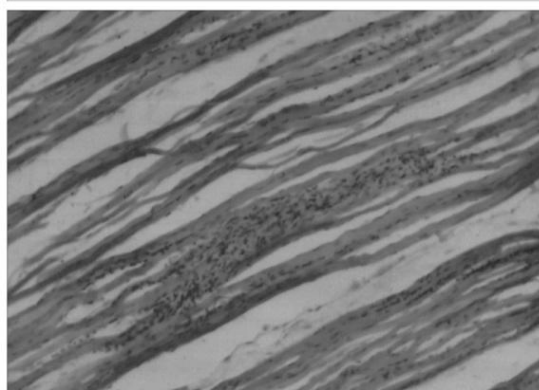


Fig. 3a : Skeletal Muscle, (H & E; LP) At temp. 17°C, duration 24 hours. Thickness of muscle fibers decrease. Thinning, Separation, Collapse & Loss of striations. Crowding of Nuclei.

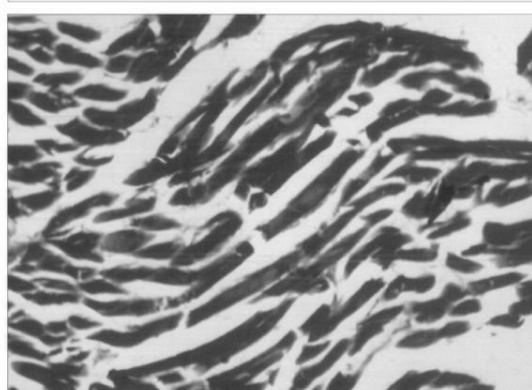


Fig. 4 : Skeletal Muscle, (H & E; HP) At temp. 35°C, duration 27 hours. Loss of striations. Marked degeneration and blurring of Nuclei. Cytoplasm fragmented.

Table 3: Degenerative Changes in muscle (According to Duration)

Duration	G 0		G1		G 2		G 3		G 4	
	No	%	No	%	No	%	No	%	No	%
Up to 12hrs(5 cases)	-	-	4	80	1	20	-	-	-	-
13-18hrs(13cases)	-	-	6	46.1	7	53.1	-	-	-	-
19-24hrs(14Case)	-	-	8	57.1	28.5	2	14.2	-	-	-
25-30hrs(9 cases)	1	11.1	4	44.4	33.3	1	11.1	-	-	-
31-34hrs(4 cases)	-	-	1	25	25	2	50	-	-	-

Table 4: Degenerative Changes in muscle (According to Temperature)

Duration	G 0		G1		G 2		G 3		G 4	
	No	%	No	%	No	%	No	%	No	%
Upto 20°C(9 cases)	-	-	2	22.2	4	44.4	3	33.3	-	-
21-25°C(6cases)	1	16.6	5	83.3	-	-	-	-	-	-
26-30°C(11Case)	-	-	4	36.3	6	54.5	1	9.1	-	-
31-35°C(19 cases)	-	-	11	57.8	7	36.1	1	5.2	-	-

Table 5: Relation between Temperature and Duration

	12 hours (5cases)		13-18hours (13cases)		19-24hours (14cases)		25-30hours (9cases)		31-35hours (4cases)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Upto 20°C(9cases)	-	-	G2-2	100	G1-1 G3-1	50 50	G1-1 G2-1	50 50	G2-1 G3-2	33.3 66.6
21-25°C(6cases)	-	-	-	-	G1-3	100	G0-1 G1-2	33.3 66.6	-	-
26-30°C(11cases)	G1-4 G2-1	80 20	G2-3	100	G2-2 G3-1	66.6 33.3	-	-	-	-
31-35°C(19cases)	-	-	G1-5 G2-3	62.5 37.5	G1-4 G2-2	66.6 33.3	G1-1 G2-2 G3-1	33.3 22.2 33.3	G1-1	100

Original Research Paper

Anatomical Variation of Superficial Venous Arrangement in Cubital Fossa

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Abstract

Distribution of superficial veins in cubital fossa varies considerably. Superficial venous return from superior extremity follows few major superficial veins like cephalic, basilic, median cubital, antebachial veins and their minor tributaries. Aim of present study was to find variations in arrangement of superficial veins of cubital fossa among 172 students of a medical college of West Bengal. A cross sectional study was designed to inspect patterns of superficial veins of right & left cubital fossa in 103 male and 69 female students. A tourniquet was firmly tied at midarm level and the prominent superficial veins were photographed & diagrammatized. Six patterns of superficial veins were observed mainly and the commonest pattern was M shaped distribution. Chi-Square test showed that there was no statistically significant difference in patterns of superficial veins between right and left side in both genders since *p* value was more than 0.05 in both cases. Only 20% of subjects had same venous pattern in both sides. The unusual but clinically important patterns include absence of communication between basilic & cephalic veins; an arched median cubital vein; absence of cephalic vein and two median cubital veins. Awareness of these uncommon patterns may be useful during venepuncture or venesection

Key Words: Anatomical variation, Cubital fossa, Superficial veins

Introduction:

The superior extremity is drained by superficial & deep veins. The veins which are close to surface of body are called superficial, i.e., are subcutaneous and present in superficial fascia.[1] Superficial veins of cubital fossa are commonly used for different invasive procedure like blood sampling, transfusions, intravenous injections etc.[2]

The superficial veins are cephalic vein, basilic vein and median cubital vein. Cephalic vein & basilic veins originate from lateral and medial side of dorsal venous arch respectively. Cephalic vein runs along lateral margin of front of forearm whereas basilic vein is ascending posteromedially along forearm. Just distal to elbow, median cubital vein joins basilic vein. Median cubital vein (MCV) is the most important anastomosing venous channel situated on front of elbow and passes supero- medially from cephalic to basilic vein usually between medial

& lateral cutaneous nerves of forearm.[2]

Recognition and awareness of variations regarding cubital venous anatomy is important for surgeons as it may enable reduction of iatrogenic bleeding or nerve damage during surgeries of forearm. For creating arteriovenous fistula[3] (during hemodialysis) it is crucial to have understanding of such anatomical variations.

Considerable anatomical variations in arrangement of superficial veins in cubital fossa are observed as studied several times in several ways in different corners of India & abroad.

According to del Sol et al[4] six different types are found. (Type A: M shaped arrangement, Type B: N shaped pattern, Type C: H shaped, Type D: no communication, Type E: veins running from lateral to superomedial part of forearm, Type F: double median antebachial veins.) This typing is followed for observation & analysis in the present study.

In one Malayasian study, done by Dharap AS & Shaharuddin MY,[5] six venous patterns were observed. There was no significant difference between the venous patterns on the right and left sides in males or in females. The most common pattern found in both sexes was N shaped.

In another Malayasian study, conducted by Hamzah AA et al,[6] it was observed that both males and females had N shaped the most in

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both limbs, followed by M shaped. There was no significant difference between the gender and patterns of superficial veins at cubital fossa. In a study from Nigeria, by Ukoha UU et al,[7] it was observed that for types A, B, C, D, E, and F, the incidence was 33%, 28.1%, 2.6%, 4.1%, 25.2%, and 7% respectively. Types A, B, C, and E were more common in males while types F and D were common in females. Also, there were statistically significant bilateral differences for both genders.

In an Indian study on both cadaver & living subjects by Vasudha T K,[8] N shaped pattern was found in 88% of the cadavers and in 96% of living subjects. Yamada et al[9] from Japan showed in their research that the frequencies of Types I (Median Ante Brachial Vein was thick and joined both the CV and BV) and II (MCV connected CV & BV), were 41.7% & 56.7% respectively. In an article by Goto M,[10] N shaped pattern was most predominant (78%). Singh SP et al,[11] in another study on Nigerian subjects, showed that the commonest was M shaped pattern. N type variation was most commonly observed by Alves N.[12] Under authorship of Halim A, Abdi SHM,[13] in a study on Indian subjects, it was found that N shaped pattern is the most prevalent variation. Wasfi FA et al[14] in their study, observed that commonest variation in venous distribution of cubital fossa was M shaped pattern. In a very recent Korean study by Lee H et al,[15] it was found that N pattern was most common, although the most common type in male & female was dissimilar as M pattern & N pattern, respectively. In another study of 2014 from Jordan by Al Bustami et al,[16] the commonest example was N type. There were no considerable differences between venous patterns on right & left sides in males or females.

The current research work may help to find out different anatomical variation of superficial venous arrangement in cubital fossa, along with gender-wise & bilateral variation, if any; and may be used to set up safer guidelines for the invasive procedures involving the structures.

Material and Methods:

This was a cross-sectional descriptive study and study design was randomized single blind. The study was conducted among the students of three batches of a semi-urban medical college of West Bengal in July-August 2015. Total 172 (male 103, female 69) subjects were studied. Students who did not give the consent, those who have any injury or vascular

disease involving cubital fossa or related region in any of the upper limb, are excluded.

Procedure for data collection:[7] The subjects were asked to sit or stand with each arm placed on a table, then a tourniquet was tied around the arm approximately at the mid arm level. The tourniquet was firm enough for occluding of the veins. Two to four minutes after applying the tourniquet, the occluded superficial veins, now prominent, was diagrammatized on a paper and photographed with a digital camera. Record of both upper limbs of the subject was taken (two drawings: one for the right and the other for the left upper limb).

Observation:

172 subjects, comprising 103 males and 69 females were included in the study. A total of 344 arms (right and left) were examined. In the present study it was found that the superficial cubital veins in the males were much more prominent than those of the females. It was also seen that in obese persons, it was not so easy to delineate venous pattern.

In our study, mainly six patterns of superficial venous arrangement were observed in the cubital fossa (Table 1). There was no significant difference between the venous patterns in males & females as p value >0.05 (Table 2). There was no statistically significant difference of superficial venous patterns on right cubital fossa in male & female since p value was 0.631 (p>0.05) (Table 3). There was no statistically significant difference of superficial venous patterns on left cubital fossa in male & female since p value was 0.583 (p>0.05) (Table 4). There was no significant difference of the venous patterns between right and left sides as p value >0.05 (Table 5). There is no statistically significant difference of superficial venous patterns between right & left cubital fossa in male since p value was 0.817 (p>0.05) (Table 6). There is no statistically significant difference of superficial venous patterns between right & left cubital fossa in female since p value was 0.406 (p>0.05) (Table 7). Out of 172 of the total sample, 35 (20.34%) of the studied cases (both males and females) had the same type of pattern in both arms (Table 8).

Discussion:

In present study, we have more or less followed the classification proposed by del So, et al,[4] in 2007. According to this, there are six main patterns of arrangement of superficial veins of cubital fossa (Fig. 1). Type A pattern was most commonly observed in present study - almost 56%. It is the M shaped arrangement (Median antebrachial vein bifurcates into median

cephalic & median basilic veins which join with cephalic & basilic veins respectively).

Second most common was the type B (17%), described as N shaped pattern (Median Cubital Vein runs obliquely connecting Cephalic Vein distal to elbow & Basilic Vein proximal to elbow, sometimes median antebrachial vein joins with median cubital vein). Third position, with 10% occurrence, was of both types, C (H shaped arrangement i.e. one extra median cubital vein transversely runs from cephalic vein to basilic vein- horizontal communication with convexity upwards, in addition to usual median cubital vein as in N pattern) and D (no communication exists between cephalic & basilic vein).

In present study, least commonly found patterns were type E, with 3% frequency, (i.e. one or few veins running from lateral to superomedial part of forearm, proximal part of cephalic vein on medial aspect of arm is usually absent) and type F (1%) i.e. double median antebrachial veins, running parallel to cephalic & basilic veins in front of forearm, forming an arch near elbow, medial end & lateral end of the arch join with basilic vein & cephalic vein respectively, concavity of the arch facing towards arm. There were two other types (total 4%), which were not described by del Sol, et al,[4] found in present study- one was inverted M shaped pattern and other was presence of three parallel veins.

Irrespective of gender or side, in most of previous studies[5, 6, 8-10, 12, 13, 15, 16], N pattern is most predominant, which differs from our observation. Findings of research work of Ukoha UU, et al,[7] Singh SP, et al,[11] & Wasfi FA, et al,[14] is in accordance with our study, i.e. M pattern is most frequently found. Hamzah AA, et al,[6] found in their study that there were no statistically significant difference between superficial venous patterns of left upper limbs (and also in right upper limbs) in male & female as the p values were more than 0.05. Above mentioned findings are in accordance with our observation.

In the work of Ukoha UU, et al,[7] it was seen that there were significant difference present in venous arrangement of cubital fossa of right & left side in male (and also in female) as the p values are less than 0.05. Both of the above mentioned scenarios are discordant with our findings. Similar results were also observed by Dharap, et al,[5] and AlBustami, et al.[16] In a very recent Korean study by Lee H, et al,[15] it was observed that difference in frequencies of each type of venous pattern between right & left cubital fossa is of no statistical significance. We also agree with this. Lee H, et al,[15] also

showed that difference in frequencies of each type of venous pattern between male & female is of no statistical significance. This is similar to our observation again.

We found in our study that types A, B, E and F patterns are more common in males, while types C and D are more common in females. F type is not found in females. Ukoha UU, et al,[7] observed that types A, B, C and E patterns are more common in males, while types F and D are more common in females. According to AlBustami, et al,[16] types A, B, C and F patterns are more common in males, while types D and E are more common in females, F type was not found in females. In research work of Dharap, et al,[5] they found that type B was the only pattern which was more predominant in female than in male and type C was not at all present in females. Also Lee et al[15] observed that N type is more commonly found in females.

In present study, 20% of the studied cases (both males and females) had the same type of pattern in both arms while the remaining 80% had different patterns in each arm. Two other research works of Ukoha UU, et al,[7] & Lee H, et al,[15] showed same venous patterns found in both side in 25% & 49% cases respectively.

Conclusion:

To know the common anatomy and variation of patterns of anastomosis of superficial veins at cubital fossa is very essential as they are frequently used in many clinical procedures. Although text books had explained about the most familiar two patterns, i.e. N-type and M-type, but this study had revealed some unusual patterns also in a small proportion of subjects. Knowledge of these exceptional arrangements of superficial cubital veins, such as double median cubital vein or absence of cephalic veins etc, and their frequencies of occurrence may be important when searching veins for venepuncture or venesection, particularly in emergency situation. There was no significant dissimilarity between the gender or side with patterns of superficial veins at cubital fossa.

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Table 1: Observation of various venous patterns in cubital fossa (Total 344 limbs)

Pattern	Description[4]	Frequency %
A	M - Median antebrachial vein forms median cephalic & median basilic vein	193 (56.14%)
B	N - Median cubital vein joins cephalic to basilic vein obliquely	58 (16.86%)
C	H - Median cubital vein joins cephalic to basilic vein transversely	33 (9.59%)
D	No connections between cephalic & basilic veins	33 (9.59%)
E	Veins run from lateral to superomedial part of forearm	10 (2.9%)
F	Double Median Antebrachial vein	3 (0.8%)
Others	Inverted M, Three parallel veins	9+5=14 (4.06%)

The last two patterns, mentioned under 'Others' are not described by del Sol et al[4].

Table 2: Gender wise distribution in both limbs

Pattern	Male (%)	Female (%)	Total(n=344)
A	117(56.79%)	76(55.07%)	193
B	36(17.47%)	22(15.94%)	58
C	17(8.25%)	16(11.59%)	33
D	18(8.74%)	15(10.86%)	33
E	8(3.88%)	2(1.44%)	10
F	3(1.45%)	0(0%)	3
Others	7(3.39%)	7(5.07%)	14

Chi-square = 5.776 with 6 degrees of freedom: p value = 0.449

****Fig 1 on page no. 216**

Fig. 1: Diagram showing pattern of superficial veins of the cubital fossa.

Table 3: Gender wise distribution in Right limbs

Pattern	Male (%)	Female (%)	Total	Chi-square = 4.337 with 6 degrees of freedom: p value = 0.631
A	59(57.28%)	37(53.62%)	96	
B	21(20.38%)	12(17.39%)	33	
C	9 (8.74%)	8 (11.59%)	17	
D	7 (6.8%)	5(7.24%)	12	
E	3(2.9%)	1(1.44%)	4	
F	1(0.01%)	0 (0%)	1	
Others	3(2.9%)	6 (8.69%)	9	

Table 4: Gender wise distribution in Left limbs

Pattern	Frequency in male (%)	Frequency in female %	Total (n=172)	Chi-square = 4.699 with 6 degrees of freedom: p value = 0.583
A	58(56.31%)	39(56.52%)	97	
B	15(14.56%)	10(14.49%)	25	
C	8(7.76%)	8(11.59%)	16	
D	11(10.67%)	10(14.49%)	21	
E	5(4.85%)	1(1.449%)	6	
F	2(1.94%)	0(0.0%)	2	
Others	4(3.88%)	1(1.449%)	5	

Table 5: Side wise distribution in both sexes

Pattern	Frequency in Right limb (%)	Frequency in Left limb (%)	Total (n=344)
A	96 (55.81%)	97 (56.39%)	193
B	33 (19.18%)	25 (14.53%)	58
C	17 (9.88%)	16 (9.3%)	33
D	12 (6.97%)	21 (12.2%)	33
E	4 (2.32%)	6 (3.48%)	10
F	1 (0.58%)	2 (1.16%)	3
Others	9 (5.23%)	5 (2.9%)	14

Chi-square = 5.47 with 6 degrees of freedom: p value = 0.485

Table 6: Side wise distribution in males

Pattern	Frequency in Right limb (%)	Frequency in Left limb (%)	Total (n=206)
A	59 (57.28%)	58 (56.31%)	117
B	21 (20.38%)	15 (14.56%)	36
C	9 (8.73%)	8 (7.76%)	17
D	7 (6.79%)	11 (10.67%)	18
E	3 (2.9%)	5 (4.85%)	8
F	1 (0.97%)	2 (1.94%)	3
Others	3 (2.9%)	4 (3.88%)	7

Chi-square = 2.932 with 6 degrees of freedom: p value = 0.817

Table 7: Side wise distribution in females

Pattern	Right limb (%)	Left limb (%)	Total
A	37 (53.62%)	39 (56.52%)	76
B	12 (17.39%)	10 (14.49%)	22
C	8 (11.59%)	8 (11.59%)	16
D	5 (7.24%)	10 (14.49%)	15
E	1 (1.44%)	1 (1.449%)	2
F	0 (0%)	0 (0.0%)	0
Others	6 (8.69%)	1 (1.449%)	7

Chi-square = 5.473 with 5 degrees of freedom: p value = 0.406

Table 8: Similarity of Venous Pattern in both the limbs

Pattern	Male (%)	Female (%)	Total
Same type in both limbs	22 (21.35%)	13 (18.84%)	35 (20.34%)
Different type in both limbs	81 (78.64%)	56 (81.16%)	137 (79.65%)
Total	103	69	172

Chi-square = 0.044 with 1 degree of freedom: p value = 0.834

Original Research Paper

A Five year Retrospective study of Fatal Snakebite in Chandigarh Region

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Abstract

This is a 5 years retrospective analysis and demographic study of cases of fatal snake envenomation presenting to the mortuary of Government Medical College & Hospital, Chandigarh, from January 2011 to December 2015. The purpose of this study is to present the epidemiological pattern of snake poisoning in this region, as also to describe the clinical characteristics and pathological changes in various organs. In our study, 49 cases of death due to snakebite were brought for medico legal post mortem examination to the Department. Of these, maximum number of cases, i.e. 15, belonged to the age group of 20 - 29 years; 42 were from rural areas and the time of incident of snakebite was mostly between 3 AM to 6 AM (28.5%), followed by 6 PM to 9 PM (14.3%). The months of the rainy season, i.e. July & August, accounted for the maximum no. of cases i.e. 32. The most common area of bite were the lower limbs (57%); swelling & cyanosis (41%), petechial hemorrhage (29%) and cellulitis (12%) were the common local changes at the site of bite. In 13 cases, no bite mark was seen; however, the involved limb showed local changes like swelling, ecchymosis, wet gangrene and cellulitis. Among the histopathological changes, acute tubular necrosis (41%), followed by disseminated intravascular coagulation (20%) & pulmonary oedema (12%) were the most common findings.

Key Words: Snakes, Snake envenomation, Wet gangrene

Introduction:

Envenomation from poisonous animals, particularly terrestrial venomous snakes, causes substantial illness and death. It increases the economic hardship on the already poor, rural population and reflects their vulnerability to snakebites, as most of them work in fields. It also puts enormous pressure on the already overburdened health care system of these countries. Even though mortality from snakebite is estimated to be one tenth that of malaria, no equivalent global snakebite envenomation control program exists.[1] A sustained and continuous effort is necessary to focus the global attention on this neglected and treatable condition.

The World Health Organization (WHO) estimates that there are about 2.5 million venomous snakebites recorded per year, 5% of which prove fatal. Nearly 1,00,000 of these deaths occur in Asia and approximately 20,000 in Africa.[2] According to the literature, in India, 81,000 cases of snakebite with 11,000 deaths are reported every year, making it the most heavily affected country in the world.[3]

There are about 276 species of snakes in India, of which 62 are venomous, the rest being non-venomous. Among the venomous species, 20 are aquatic snakes and 42 are terrestrial snakes, with most of them having very limited distribution. Only four venomous species are known for the vast majority of snake bites and associated mortality and morbidity.[4] These are named the "Great Four" - Common Krait, Cobra, Russell's Viper and Saw Scaled Viper.[5] The true global incidence of envenomation and its severity remain largely underestimated. Though, large number of venomous and non-venomous snakes exist in India, specific treatment by anti-snake venom is available only for few.[3]

Most of the victims seek traditional treatment/ home based remedy and hence, hospital-based data is probably not a true picture of the incidence, case-fatality ratio, and the overall contribution of snakebites, to worldwide

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morbidity and mortality. These victims usually die at home and their deaths remain unrecorded.[6] Previous data suggests that the public health importance in case of snake envenomation has been invariably neglected in spite of the various advances made in medical field in the past.[7] Hence, the objectives of this study are to highlight the epidemiological & demographic factors and discuss the clinical characteristics and the pathology of common venomous snakebites in this region.

Materials and Methods:

A 5 year retrospective hospital based observational study was conducted from 1st January 2011 to 31st December 2015, at the Department of Forensic Medicine & Toxicology, GMCH Chandigarh. The age and sex-wise distribution of cases, occupation, incidence of fatal snake bites, date and time of presentation of cases, distribution of bite marks, their local affects and the most affected organ on histopathological examination, were analysed from the combined data compiled from hospital case files and post-mortem reports.

Observations and Results:

A total of 3525 cases were brought for medico legal post-mortem examination to the mortuary of the department during the study period; of these cases, 49 (1.4%) were of snakebites. Maximum cases of snakebite were from Punjab (57%), followed by Haryana (24%) and Chandigarh (9%).[fig 1] A total of 39 males (79.5%) were involved, the male: female ratio being 3.9:1.[fig 2] The most commonly involved age group was the 20 - 29 years (30.6%).[fig 3] Majority of these cases, 42 (85.7%) belonged to rural areas [fig. 4] and the most common time of occurrence of the snakebite was 3 AM to 6 AM (28.6%), followed by 6 PM to 9 PM (18.4%). [fig 5] Most of the victims were labourers (61%), working in the field, followed by students of the age group 6-14 years.[fig 6] The months of the rainy season, i.e. July & August, accounted for the maximum no. of cases i.e. 32(65%), while the months from December to April didn't register any case.[fig 7]

The most common area of bite were the lower limbs i.e. 28 (57 %) cases.[fig 8] Swelling & cyanosis (41%), petechial hemorrhage (29%) & cellulitis (12%) were the common local changes at the site of bite, respectively, while 5 (10%) cases didn't show any local change.[fig 9] In 13 (29.5%) cases, no bite mark was seen; however, the involved limb showed local changes like swelling, ecchymosis, wet gangrene and cellulitis. Acute tubular necrosis, followed by disseminated intravascular

coagulation & pulmonary oedema were the most common histopathological changes.[fig 10]

Discussion:

The present study helps us to identify the epidemiological factors of snake bite in this region, as also the consequences of delay in management of these cases. Snakebite is an underestimated, but a very important public health issue. It is particularly so in the rural population who do not have access to the life-saving antivenom, most of the times. [8] The clinical classification is found to be better than the conventional classification for treatment and prognosis of snake bites.[9] In majority of the cases of fatal snakebite, the species of snake remain unidentified due to inconclusive description of snake by the patient; or in many cases, the patient may not have seen the snake at all.[1] Acute renal failure is a serious complication of venomous snakebite because the kidney is a particularly vulnerable organ to venom toxicity and results in acute tubular necrosis; but all renal structures may be involved.[5] Antivenom is the only specific antidote to snake venom and its timely administration can reverse all systemic manifestations of envenoming.[10]

The highest incidence of deaths due to snake bite was found in the age group of 20 to 29 years of life in the present study, which was consistent with the studies conducted by other authors.[4,6,8,11-14] The greater involvement of the young population can possibly be explained by the fact that they are more commonly social and are involved in outdoor activities and are therefore more likely to get exposed to snakes.

In the present study, the male: female ratio was found to be 3.9:1. Males, being the usual bread-winners of the family, venture out and work in the fields and thus become prone to snakebites. The male dominance of the snakebite cases was in accordance to the studies conducted previously.[3,4,9,11-14]

In the present study, lower limbs (foot and legs), were the most common body parts which were involved in snakebite cases (57%), which is consistent with the previous studies [3,6,8,11-13]. All these studies have been conducted in regions where a major population, belonging to the rural area had been working in the fields, during the early morning or late evening hours when visibility is minimal.[4,6,8,13] Thus, snakes could have possibly been trodden upon by the victims.

In the present study, the most common organ affected by snake envenomation was the kidney, which showed acute tubular necrosis

and glomerulonephritis followed by disseminated intravascular coagulopathy. These findings are also consistent with the studies conducted earlier,[3,4,6,13] as shown in **table 1**. Some studies have mentioned other complications of snake envenomation such as, acute respiratory distress syndrome, myocarditis, brain infarction and thrombotic stroke but there is no corroboration with their respective histopathological examination findings.[5,6,9,11] However, in our study, histopathological examination of most of the organs were performed which revealed findings such as bronchopneumonia, pulmonary oedema and pericarditis.

We observed that snakebite cases occurred during the months from June to September having a peak incidence in July and August which is consistent with the studies done by Sreekrishnan TP, et al[3] and Kumar, et al[6], who also found that these incidences occurred during the monsoon season, when there is rainfall and increase in harvesting activities.

A relationship between poverty with incidence of snakebite and associated mortality has been clearly demonstrated in our study which emphasises on the rural preponderance, being consistent with most of the authors.[4,9,13,14] According to the study conducted by Rao CPS, et al,[8] more than 2/3rd with an unknown bite or bite from an unidentified species of snake. Since, most of these cases were from rural area, they could not seek medical aid especially in the most crucial period following the bite. Causes of delay were primarily ignorance, callous attitude of the victims, dangerousness of situation, dependence of the affected population on unscientific methods of treatment, and lack of transportation facilities to reach the higher centres. Proper pre-hospital care was sought only in 30% cases and the rest approached an untrained traditional therapist.

Conclusion:

As per the analysis of our study and its correlation with the various studies conducted in past, we conclude that there is not only a need to promote awareness directed to prevention of envenomation, strict incorporation of specific guidelines for treatment, but also of appropriate facilities for dealing with the associated complications.

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Fig 1: State wise distribution of snake bite cases

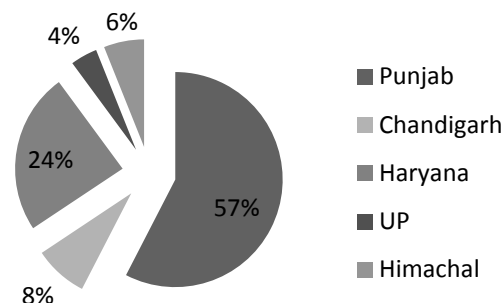


Fig 2: Ratio between Male & Female

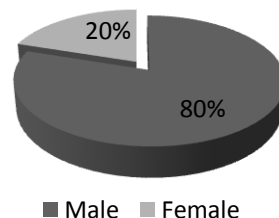
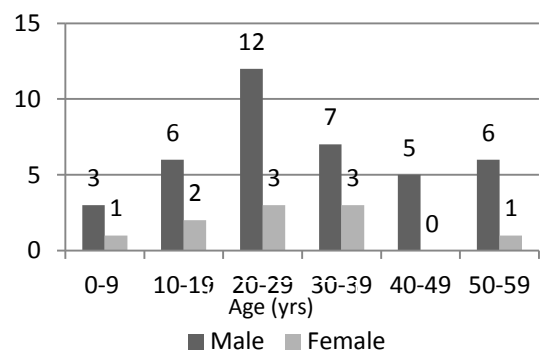
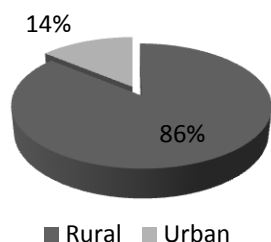
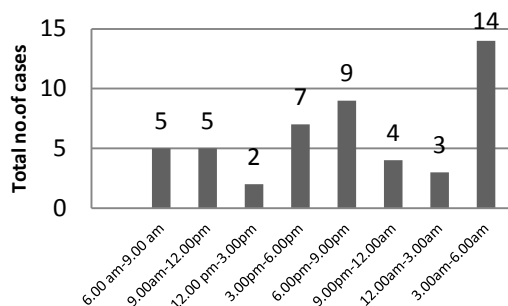
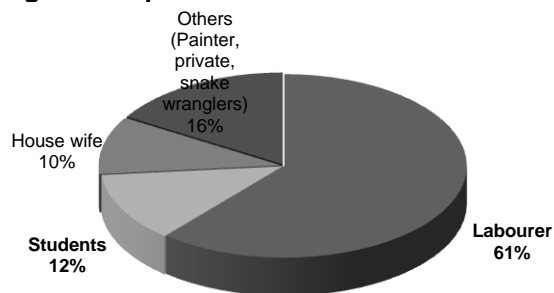
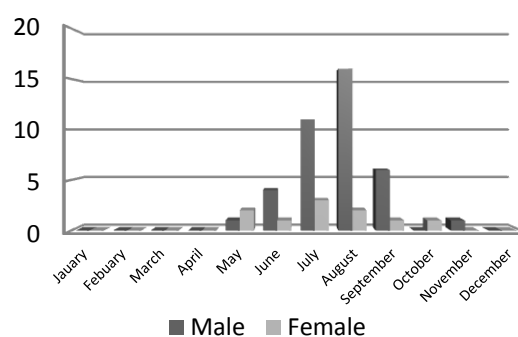
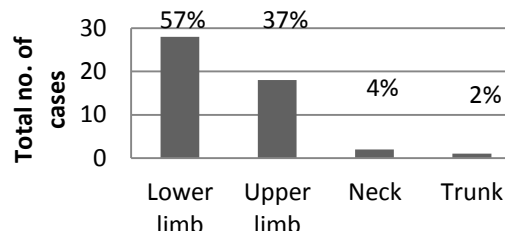
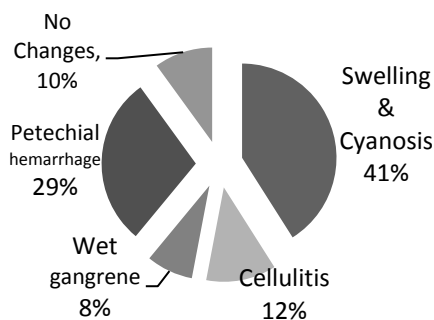
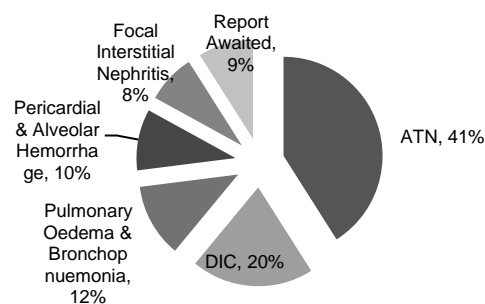


Fig 3: Age & Sex wise distribution of cases**Fig 4: Area wise distribution of cases****Fig 5: Time range of occurrence of snake bite****Fig 6: Occupation wise distribution of cases****Fig 7: Month wise distribution of cases****Fig 8: Body part involved in the bite****Fig 9: Local changes at the site of snake bite****Fig 10: Histopathological finding in snake bite cases****Table 1: Comparison of most common Histo-pathological (H/P) changes**

Study/Author	ATN (Renal Changes)	DIC	Pulmonary changes	Pericardial Changes	Report awaited/ No subjected to H/P
Present study	41 %	20 %	12 %	10%	10 %
Naik CRS, et al	46 %	23 %	7.7 %	7.7 %	6 %
Yogesh CR, et al	62.8 %	12 %	7 %	8 %	10 %
Kumar MR, et al	6.8 %	32.2 %	-	2.3%	-
Sreekrishnan TP, et al	24 %	33.3 %	14.8 %	1.9 %	-

Original Research Paper

A Study of Medico legal profile of fatal burn cases in Mumbai region.

¹Bhore D V, ²Nanandkar S D, ³Bhise S S

Abstract

Since ancient time fire is both boon and bane for mankind. Invention of fire was greatest invention towards the human civilization. Fire was perhaps, first double edged sword, it serves as well as destroys life and property. Burn is an injury which is produced by the application of dry heat such as flames, radiant heat or heated substances and corrosive chemicals to the body. By law all heat lesions have been designated as burns. Burn injuries are among the most devastating of all injuries and a major global public health crisis.

The profile of 150 cases of fatal burns was studied in Dept. of Forensic Medicine and Toxicology, during the period of two years from October 2012 to September 2014. The study includes all the referred brought dead burn cases from the concerned revenue division and admitted burn injury cases that subsequently died in the hospital coming to the mortuary for autopsy. The main objective of study is to know the medico legal aspects of various types of fatal burns cases. In addition to this the study also aims at understanding and analysing magnitude of relevant socio-culture and epidemiological factors associated to find the pattern and causes of death in different type of burn cases.

Key Words: Fatal burns, Medico-legal aspects, brought dead, Autopsy, Epidemiological factors, Shock.

Introduction:

We are in developing twenty first century but still the toll of death due to burns is much more. The thermal injuries causing death are still a major cause of death in working age groups. The stigma of dowry death is also going on. Death due to burns affects all the communities, including urban as well as rural areas. Every year more than 2 million people sustain burns in India. Around 5 lakh people were treated as outdoor patients. About 2 lakh people are admitted in hospital, of which about 5000 people die every year.[1] Burn is an injury which is produced by the application of dry heat such as flames, radiant heat or heated substances and corrosive chemicals to the body.[2,3] The term burn is restricted to the local effects of dry heat. By law all heat lesions have been designated as burns.[4]

Burn injuries are among the most devastating of all injuries and a major global public health crisis. The most common cause of flame burns in modern society is accident.[5,6] Burns are the fourth most common type of trauma worldwide, following traffic accidents, falls and interpersonal violence.[7] The burns have tremendous medico legal importance as they may be considered to be commonest cause of unnatural death in India. In all societies including developed or developing countries, burns constitute a medical, surgical and psychological problem.

Death due to burns usually accidental, but they may be often suicidal or homicidal. Victims may die of burns or bodies may be burnt after death in order to conceal a homicide. In India deaths in newly wedded brides due to burns are being reported frequently. Illiteracy and negligence in taking precautions while using proper fire and fire producing materials in poor socio-economic group of peoples are also the reasons for burns incidents in them.[8] It is sometimes difficult for an autopsy surgeon to decide the manner of burns whether suicidal, homicidal or accidental. It would be inappropriate to see the dead body in post-mortem room and directly opine that the death was due to burns. In such cases, the post-mortem should begin by spot examination, so as

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to reconstruct the circumstances in addition to meticulous autopsy.

Material and Methods:

The present study is medico legal profile of 150 cases of fatal burn injury referred to the Dept. of Forensic Medicine and Toxicology, Grant Govt. Medical College at Mumbai which is a tertiary care centre, during the period of 2 years from October 2012 to September 2014. This study was carried out in all the cases of burn victims who were admitted and brought dead to the tertiary care centre hospital. All these burn cases were examined in post-mortem room after being brought by police with inquest reports and hospital records. The main objective is to collect epidemiological information, to find type of burn, manner of death and exact cause of death.

Observation:

During the study period, the medico legal profile of 150 burn cases was taken. As for the age of the victims, the most of the victims were between 16-30 years of age comprising 54%, followed by 31-45 years age group comprising 26.7% cases. Very few cases were reported in the age group <15 years (4.7%) and age group >60 years (3.3%). (Graph 1) In present study most of the victims were female comprising 60.7% cases and male victim comprising 39.3% cases out of 150 cases studied. (Graph 2) Most of the victims belongs to the Hindu community comprise 76.7% cases, followed by Muslim community comprise 22.7% cases and only one case belongs to Christian community was reported. (Graph 3) Most victims belongs to the middle socio-economic class comprise 85.3% cases, followed by lower socio-economic class comprise 12.7% cases out of 150 cases. (Graph 4)

The most of the victims were sustained burns between 71-90% of total body surface area comprising 29.3% cases, followed by >90% of total body surface area comprising 28% cases out of 150 cases studied. (Graph 5) In our study type of burn in majority of cases was thermal burn comprise 89.3% cases, followed by scald burn comprise 6% cases and electric burn comprise 4% cases. (Graph 6) In present study, highest number of victims survived for more than 7 days comprising 26.7% cases and about 20.6% cases were died on the spot or on the way to hospital. 12% cases were died within 24 hours after being hospitalised. (Graph 7)

As for the nature of injury, in 111 cases (74%) burn injury was accidental; in 33 cases (22%) burn injury was suicidal and only in 06 cases (4%) burn injury was homicidal in nature. (Graph

8) In our study, burn victims who were admitted and treated survived beyond 3-4 days and died due to septicaemia comprise 56.7% cases and in 43.3% cases cause of death was shock, of which 20.6% cases were brought dead and in 22.7% cases victims died within 1-3 days. (Graph 9)

Discussion:

In the present study, total 150 cases of burn injury were studied, which was brought to morgue for post mortem examination. Most of the victims are between 16-30 years of age group, which is similar to the findings of the other study.[9-12] The age group 16-30 years is the young adult group and majority of victims were married housewives females. Incidence is more in this group, as most female being housewives and indulged in cooking work, do not take safety measure due to lack of knowledge.

In our study, most of the victims were female and belong to Hindu community and middle socio-economic class, which is similar to the results of other study. [9,10,12] Hindu is majority community in the region where studied conducted so that more victims being Hindu females. It was observed that, Dowry customs are being used more in community like Hindu. More victims belongs to middle and lower socio-economic class as they do follow preventive and safety measures while cooking because of illiteracy, negligence, overcrowded and limited living place. The use of open and unguarded cooking fire is common in this class.

Most of the injuries are accidental in nature, which is similar to the findings of other study.[9-12] It is always difficult to ascertain the nature of burn as accidental, suicidal or homicidal. Most of victims met with accidental burn injury as they do not follow safety measure and precautions prior to lightening the fire due to lack of knowledge and negligence. Stove burst is major cause for accidental burn injury throughout the study. Under such circumstances only eye witness can ascertain the nature of injury. Dying Declaration is type of documentary evidence can only corroborate the homicidal nature of burn in case of bride burning.

In present study, most of victims had burn injury involves 80-100% of total body surface area, which is similar to the findings of other study. [9,10,12] In the study region, usually females used to wear sari, salwar, kameej, petticoat, gown etc. wearing garments. So once it got fire it is difficult to remove the clothes resulting in higher percentage of burns over body. It is also found that limited and

congested living place could not allow them to reach out to help result in more damage.

In our study, most of victims died due to septicaemia, which is similar to the findings of other study. [9] Majority of victims got treated after being admitted and survived for 4-10 days. Septicaemia as a cause of death reflected that deaths in burn cases occurred due to secondary infections. Sepsis is the most important factor in death occurring in 4-5 days or longer after burning. Shock is also found as a cause of death in burn cases within 1-2 days. Most of the burns were epidermal to dermo-epidermal in nature, which were agonising resulting in neurogenic shock. Hypovolemic shock is also prevalent in first 24-72 hours due to increased capillary permeability with loss of fluid. The causes of death due to burns are primary shock, secondary shock, suffocation, toxemia, sepsis, hypokalaemia, acute tubular necrosis, pulmonary embolism.

Conclusions:

Before conducting autopsy in burn case, the autopsy surgeon must be well aware of marital status, socioeconomic status, occupation and history of incidence of burns. An approach of prejudice due to history given by police or relatives can't yield good results. So autopsy surgeon should rely on its own observations during autopsy. There is no substitute for thorough external and internal examination. Hence, autopsies in burn cases have to be complete in every technical respect. Sample collection in burn cases is very important particularly in unconscious and brought dead cases. The same should be followed as mandatory requirement in above mentioned and other suitable cases. On many occasions the history of incidence given by police and relatives is not reliable for answering many questions in crime investigations (like identity, time of death, cause of death, manner of death) visit to scene of crime must be mandatory done in all suspicious and complicated deaths. There has to be good liaison cum co-ordination is very necessary between investigating police officer and autopsy surgeon. This can ensure prompt and immediate crime scene visit in justified and genuine cases.

The most important step in reducing the burn incidence is through mass education. A community based programme involving the active participation of medical paramedical healthcare personnel is needed to address educate preventive measures against burn injuries. Safety instructions like putting the lights off while going out, wearing tight and cotton

clothes while cooking, not leaving a fire source unattended etc., will definitely help to reduce the incidence of burn injuries.

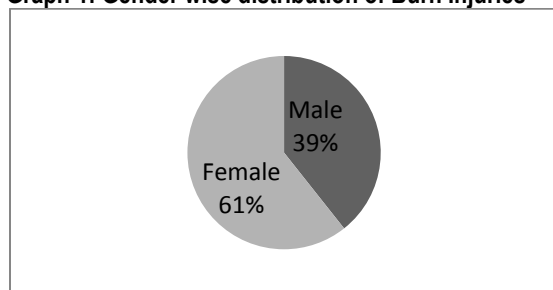
For planning and implementing prevention programs the approach have to be multi-disciplinary and co-ordinated and accomplished by providing education so as to build awareness in the mind set of general population, school education programs, male concerning risk in work location's, the family especially the housewives and parents. People have to be educated for adoption of safe cooking habits, which mainly include avoiding cooking at floor level, use of safe oil stoves and keeping hot liquids and cooked articles out of reach of children. Legislative measures have to be promulgated for strict introduction of safe kitchen environment at the time of approval of house plans and ban on sale of inflammable garments.

There should be well planned electricity codes in all residential areas or colonies. Electric poles should be well away from rooftops and all transformers should be well guarded and inaccessible to public. Steps should be taken not only to minimize burn mortality but also to prevent and reduce their incidence at least in cases where human errors and human greed plays a role. This study emphasizes the urgent need for effective burn prevention programme and specialised burn care centres in which all health professional should an important role.

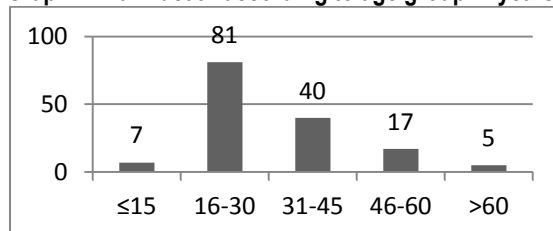
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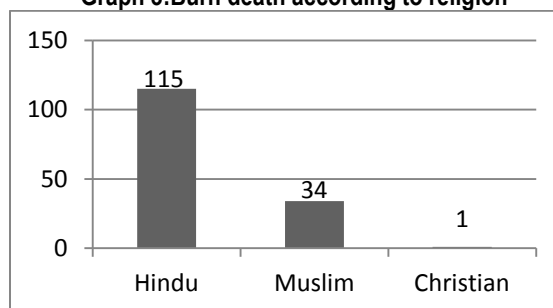
Graph 1: Gender wise distribution of Burn Injuries



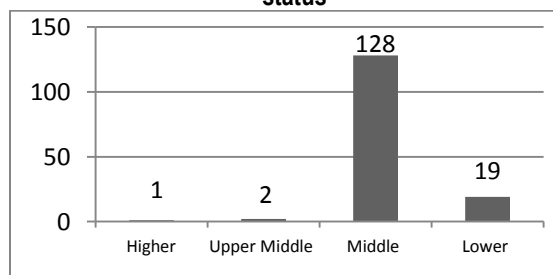
Graph 2: Burn death according to age group in years



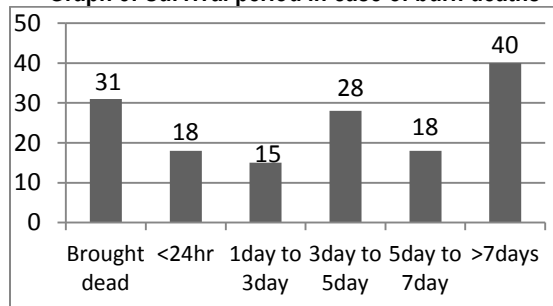
Graph 3: Burn death according to religion



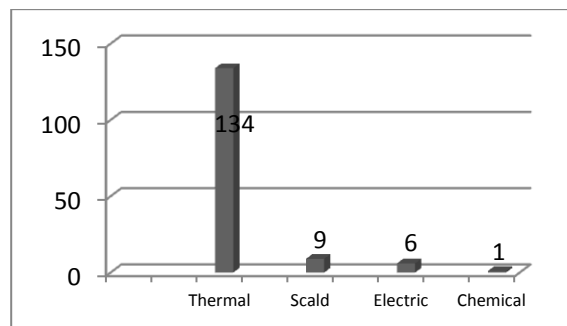
Graph 4: Burn death according to socioeconomic status



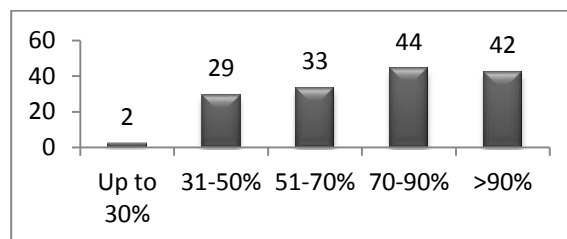
Graph 5: Survival period in case of burn deaths



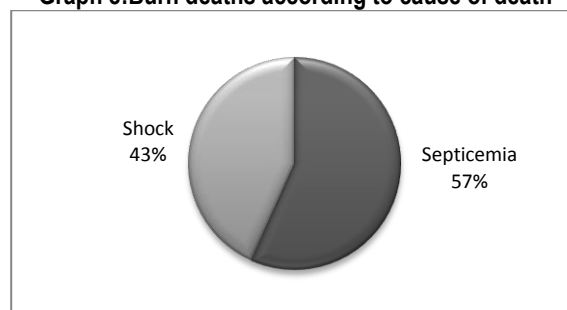
Graph 6: Distribution of burn deaths according to type of burn



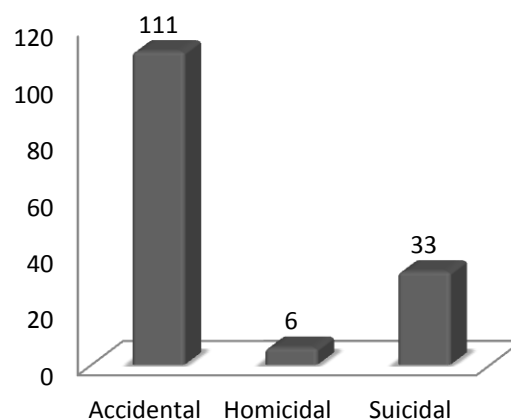
Graph 7: Percentage of body surface area involved in burn injuries



Graph 8: Burn deaths according to cause of death



Graph 9: Burn deaths according to manner of death



Original Research Paper

Poisoning Death trends in North East Delhi – A Retrospective Study

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Abstract

All autopsies conducted at the Mortuary of University College of Medical Sciences and GTB Hospital, Delhi during the 10 year period of 2003 to 2012 were studied for alleged history of poisoning cases. It was observed that about 7 % of total medico legal deaths were due to poisoning. Males in 2nd to 3rd decade of their life were more involved than the females. In this study we observed that Aluminium phosphide poisoning was the commonest poisoning followed by Corrosive poisoning. About 3% cases were associated with one or the other form of injuries. Survival time in about 60% of the cases was less than 24 hours. Proper identification of the poison and early management of the cases is vital to save the life of the victim.

Key Words: Poisoning, Death, Postmortem, Survival time

Introduction:

The father of Toxicology, Paracelsus, once wrote, "Everything is poison, there is poison in everything, only the dose makes a thing not a poison".[1] The word poison is evolved from the Latin word "potion" that is 'to drink'. [2] Biologically speaking, any substance, if given in large amounts is poisonous and can cause death. For instance, while botulinum toxin is lethal in small doses, a person would have to ingest gallon of water to receive a lethal dose.

There is no universal definition of poison. In medical context, the term "poison" can be defined as a substance solid, liquid or gas, which on gaining entrance into or in contact with body parts of a living subject, will cause ill health, disease or even death.[3]

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students, etc., will come into the forefront immediately and preside over the matter. Therefore, this study has been done in order to know the various outcomes of a crime occurring in a society which is conducive to mob formation and to suggest preventive measures for the general good.

Material and Methods:

The present study was conducted in the department of Forensic Medicine, University College of Medical Sciences and Guru Teg Bhadur Hospital (UCMS & GTBH), situated in the Northeast part of Delhi and adjoining Uttar Pradesh (UP) border. It caters to the metropolitan population of Delhi and most of the parts of Uttar Pradesh (adjoining districts), and more than half of the patients are from this state. The present study is a retrospective study in which all the cases, having alleged history of death due to any kind of poisoning (including alcohol and food poisoning), brought for postmortem examination in the mortuary of UCMS & GTBH, during the period of Jan 2003 to Dec 2012 were studied.

All the data was collected in detail, statistically and critically analyzed, tabulated and compared with other various studies to analysis the trends. Trends in distribution of poisoning case were observed in relation to age, gender, type of poison, survival period and seasonal distribution.

Observation:

During the period from January 2003 to December 2012 a total of 15,513 postmortem examinations were conducted, of which 971

cases (6.26%) had the alleged history of poisoning. In present study, the highest incidence of deaths 362 cases (37.2%) due to poisoning was found in the 3rd decade of life. **(Table-1)**

In present study it was observed that, of the 971 cases, 656 (67.6%) were males and 315 (32.4%) were females, the male: female ratio being 2.08:1.

Again, of the 971 cases of alleged history of poisoning only 432 (44.5%) gave the proper history of nature and type of poison they consumed while 539 (55.5%) gave the history of consuming unknown poison.

It was observed that the commonest history of poison consumed was of Aluminium Phosphide, 139 cases (32.2%); followed by corrosive poison 92 cases (21.2%). Sixty two (14.4%) persons gave the history of consuming alcohol while 57 (13.2%) gave the history of consuming insecticide and rodenticide. **(Figure-1)**. Aluminium phosphide, insecticides and rodenticides, all are agricultural poisons. India, being a land of farmers; agricultural chemicals are being widely used and are easily assessable to most of the population.

It was observed that the highest incidence of poisoning cases was found in the months of May, June and July; accounting for about 30.8% of the total. **(Table-2)** This may be due to the hot climatic conditions in India during which draught and famine are common. Lack of income during this period of the year may lead to financial frustrations provoking suicides.

In present study, it was observed that of the 971 cases, 489 (50.3%) had survived for less than 12 hours and only 180 (18.5%) survived for more than one day. **(Figure-2)**

Discussion:

The incidence of death due to poisoning was 6.2% in present study, which was less as compared to the previous study conducted by Aggarwal, et al,[15] at this institute a decade ago which observed an incidence of more than 10%. The highest incidence of deaths due to poisoning was found in the age group of 20 years to 30 years of life in the present study, which was consistent with the studies conducted by other workers in the field.[4,5,11-15] (Table-3) The highest incidence of poisoning deaths in this age group may be due to the fact that it is the most active phase of life and people are involved physically, mentally and socially more with each other. Most of the marriages occur in this age group of life with which responsibility, duties and financial problems increase, consequently they get more stressed and frustrated.

In the present study, the male: female ratio was 2.08:1. Male dominance of poisoning cases similar to our study was seen in studies by other authors, as shown in Table-4. The increased incidence of poisoning in males may be attributed to more exposure to stress, strain and occupational hazards in general as compared to females.

In the present study, 57.06% died within 12 hours of consuming poison among which 7.8% were reportedly brought dead to the hospital. The comparison with other studies is shown in Table-5. This illustrates that if the initial crucial time of 12 hours is properly managed, the chances of survival would increase substantially.

Highest incidences of poisoning cases were found to be in the months of May, June and July. These findings were consistent with the study conducted by Singh et al.[13] This may be due to the hot climatic conditions in India during which drought and famine are common. Lack of income during this period of the year may lead to financial frustrations provoking suicides.

Conclusions:

There has been a substantial reduction in poisoning cases from 2003 to 2012, the annual incidence of poisoning deaths decreased from 9.4% to 5.0% respectively **(Table-2)**. This can be attributed to improvement in the medical facilities and awareness among the common public.

It was observed in the present study that poisoning was common among the age group 20 years to 40 years. Young adults are more prone to psychological breakdown that could be taken care of by Psychological counseling talking their problems sympathetically and categorically.

It was further observed that the agriculture chemical based poisons are the leading causes poisoning therefore it is the duty of Government & Non-Government Organizations, Doctors and General Public to educate the vulnerable group of society. Agricultural chemical based poisons such as Organo-Phosphorous Compounds, Aluminium Phosphide and other Spray Poisoning could be restricted by regulation of their sales and distribution. The preventive and educational measures should be more effectively designed and implemented.

Acknowledgment

We are thankful to all the Faculty members and Residents of the department who had conducted these postmortems or helped during conduction of the postmortems of these victims.

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Table 1: Showing age-wise distribution of cases

Age period	Number of Cases	Percentage
0 to 10	22	2.2
10 to 20	220	22.6
20 to 30	362	37.2
30 to 40	206	21.2
40 to 50	102	10.5
50 to 60	45	4.6
More than 60	14	1.4
Total	971	100

Fig 1: Distribution of cases in relation to type of poison

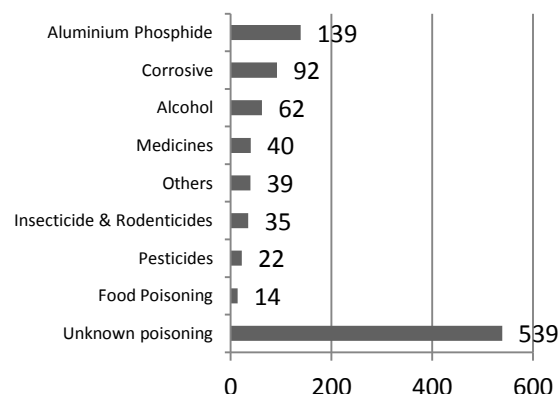


Fig 2: Distribution of cases according to survival time

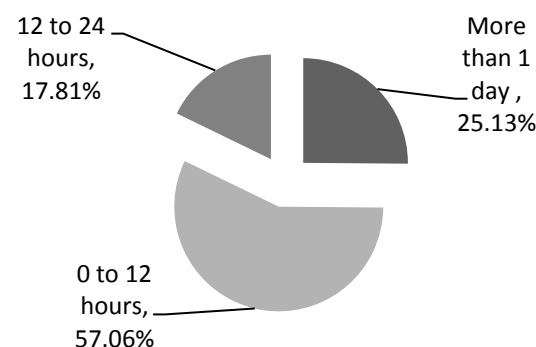


TABLE 4: Comparison of sex wise distribution of poisoning cases

Study/ author	Male cases	Female cases	Total cases
Present study	965 (67.7%)	315 (32.4%)	971
Gupta et al [3]	82 (62.1%)	50 (37.9%)	132
Varma et al [4]	93 (65.03%)	50 (34.97%)	143
Siddapur et al [10]	159 (69.7%)	69 (30.3%)	228
Guntheti et al [11]	431 (85.85%)	71 (14.14%)	502
Zariwala et al [12]	342 (61.5)	214 (38.5%)	556
Sharma et al [14]	764 (76.4%)	236 (23.6%)	1000
Aggarwal et al [15]	193 (72%)	75 (28%)	268
S K Dash et al [16]	163 (53.3%)	143 (46.7%)	306
Haloi et al [17]	60 (62.5%)	36 (37.5%)	96

TABLE 5: Comparison of cases according to survival period

	Survival Period		
	0 to 12 hrs	12 to 24 hrs	> 1 day
Present study	554 (57.06%)	173 (17.81%)	244 (25.13%)
Gupta et al [4]	107 (81.06%)	08 (6.06%)	17 (12.8%)
Varma et al [5]	96 (67.13%)	09 (6.29%)	38 (26.57%)
Siddapur et al [10]	129 (56.6%)	49 (21.5%)	50 (21.9%)
Zariwala et al [12]	523 (94%)	32 (5.7%)	1 (0.3%)
Aggarwal et al [15]	148 (55.22%)	35 (13.05%)	61 (22.73%)

Table 2 – Showing month-wise distribution of cases

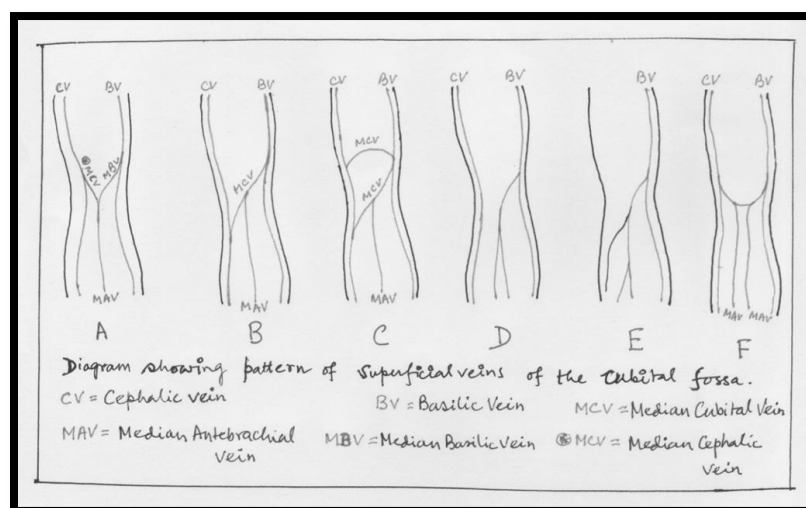
Years Months	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
January	6	11	8	9	5	7	7	5	6	8	72 (7.4%)
February	6	8	5	12	3	4	5	6	4	11	64 (6.5%)
March	6	9	12	6	4	8	8	10	9	8	80 (8.2%)
April	10	8	6	6	6	6	7	9	5	11	74 (7.6%)
May	13	12	9	11	6	7	7	7	17	8	97 (9.9%)
June	14	14	12	6	13	10	12	5	8	9	103 (10.6%)
July	14	12	9	6	8	8	10	13	8	11	99 (10.1%)
August	6	8	5	10	6	6	10	9	11	6	77 (7.9%)
September	8	8	7	1	10	5	10	2	11	9	71 (7.3%)
October	10	8	11	6	6	4	9	9	10	10	83 (8.5%)
November	10	10	14	5	6	4	8	10	10	2	79 (8.1%)
December	8	11	8	6	10	6	4	6	5	8	72 (7.4%)
Total poisoning cases	111 (9.4%)	119 (9.6%)	106 (8.1%)	84 (5.9%)	83 (5.6%)	75 (5.0%)	97 (5.3%)	91 (5.1%)	104 (5.7%)	101 (5.0%)	971
Total autopsy	1177	1237	1301	1418	1477	1481	1800	1784	1824	2014	15513

TABLE 3: Age wise distribution of cases, comparison

	Age group in years								Total
	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	> 60		
Our study	22 (2.2%)	220 (22.7%)	362 (37.3%)	206 (21.3%)	102 (10.5%)	45 (4.6%)	14 (1.4%)	971	
Gupta et al [4]	02 (1.5%)	32 (24.3%)	57 (43.2%)	17 (12.9%)	14 (10.6%)	06 (4.5%)	04 (03%)	132	
Varma et al [5]	05 (3.5%)	38 (26.6%)	43 (30%)	19 (13.3%)	23 (16.1%)	09 (6.3%)	06 (4.2%)	143	
Guntheti et al [8]	10 (2%)	72 (14.3%)	257 (51.2%)	104 (20.7%)	49 (9.7%)	07 (1.4%)		502	
Zariwala et al [12]	14 (2.5%)	113 (20.3%)	224 (40.3%)	96 (17.3%)	73 (13.2%)	24 (4.3%)	12 (2.1%)	556	
Sharma et al [14]	14 (1.4%)	152 (15.2%)	350 (35%)	292 (29.2%)	108 (10.8%)	84 (8.4%)		1000	
Aggarwal et al [15]	09 (3.3%)	72 (26.8%)	129 (48.2%)	41 (15.3%)	11 (4.1%)	04 (1.5%)	02 (0.8%)	268	
Dash et al [16]	7 (2.3%)	64 (20.9%)	124 (40.5%)	66 (21.6%)	40 (13.1%)	05 (1.6%)		306	

Contd. from page no. 204

Fig. 1: Diagram showing pattern of superficial veins of the cubital fossa.



Original Research Paper

Study of Skull Fractures in Fatal Cranio Cerebral Injuries in Light with the Manner of Death

¹Geeta Sahu, ²Subal Naik

Abstract

Background: Brain damage, as a result of head injury, constitutes a hidden epidemic and is a major problem worldwide. It is the most common emergency encountered in trauma units and the casualty department. **Materials and methods:** The present study was conducted at the central morgue, Department of Forensic Medicine and Toxicology, SCB Medical College, Cuttack, Odisha, during the period from September 2010 to August 2012 and included 200 cases of fatal cranio cerebral injuries. **Result:** Among all fatal cranio cerebral injuries 87% cases were non homicidal and rest 13% were homicidal cases. The commonest skull bone involved was parietal followed by temporal, frontal and occipital, respectively. The incidence of fissured fracture was the commonest, followed by comminuted, depressed and cut fractures. Extradural haemorrhage was absent in both homicidal and non homicidal deaths when there was no associated fracture of the skull bone. **Conclusion:** In all categories of cranio-cerebral injuries, skull fracture was noticed to have a definite association with brain injury in comparison to brain involvement without fracture skull. The overall frequency of intracranial hemorrhage was more in association with skull fracture than without skull fracture. The definite role of skull fracture in cranio-cerebral injuries can be explored in deciding the fatality and the manner of the cases.

Key Words: Cranio cerebral injury, Skull fracture, Non homicidal cases

Introduction:

“Head injury is a morbid state, resulting from gross and subtle structural changes in the scalp, skull and or the contents of the skull produced by mechanical force”, as per the National Advisory Neurological Diseases and Stroke Council.[1] Brain damage as a result of head injury constitutes a hidden epidemic and major problem worldwide. It is the most common emergency encountered in trauma units and casualty department. Irrespective of the manner, traumatic head injury due to road traffic accident claims largest toll of human life worldwide. The number of people killed in road traffic accident is almost 1.2 million each year while the number of injured could be as high as 50 million. As homicide is a reflection of extreme aggression, head is the target of choice in majority of homicidal injuries.

Cranio-cerebral injuries are also sustained due to fall from height, fall of heavy object on head, occupational accidents and in calamities like earthquake, building collapse, mine wreck etc. It has been truly said that no injury of the head is too trivial to be ignored or so serious as to be despaired of. Cranio-cerebral injuries commonly occur as a consequence of either direct impact to the head or rapid change in velocity of the head with or without a head impact. The impact to the head may be hard and blunt or object that penetrate or perforate the cranial cavity. Skull being a shield for the brain, very often faces the brunt first

Material and Methods:

The present study was conducted at the central morgue, department of forensic medicine and toxicology, SCB Medical College, Cuttack, Odisha, during the period from September 2010 to august 2012. A total number of 200 cases were chosen which contributed to fatal cranio-cerebral injuries only, including both assault related and non assault cases. Keeping in mind the history obtained from the relatives and police personnel, meticulous examination was conducted over the head and face. The data was analyzed and all attempts were made to corroborate with the alleged manner of death and with the available literature to establish,

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distinguish and demarcate, definite and determined parameter for this study.

Observation:

Distribution of victims in homicidal and non homicidal categories

Table -1 illustrates the overwhelming dominant majority of accidents accounting for 87% of victims among the non homicidal cases. There was no suicidal case in the group. Rest 13% comprised the homicidal group.

Involvement of skull in cranio cerebral injuries

Table -2 showed that the commonest skull bone involved was parietal followed by temporal, frontal and occipital. The incidence of fissured fracture was the commonest, followed by comminuted, depressed and cut fractures. Depressed fracture was more common in homicidal deaths than non homicidal deaths. In homicidal manner, cut fracture was the significant feature along with fissured and depressed fracture; and this was rare in non homicidal deaths. Bilateral parietal bones were more frequently involved in all categories involving the homicidal deaths.

Types of intracranial injuries with fracture skull

As per **table -3**, Extradural hemorrhage was more common in fall from height, followed by homicide and fall of a heavy object. The incidence of subdural hemorrhage was high in road traffic accidents, followed by direct fall on ground and fall from height. Subarachnoid hemorrhage and intra cerebral hemorrhage were predominant in homicide. Contusion of brain was predominant in road traffic accident cases. Incidence of laceration of brain was most common in death due to fall of heavy object, followed by road traffic accident case. Brain stem hemorrhage was mostly found in cases where death was due to fall from height, followed closely by road traffic accident cases.

Types of intra cranial injuries without fracture skull

As per **table - 4**, the incidence of subdural hemorrhage was predominant in fall from height, followed by road traffic accidents; whereas subdural hemorrhage was least in homicides. Extradural hemorrhage was absent in both homicidal and non homicidal deaths when there was no associated fracture of skull bone.

Discussion:

The incidence of fatal cranio-cerebral injury has been found to be variable in the different studies conducted by research workers. This reflects the differences in methodology

adopted in research by different workers and may also be due to complexities in the interplay of multiple epidemiological factors in the causation of fatal cranio-cerebral injury.

In our study, majority, 87%, of victims with fatal cranio-cerebral injuries were in the non homicidal group including road traffic accidents, fall from height, fall of heavy object, direct fall on ground and railway accidents. No suicidal head injuries were found with homicidal injuries being 13% only.

The incidence of non homicidal deaths coincides with the study of Jena M K (88.3%),[2] Fimate (89.7%), [3] Sevitt S, (70%)[4] and Mc Kissok W, et al, (78.4%).[5] Among the homicidal incidences, our finding of 13% almost coincides with the study of Mittal Shilekh, et al (12%)[6] and Dixit P C, et al, (11.5%)[7] but still higher incidence was recorded by Fimate, et al (27.8%).[3] The increasing trend of non homicidal head injury is possible due to overcrowding, speeding and overtaking of vehicles, ignorance of traffic rules and advancement of industrialization. The homicidal manner is reasoned to be as a result of urbanization, lack of faith and confidence, moral change in human nature being ambitious and impatient and due to land, property, women etc.

Parietal bone involvement, followed by temporal bone, is significant in all manners of death. Fissured fracture was most commonly found in non homicidal deaths like road traffic accident, fall from height, direct fall on ground and similar results were found in the category of comminuted fracture also. Fissured fracture incidence was less often in homicidal deaths where the depressed fracture was predominant. Our observation tally with those of other workers.[8-13] Cut fracture of skull was almost restricted to homicidal category. Victims of fall of heavy object over head had negligible fissured fractures but had mostly depressed comminuted fracture. The maximum involvement of parietal bone in fall can be explained mainly due to prominences and elevation of parietal bone of skull and also the mode of fall occurring in different circumstances. Temporal bone involvement is mostly due to the thin structure and maximum exposure. Base fracture is a predominant finding in road traffic accident cases as compared to homicidal and other non homicidal deaths. Our observations tally with that of Patil Amit, et al,[10] and other previous workers.

Subdural hemorrhage was the predominant association in road traffic accidents, irrespective of fracture skull. Extradural hemorrhage was 100% confined to fracture skull. Our observation

are in consonance other researchers[2,10,14-17] In homicide, the incidence of subarachnoid hemorrhage (50%), intra cerebral hemorrhage (46.2%) and laceration of brain (38.4%) were the most common findings with fracture skull, followed by subdural hemorrhage (30.8%). These findings tally with those of others.[7,17-21] In case of homicides, subarachnoid hemorrhage was more common in association with fracture skull as compared to without, because in fracture more force is applied resulting in disruption of arterioles, where as in subdural hemorrhage emissary veins can be ruptured without much force. Brain stem hemorrhage was a common finding in both intact or fractured skull, whether homicidal or non homicidal death. Our observation goes in favor with other researchers.[17,22-23] The origin of intra cranial injuries and its cause is complex and multifactorial and its presence is guided by the force of trauma to the head along with angular, linear and shearing movement of the brain inside the cranial cavity. The different intra cranial hemorrhagic components alone or in combinations account for non homicidal head trauma, resulting from violence to the head when it is free, unsupported and movable; thus creating an angular or shearing strain force to the brain.

Conclusions:

The homicidal victims in cranio-cerebral injuries accounted for 13% and non homicidal victims were 87%. In all categories of cranio-cerebral injuries, skull injury was noticed to have a definite association with brain injury in comparison to brain involvement without fracture skull. Cranio-cerebral injury in its all forms involved the parietal skull dominantly constituting the highest number of fissured fractures and the parieto temporal skull revealing a significant cut fractures in homicidal deaths alone. Vault fractures were more often found in homicidal cases whereas base fractures were more common on road traffic accidents. Among all the forms of intra cranial hemorrhages, subdural hemorrhage was the most common. Incidence of subdural hemorrhage was more frequent in road traffic accident cases than in homicidal. Extradural hemorrhage was almost always associated with fracture of skull. The overall frequency of intracranial hemorrhage is more in association with skull fracture. After analyzing the data from the observation tables it appears to be easier to distinguish between skull involvement and intra cranial injuries in

homicidal and non homicidal manner. Hence it needs a meticulous observation of the cranio-cerebral injuries along with other bodily injuries and its corroboration with circumstances and evidence of eye witness, is always required to arrive at a conclusion. The definite role of skull fracture in cranio-cerebral injuries can be explored in deciding the fatality and the manner of the cases.

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Table : 1 Mechanism of trauma

Mechanism of Trauma	No. of cases (n=110)	Z-score for 15.71±5.9995	P value*	Result*
RTA	71 (64%)	9.22268	<0.00001	ES
Fall from height	23 (20%)	1.2160	0.111992	NS
Assault	5 (5%)	-1.7865	0.03705	S
Fall of heavy weight	5 (5%)	-1.7865	0.03705	S
Railway accident	5 (5%)	-1.7865	0.03705	S
Industrial accident	1 (1%)	-2.454	0.007064	S
Sports related	0 (0%)	-2.621	0.004304	S

Table 1: P value is significant for all except for fall from height. *p value >0.5 is not significant (NS), p<0.5 is significant (S), p<0.001 is highly significant (HS) and p<0.00001 is extremely significant (ES).

Table 2: Site of vertebral column involved

Statistically, Z-score was 6.2167 with p value <0.00001 for C5-C6 vertebra.

Site of vertebral column	No. of cases (n=110)	Z-score for 8.4615±2.9697	P Value*	Result*
C1C2	2 (2%)	-9.202	0.013833	S
C2C3	9 (8%)	0.1552	0.438332	NS
C3C4	23 (20%)	4.8697	< 0.00001	ES
C4C5	20 (18%)	3.8594	5.7E-05	ES
C5C6	27 (24%)	6.2167	< 0.00001	ES
C6C7	5 (4.5%)	-1.192	0.116631	NS
C1	1 (1%)	-2.539	0.005558	S
C2	0 (0%)	-2.875	0.00202	S
C3	3 (3%)	-1.865	0.031091	S
C4	4 (4%)	-1.528	0.06325	NS
C5	9 (8%)	0.1552	0.438332	NS
C6	5 (4.5%)	-1.192	0.116631	NS
C7	3 (3%)	-1.865	0.031091	S

Table 2: P value is not significant for C3C4, C6C7, C4, C5 and C6. *p value >0.5 is not significant (NS), p<0.5 is significant (S), p<0.001 is highly significant (HS) and p<0.00001 is extremely significant (ES).

Table : 3 Cervical vertebra involved

Statistically the Z score for C5 and C6 was 6.0602 and -1.754 respectively with significant p values.

Cervical Vertebra	No. of cases (n=110)	Z score for 19.2857±3.5831	P value*	Result*
C1	2 (2%)	-4.824	< 0.00001	ES
C2	12 (9%)	6.6176	< 0.00001	ES
C3	30 (22%)	2.9902	0.001394	HS
C4	33 (24%)	3.8275	6.5E-05	ES
C5	41 (30%)	6.0602	< 0.00001	ES
C6	13 (10%)	-1.754	0.039715	S
C7	4 (3%)	-4.266	<0.00001	ES

Table 3: P value is significant for all seven individual vertebra. *p value >0.5 is not significant (NS), p<0.5 is significant (S), p<0.001 is highly significant (HS) and p<0.00001 is extremely significant (ES).

Table 4: Part of cervical vertebra involved

Statistically, Z score for body of cervical vertebra was 7.5889 and p value <0.00001 which is extremely significant.

Cervical Vertebra	No. of cases (n=110)	Z score for 37.6±5.06	P value	Result
Body	76 (41%)	7.5889	< 0.00001	ES
Articular Facet	53 (28%)	3.0435	< 0.001169	HS
Lamina	25 (13%)	-2.490	0.006387	S
Pedicle	23 (12%)	-2.885	0.001957	HS
Transverse Process	11 (6%)	-5.257	< 0.00001	ES

Table 4: P value is significant for all the parts of cervical vertebra.

Table 5: Spinal cord involvement

Statistically, the Z score for hemorrhagic spinal cord is extremely significant with P value < 0.00001.

Cervical Spinal Cord	No. of cases (n=110)	Z score for 36.67±4.38	P value*	Result*
Hemorrhagic	74 (67%)	8.523	< 0.00001	ES
Non-hemorrhagic	18 (16.5%)	-4.263	1E-05	ES
Intact	18 (16.5%)	-4.263	1E-05	ES

Table 5: P value is significant for hemorrhagic, non-hemorrhagic and intact spinal cord. *p value >0.5 is not significant (NS), p<0.5 is significant (S), p<0.001 is highly significant (HS) and p<0.00001 is extremely significant (ES).

Original Research Paper

Case-Based Learning: Study of an educational tool for active and meaningful learning in Forensic Medicine

¹Hrishikesh V. Pathak, ²Pradeep G. Dixit, ³Anindya A. Mukherjee**Abstract**

Introduction: At present, Forensic Medicine is mainly taught by means of didactic lectures and practical classes, where there is minimal active participation from the students. As a result, the students fail to develop critical thinking and reasoning skills required during the practice of Forensic Medicine. Case-based learning is an interactive student centred teaching-learning method, wherein real life situations are used in the form of cases to promote active learning and imparting analytical as well as reasoning skills. *Material and Methods:* Amongst the second year medical students, two groups were formed to conduct the case-based learning project. The academic performance of the study and control group was compared. Moreover, perceptions of the students towards case-based learning were also recorded using questionnaire. *Results:* There was a statistically significant difference in the mean scores of the study group as compared to the control group. The students strongly agreed that the case-based methodology enhanced their learning skills, analytical and problem solving skills, along with independent learning abilities in Forensic Medicine. *Conclusion:* The students largely favoured the case-based learning in Forensic Medicine. Case-based learning could be implemented as an adjunct to the conventional teaching in Forensic Medicine.

Key Words: Case-based learning, Forensic Medicine education, Medical education, Medical curriculum, Teaching and learning, Student centred learning

Introduction:

The Case-Based Learning (CBL) is an interactive student centred educational paradigm, wherein the cases place the real life events in an environment that promotes active learning.[1] Such an approach in CBL results in active involvement of the students in the process of learning and prepares them for a lifelong self-directed learning process.[2] The most important advantage of CBL is that this teaching method makes the process of learning more effective, meaningful and interesting, rather than just providing information.[3] The educators in health sciences subjects such as Anatomy,[4] Physiology,[5] Biochemistry,[6] Pharmacology,[7] Microbiology[8,9], Surgery,[10], Obstetrics and gynaecology, [11] Dermatology, [12] and Cytopathology [13] have evaluated the applicability of CBL in their subjects.

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However, though there is literature on CBL in many disciplines of medicine from various countries, there is lack of literature regarding the use of CBL in Forensic Medicine teaching.

Forensic Medicine is an important subject in the undergraduate medical curriculum[14] and an interesting branch which serves as a bridge between medical and legal field to aid in the administration of justice. It consists not only of medico-legal autopsies, but also deals with various clinical aspects such as certification of age, injury, domestic violence, sexual assault and drunkenness.[15] Therefore, considering the scope and applicability of Forensic Medicine, it is very important to teach this subject with the help of innovative teaching-learning methods so as to make the process of learning student centred and interesting.

However at present, in the conventional method of medical education, Forensic Medicine is mainly taught by means of didactic lectures, tutorials and practical classes, wherein the teaching-learning process is teacher centred with minimal active participation from the students. As a result of this, the students fail to develop critical thinking and reasoning skills.[6] Whereas, CBL being a student-centred teaching-learning process, helps them by

promoting active learning and knowledge application. Moreover, CBL imparts analytical and reasoning skills, and positive attitudes in the students.[1]

Therefore, assessing the applicability of CBL in teaching Forensic Medicine is essential and very important. The objective of the present study was to assess the attitudes of medical students towards CBL in Forensic Medicine, compare the academic performance of the undergraduate medical students by using traditional method and Case-Based Learning; and to make a contribution towards discussions on curricular reform. To the best of our knowledge, probably this is the first educational research based on CBL in Forensic Medicine.

Material and Methods:

The present study on Case-Based Learning was conducted in the department of Forensic Medicine, GMC, Nagpur. As per the undergraduate curriculum, Forensic Medicine is taught in the second year of the M.B.B.S. course. Second year comprises of 3rd, 4th and 5th semesters of the M.B.B.S. course. The CBL project in Forensic Medicine was held during the 4th semester of the second year medical students. The participants were introduced and oriented to the concept of CBL before the study. Amongst the 100 undergraduate students, two groups were formed for the purpose of the study. An informed consent was obtained from all the students participating in the study.

The control group (n=50) was taught the topic as per the conventional method. The study group (n=50) was presented with a clearly defined, short case scenario which was related to the topic, in addition to the conventional teaching. They were given time to define, and to resolve the case. The facilitator, during this phase, also motivated and guided the students for learning, by assisting the students through the facts and engaging them in reading to arrive at the possible conclusion. Subsequently, the case was discussed under the guidance of the facilitator, properly and systematically, taking care to ensure that every student participated in it. Relevant questions were asked by the facilitator so as to streamline the thought process and to draw the focus of the students to the main learning objectives. Both the groups were evaluated by MCQs and SAQs at the end of 4th semester to find the effect of CBL on the academic performance. Later on, the control group was also exposed to CBL session as it would have been inappropriate to deprive them of a newer teaching-learning method. Lastly, perceptions of students from both groups on

CBL in Forensic Medicine were recorded on a Likert scale questionnaire having ten items.[16] To ensure anonymity, the respondent's names were not recorded on the response sheet.

A Likert scale was used to assess the attitudes of students towards the CBL in Forensic Medicine.[17] In the Likert-type scale, the students were asked to indicate their agreement or otherwise with 10 items in the questionnaire, by ticking one of the five alternative responses i.e. strongly agree, agree, can't say, disagree and strongly disagree. The responses to Likert-type items were graded using a differential scaling procedure from 1 (strongly disagree) to 5 (strongly agree). Mean attitude score was calculated for each item as well as for the total scale. The Likert-type items were analysed such that scores <3 indicated disagreement and scores >3 indicated agreement with an item.

Observation:

There was a statistically significant difference in the mean scores of the study group i.e. CBL group as compared to the control group ($p < 0.0001$). The mean score (%) for the CBL group was 82.6 whereas for the control group was 60.8. **Figure 1** shows the median score, inter-quartile range, along with the maximum and minimum score for control group and the CBL group. From **Figure 1**, it is evident that there was significant difference between the marks obtained by the control group and CBL group. In the questionnaire survey conducted to assess perception of student's on CBL, majority of the students responded positively to the 10 items on the Likert-type scale. The item wise mean attitude score is shown in **Table 1** along with the items used for assessment. Additionally, the overall mean attitude score is also shown. The overall mean attitude score of 4.3 was towards the favourable side. Furthermore, the item wise mean attitude score also indicated that the attitudes of the second year undergraduate medical students were favourable towards the CBL. None of the mean attitude scores indicated disagreement with the items provided in survey. The positive responses i.e. strongly agree and agree on the likert-type scale to the questionnaire are shown in **Figure 2**.

Discussion:

In recent times, CBL is being used increasingly in various medical subjects to teach undergraduate medical students.[4-13] As suggested by its name, CBL is intended to stimulate the learning by placing events or situations based upon real life problems in such a way that promote active learning. CBL also

helps the students in acquisition of knowledge and developing positive attitude. Moreover, it allows students to develop a collective approach towards their education along with hypothesis generation; and the consolidation and integration of learning activities.[1] Jones, et al, have demonstrated that changing a traditional course into a new integrated course, has significantly improved the graduate students' perceptions of their readiness for the role of pre-registration house officer.[18] Furthermore, the case-based learning method requires only one faculty facilitator and can be applied to a large group in addition is less susceptible to intra-group problems.[19] Hence, it has been publicized as a good teaching intervention in addition to the conventional method of didactic teaching.[20]

Considerable attention is given to the attitudes of medical students towards the training programme along with its effect on academic performance, especially when the conventional method of teaching is modified by introducing newer concepts like CBL. The present intervention indicated that, the CBL is an acceptable teaching-learning method in Forensic Medicine at the undergraduate level. The overall mean attitude score in the present intervention was towards the favourable side. The present intervention does not intend to demonstrate that the newer concept like CBL is better than the conventional method of teaching, but it highlights that the strengths of the concept like CBL are worthy of more exploration. Our intension was to make an attempt to transform a theoretical course into a more thought-provoking and efficient one, so that the concepts acquired during the classes would be applied to the real medico-legal cases during their practice in future. In the current intervention, the students strongly agreed that the CBL enhanced their learning skills as well as analytical and problem solving skills, along with independent learning abilities in Forensic Medicine. They also strongly agreed that the cases selected for the CBL session were appropriate and realistic. Similarly, they agreed that the discussion during CBL addressed the objectives of the case. Furthermore, the students agreed that the CBL improved their communication skills and understanding of difficult matter due to the active discussion between faculty and students. Moreover, students agreed that CBL fits well with the conventional teaching method and the time allotted for the CBL session was adequate.

Conclusions and Recommendations:

In conclusion, the students largely favoured the CBL in Forensic Medicine. The

present intervention shows that, case based learning could be implemented as an adjunct to the conventional teaching in Forensic Medicine. Case based learning techniques must be encouraged and promoted in teaching-learning for better active and meaningful learning in Forensic Medicine. Maybe the insights gained from our study will encourage a modification in the prevailing pattern of Forensic Medicine teaching in medical universities, where the CBL pattern has not been implemented in Forensic Medicine teaching curriculum.

Acknowledgements:

The authors would like to thank the students for their engagement with this educational project. Our acknowledgments are due to the Dean, GMC, Nagpur for allowing us to conduct this study in college. In addition, the authors would like to specifically thank Dr. Payal Bansal, Professor and Head, Institute of Medical Education Technology and Teachers' Training (IMETTT), Maharashtra University of Health Sciences (MUHS) Regional Centre, Pune and the faculty members of IMETTT, Pune for their guidance during this project.

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Figure 1 - Box plot of marks obtained for control group and CBL group. Horizontal line inside box indicates the median, the height of box represents the interquartile range, and vertical lines represent the minimum and maximum values.

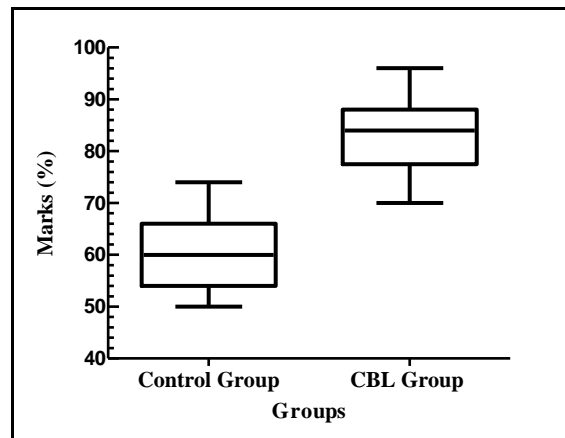


Figure 2 - Positive responses (Strongly agree and agree) to items in the questionnaire on the Likert-type scale towards the CBL in Forensic Medicine.

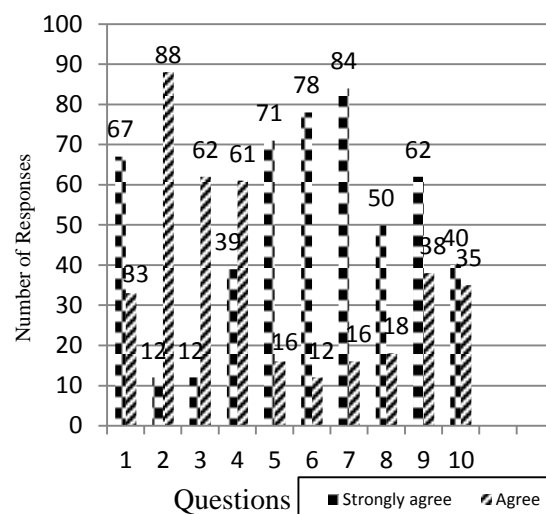


Table 1
Likert-type items used in the study to assess students' perception towards CBL in Forensic Medicine, with mean attitude score for each item and the overall mean attitude score.

S No.	Item	Mean attitude score
1.	CBL has enhanced my learning skills and has facilitated my independent learning abilities in Forensic Medicine	4.67
2.	Cases selected for CBL were appropriate and realistic in context of Forensic Medicine; and time allotted for the CBL session was adequate	4.10
3.	CBL has improved my communication skills due to the active discussion between the faculty and students	3.69
4.	Discussion during CBL sessions addressed the objectives of the particular case	4.39
5.	CBL improved my analytical and problem solving skills	4.43
6.	CBL has helped me in application of knowledge by generating questions that forced me to further study the scenario mentioned in the case	4.56
7.	CBL fits well with the conventional teaching method and I liked the blended learning approach	4.83
8.	CBL enhanced my understanding of the difficult matter by hearing my classmates discuss it and by talking it out	3.78
9.	I would like to see similar sessions incorporated into other classes	4.63
10.	CBL in Forensic Medicine was an effective learning tool and increased my interest in the topic taught resulting in positive attitude towards Forensic Medicine education	3.93
Overall mean score		4.30

Original Research Paper

Deaths due to Mob Violence - A Postmortem Study

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Abstract

Mob justice or instant justice occurs when a mob, usually several dozens or several hundreds of people take the law into their hands to injure, maim and kill a person or persons accused of wrongdoing. Mob justice constitutes a medico-legal, social and public health problem in our setting. This study was undertaken to find out the incidence and circumstances leading to mob violence in Imphal. A retrospective study was done from the post mortem records from 2005 to 2014 and various parameters responsible for mob violence were analyzed. During the 10 year study period from 2005 to 2014, out of 4203 autopsies done at a teaching hospital in Imphal, 21 cases were deaths due to mob violence. The young adult men in their economically productive age-group are mostly affected. Robbery or theft were the most common reason. Blunt force injury was the commonest cause of death. Weak public administrative systems propel people to take the laws into their own hands to engage in mob action or instant justice. Eliminating mob justice requires a concerted effort on behalf of the government, civil society organizations, and individual citizens.

Key Words: Accused person, Mob violence, Mob justice, Weak public administration

Introduction:

The concept of mob justice has been adequately explained to mean the use of force in reaction to crime and social deviance for personal and collective security.[1] The very mode in which a crowd is formed is highly favorable to its hypnotization, and hence to its becoming a mob. Thus a mob is a hypnotized crowd.[2] Weak public administrative systems propel people to take the laws into their own hands to engage in mob action or instant justice. Mob justice or instant justice occurs when a mob, usually several dozens or several hundreds of people take the law into their hands to injure, maim and kill a person or persons accused of wrongdoing.[3] The most glaring example is a recent case in which a mob in Dimapur, Nagaland, broke into a jail and lynched a rape accused awaiting trial on 5 March 2015.[4] The city of Imphal where the present study has been conducted is coloured with a unique social phenomenon in the sense that whenever any crime occurs, different types of social organizations particularly of women,

students, etc., will come into the forefront immediately and preside over the matter. Therefore, this study has been done in order to know the various outcomes of a crime occurring in a society which is conducive to mob formation and to suggest preventive measures for the general good.

Material and Methods:

A retrospective analysis of deaths due to mob violence from 2005 to 2014 was conducted from the post mortem records of the department of Forensic Medicine of a teaching hospital in Imphal. The parameters which were studied were year wise distribution, year and gender wise distribution, caste distribution, age group of the victims, socio-economic status, motive/reason for attack, time of occurrence, place of occurrence, place of death, type of weapon used, external injuries involvement as per body region, internal organ injuries and cause of death.

Observation:

The total number of autopsies during the 10 year study period from 2005 to 2014 was 4203 and the total number of deaths due to mob violence was 21 (Table 1). All the cases were males and majority of the victims were Meiteis (66.7 %) as shown in Fig 1. It is evident from Fig 2 that, the maximum number of cases (57.4 %) were in the age group of > 20-30 years followed by the age group of > 30-40 years (14.3 %). Regarding socio-economic status, 66.7 % belonged to the lower socioeconomic group,

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while 33.3 % belonged to middle class (Fig 3). Motive or reason for the attack were stealing/theft in 42.9 % of the cases, quarrel in 23.8 %, alleged sexual assault/molestation in 14.3 %, extortion in 9.5 % and alleged murder in 9.5 % as shown in Table 2. Most of these mob violence cases (47.6 %) occurred during 5 pm to 12 midnight (Fig 4), and 52.4 % of these cases occurred at public places (Fig 5). Spot death was observed in 52.4 % of the cases while 47.6 % died at the hospital (Fig 6). The types of weapon used were blunt weapon in all these cases. Head injuries were seen in 66.7 % of the cases, while head and chest injuries were seen in 14.3 % (Table 3). Head injury was the commonest cause of death (57.1 %) followed by shock & haemorrhage (33.3 %), and head injury combined with shock and haemorrhage constituted remaining cases, as shown in Fig 7.

Discussion:

Mob violence as response to danger and distress is recorded all over the world. It can take the form of lynching, vigilantism, rioting and terrorism.[1,5]

A riot is the violent disturbance of the public peace by three or more persons assembled for a common purpose in executing a lawful or unlawful enterprise in a violent or turbulent manner.[6] The difference between riot and mob violence is that mob violence typically ignites with little planning. Many who join are young people attracted to excitement and the lure of defying authority.[7]

The World health Organization (WHO) estimated that 535000 deaths due to violence occurred in the world in 2008 and that interpersonal violence was the second leading cause of injury deaths among men aged 15–44 years after road traffic injuries.[8,9]

Mob justice is more common in societies where the legal system cannot be trusted due either to feeling of social inequalities or corruption. The gap between the rich and the poor may also be widening. This leads to social groups to develop and dispense out their own system of social justice.[10]

In the present study 21 cases (0.49%) were of deaths due to mob violence out of 4203 autopsies during the 10 year period. Mob justice has been reported to be a growing issue in most developing countries and claims the lives of many of the young persons and threatens the health and well-being of many persons of all ages. The young age group in their 2nd and 3rd decades of life was commonly affected which is similar with the findings of other workers.[10]

All the cases were males. This finding is similar with other workers in Africa.[10] According to them, male preponderance may be attributable to their active participation in risk taking behaviors and their frequent involvement in crime activities. This has great economic impact since these are people in their most productive years and the injuries impose a considerable burden on their families and the society as a whole.

Racial distribution shows that Meiteis were most frequently involved (66.67%) followed by Muslims (19.05%), Tribals (9.52%) and Non-Manipuris (4.76%). This could be due to the demographic dominance of the Meiteis, the rest being minority communities.

Regarding socio-economic status, no case belonged to the upper class, 33.33% were from the middle class and 66.67% were from the lower class. This observation could be explained partly by uneven opportunities amongst the rural and the urban societies.[10,11] Mob justice is more prevalent in people with lower social class which is characterized by poverty, lack of education, unemployment and unequal distribution of wealth.[12] This observation is reflected in our study where most of victims had either primary or no formal education and the majorities were unemployed. It is reported that people from a lower social class, is less likely to use the judicial system as opposed to people from a higher social class. As a result this social group may develop their own system of social justice which can lead to taking the law into their own hands.[10]

The reasons for the mob attack were stealing/theft (42.86%); quarrel (23.81%); alleged sexual assault/molestation (14.28%); extortion (9.52%) and alleged murder (9.52%). In agreement with findings in Tanzania[14,15], the most common reason for a mob to take the law into their own hands in the present study was theft/robbery. This may be attributed to harsh economic climate, rising unemployment rate, ineffective law enforcement, lack of education and failure of successful poverty eradication programmes.

Regarding time of occurrence, 47.62% of the cases occurred during 5 pm to 12 midnight and 14.28% cases during 12 midnight to 5 am. The maximum incidence during the evening time may be due to the fact that people are free from their day jobs during this time and are easily propelled towards any gathering.

Most of the mob violence cases in the present study occurred at public places (scene of crime). Mob violence almost instantly starts at the scene of crime[3,5] which corresponds to the

maximum number of cases in our study. In this study, objects such as stones, iron bars, sticks, bricks as well as flame burn were the most common weapons used. This observation agrees with other studies.[13,14]

The majority of victims i.e., 95.23% in the current study sustained multiple injuries. This observation is comparable with other studies. [13,14] The head/neck and musculoskeletal regions were commonly affected. Regarding internal organ injuries, head injury was seen in 66.67% cases; chest injuries in 9.52% cases; head and chest injuries in 14.28% cases; extremities in 9.52% cases. Regarding cause of death, head injury was the main cause (57.14%) followed by shock & haemorrhage in 33.33%. Similar injury patterns were also reported by other authors. [13,15] Knowing the pattern of anatomical site distribution of the injury allows the clinicians to understand the nature of intent of the mob and this is of great importance for medico-legal purposes. Many lower limb injuries indicate a desire to immobilize victims while trying to escape, whereas injuries involving the head, neck, chest and abdomen indicate a desire to kill. [15,16]

Conclusions:

Mob justice constitutes a medico-legal, social and public health problem in our setting and it is associated with significantly high morbidity and mortality. The young adult men in their economically productive age-group are mostly affected. Eliminating mob justice requires a concerted effort on behalf of the government, civil society organizations, and individual citizens.

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Table 1: Year wise distribution of cases

Year	Total No. of Cases Autopsied	Total No. of deaths due to mob violence	%age
2005	448	2	0.45
2006	410	4	0.97
2007	545	0	0.00
2008	650	2	0.31
2009	591	2	0.34
2010	364	2	0.55
2011	313	3	0.96
2012	310	3	0.97
2013	301	0	0.00
2014	271	3	1.11
Total	4203	21	0.49

Table 2: Motive / reason for attack

Sl. No.	Motive/reason	No.	%age
1	Stealing/theft	9	42.86
2	Quarrel	5	23.81
3	Alleged sexual assault/molestation	3	14.28
4	Extortion	2	9.52
5	Alleged murder	2	9.52
Total		21	100.00

Table 3: Injuries sustained by the victims

Sl. No	Injuries	Numbers	Percent
1	Head injuries	14	66.67
2	Chest injuries	2	9.52
3	Head + chest injuries	3	14.28
4	Extremities	2	9.52
Total		21	100.00

Fig. 1: Case distribution of victims

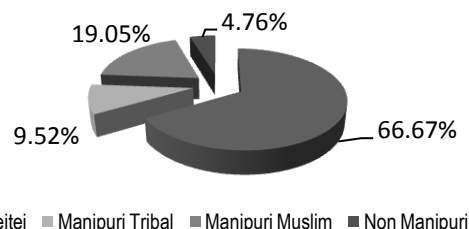


Fig. 2: Age distribution of victims

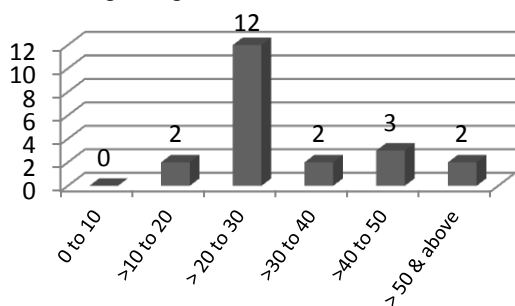


Fig.: 3 Socio-economic status

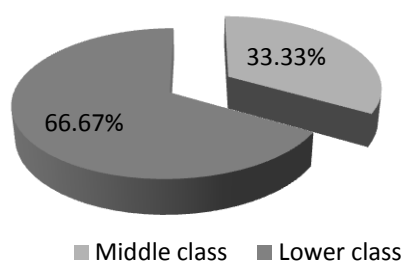


Fig.: 4 Time of incidence

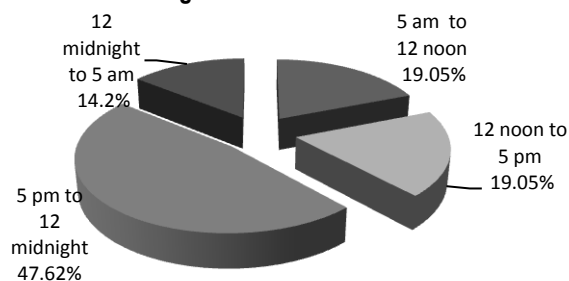


Fig 5: Place of occurrence

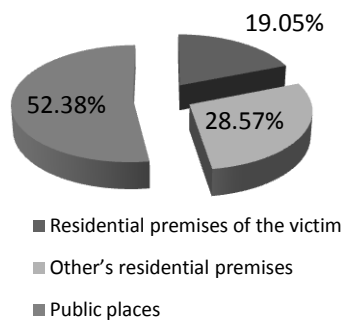


Fig 6: Place of death

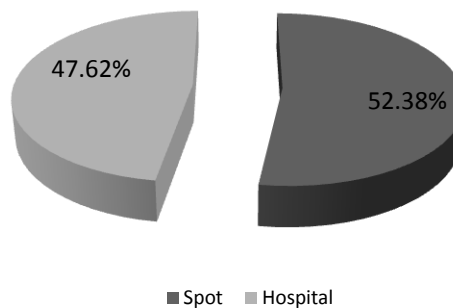
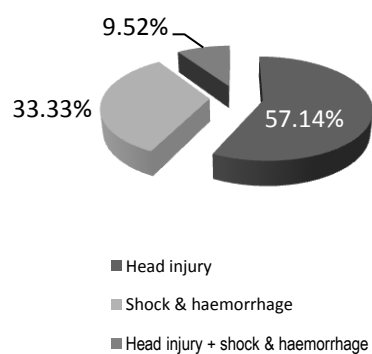


Fig 7: Cause of Death



Review Research Paper

Mitochondrial DNA (mtDNA) sequence analysis as an additional tool for forensic identification purposes

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Abstract

When there is suspicion that the DNA in the sample is degraded, charred or insufficient for STR analysis in particular for forensic investigations, an alternative technique/approach that is commonly being employed and must be is mitochondrial DNA (mtDNA) sequence analysis - a valid and reliable tool for genetic characterization of forensic biological specimens. Apart from the commonly used materials for human identification, which include skin, blood, semen and saliva, mtDNA has been extracted from teeth, hair shafts, bone fragments and even human feces all of which often fail to yield results with nuclear DNA markers. Thus mtDNA which was for the first time demonstrated by electron microscopy has proved to be more robust than nDNA. The results of which are attributed to its high copy number per cell and resistance to extreme environmental conditions along with other special features including its haploid maternal mode of inheritance, high levels of diversity, lack of recombination, lack of introns and histones and rapid rate of evolution. MtDNA haplotypes which are uniparentally inherited therefore reflect information from a non-recombining maternal lineage that may be shared by numerous people within the maternal lineage. As a result, mtDNA data cannot be applied to the identification of individuals in the same way that analyses from recombining nuclear DNA markers can. The present study is aimed at providing an overview of mitochondrial DNA analysis that can aid in criminal justice delivery system particularly related to kidnapping, murder, disaster and missing person identity.

Key Words: Forensic Science, Identity, Heteroplasmy, Maternal inheritance, DLoop sequencing, mtDNA

Introduction:

Forensic science has played lead roles since its inception, in particular by DNA typing analytical methods used worldwide to resolve identity issues in violent crimes, lesser crimes, acts of terrorism, missing person's cases, and mass disaster cases.[1-5] While STR markers are very precise in determining human identity, they might fail to amplify when there is an expectation of insufficiency in template DNA probably due to extensive degradation or has gone modifications or present in low copy numbers.[6] In such cases mitochondrial DNA (mtDNA) sequencing is and must be applied and which was for the first time used in a criminal case by FBI laboratory as an evidence of identity. [7]

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Present in the cytoplasm (fluid filled space between the cell nucleus and the outer membrane) of virtually all eukaryotic cells, mitochondria converts chemical energy into a form (adenosine triphosphate) that can readily be used. The mitochondrion is formed by two distinct membranes, an outer surface membrane and a highly folded inner membrane making two compartments-the inner membrane space and the matrix with the inner membrane where special mitochondrial ribosomes, tRNAs, and various enzymes besides several identical copies of mitochondrial genome are present. MtDNA a semi-autonomous organelle is found to be a double stranded 16569- nucleotide pair closed circular molecule in humans. Moreover, on complete sequencing it was found that the two strands have an unusual asymmetry in the base composition with "heavy" or H strand (outer strand) rich in purines (i.e Adenine + Guanine) while the "light" or L strand (inner strand) correspondingly rich in pyrimidines (i.e Cytosine + Thymine).[8] This 16569bp genome contains the information for the synthesis of 37 genes encoding 13 proteins, 22tRNA's and 2rRNA's of which 28 are encoded by H strand and 9 by L strand. Most of the coding genes are found on H strand and is known as Coding

region responsible for the production of various biological molecules involved in energy production. The remainder of the genome contains a relatively small region called Control region (non coding) also called as Displacement loop, or D loop which serves to regulate transcription of genes within the coding region as well as replication of genome itself. The mtDNA control region spans over 1122 base pairs from nucleotide position 16,024 (the origin of heavy-strand replication) to position 576. The region is divided into two distinct regions known as hyper variable region 1 (HV1) and hyper variable region 11 (HV11). Traditionally, only the first two hypervariable segments (HVI and HVII) of the control region have been targeted for forensic purposes, because a good portion of the differences found between two mtDNAs in these two short segments, with maximum ranges of roughly 16024–16,400 and 40–400. Another short stretch in the control region harbouring notable variation became evident in late 1990's was called as third hypervariable segment (HVIII), with approximate range from about 430 until 576, the 3' end of the control region.[9-11] HVS-III besides other two hypervariable segments was targeted in only few studies increasing the discriminative power of forensic analyses.[12,13] The control region (D loop) which is highly polymorphic makes it useful for human identification. Nucleotide positions in the mtDNA genome are numbered according to the conventions of Anderson *et al* with minor modifications. An arbitrary position on the heavy strand begins the numerical designation of each base pair, continuing around the molecule for approximately 16,569 base pairs.[14]

Properties of human mtDNA that make it fit for forensic testing:

Compared to nuclear DNA, mtDNA genome due to circular nature and sub cellular sequestration make it less prone to degradation thereby making it powerful for analyzing low quality and low quantity DNA samples as well as an alternate method for identifying potential familial relationships. Pertinently three major disadvantages of mtDNA analysis including low discriminatory power (1:200), expensiveness of the procedure and heteroplasmy, (discussed elsewhere) does not render the technique inefficient. However special properties robust for forensic testing are:

High copy number: A characteristic feature of mtDNA different from nDNA is its high copy number approximately ~200 and 1,700 per cell and less number of bases make it profitable. Usually, mtDNA content is referred to nuclear

DNA (nDNA) as the copy number ratio of mtDNA to nDNA. Increased sensitivity of detection is achieved because of high copy number of mtDNA molecules in a cell, along with its extra nuclear cytoplasmic location, making mtDNA typing particularly advantageous, for certain kinds of forensic analyses, in cases where the amount of extracted DNA is very small or degraded. The greater probability of survival of mtDNA makes mtDNA typing an alternative method of choice in situations where typing polymorphic markers in nuclear DNA yield no results.[15]

Maternal mode of Inheritance: Barring mutation, mtDNA sequence of siblings and all maternal relatives is identical, a characteristic, helpful to identify the remains of missing persons, where known maternal relatives can provide reference samples for direct comparison to the questioned mtDNA type. Paternal inheritance of mtDNA occurring in mussels, mouse, and bird hybrids, has been shown inter- and intraspecific. Strictly maternal inheritance of human mtDNA was regarded as an unshakable dogma of the field.[16-19] Uniparental mode of inheritance, one of the great advantages of mtDNA, enables researchers to trace related lineages back through time, highlighting the maternal ancestry of a population, without the confounding effects of biparental inheritance and recombination inherent in nuclear DNA, thereby aiding in scenarios of putative exclusion testing in human identification.[20] However, it was shown that a man with severe exercise intolerance had muscular mtDNA predominantly of paternal origin casting doubt on the validity of strict maternal inheritance of mtDNA.[21] Further research investigations of more patients with mitochondrial myopathies did not yield any further case of paternal inheritance.[22,23] Nevertheless, it is important to stress that MtDNA haplotypes which are uniparentally inherited reflect information from a non-recombining maternal lineage that may be shared by numerous people within the maternal lineage. As a result, mtDNA data cannot be applied to the identification of individuals in the same way that analyses from recombining nuclear DNA markers can.

Lack of recombination: Because of lack of recombination, maternal relatives several generations apart from the source of the evidence (or biological material) can serve as reference samples for comparisons. However, a discrepancy casting doubts on the lack on mtDNA recombination[24] was later shown to be based on phylogenetic and statistical analyses of mtDNA sequences, wherein the authors

argued that the excess of homoplasmic sites observed in phylogenetic trees of mtDNA sequences, and correlation of linkage disequilibrium with distance across the mtDNA genome provided recombination evidence.[25-27] Upon careful re-analyses it became clear that the phylogenetic/statistical studies used faulty data and/or questionable statistical methods, giving no significant results of recombination.[28-31] Although in subsequent studies homoplasmic sites were detected in excess, but correlation of linkage disequilibrium and distance in large data sets of complete mtDNA sequences didn't yield any recombination evidence and hence the results are likely attributed to heterogeneous mutation rates in human mtDNA.[32,33] Since paternal mtDNA leakage being a very rare phenomenon, recombination isn't treated a major issue.[34,35] Because of lack of recombination evidence between mtDNA molecules, and haploid mtDNA genotype in an individual, a mtDNA sequence is treated as a single locus or haplotype.[36]

Mutation Rate: The low fidelity of mtDNA polymerase and an apparent lack of mtDNA repair mechanisms have led to a higher mutation rate in mitochondrial genome compared to nuclear genome. Some regions of the mtDNA genome appear to evolve at rates 5–10 times higher than that of single-copy nuclear genes making them interesting regions for human identity testing for their hypervariability consequent of their higher mutation rate. The mutation rate of mtDNA is estimated at a rate of 0.017×10^{-6} substitutions per site per year for the whole genome excluding the control region which is several orders of magnitude higher than that of nuclear genes.[37] But the rate is even higher in the two hypervariable regions (HVI and HVII) of the noncoding control region. However, there is a discrepancy between phylogenetic estimates and pedigree based estimates of mutation rates in human mtDNA leading to a debate among various researchers.[38-42]

Laboratory analysis procedure:

Several molecular biological techniques are combined to obtain mtDNA sequence from a sample despite the analysis being rigorous and labor-intensive. The separate analysis of two or three hypervariable segments of mtDNA sample inherently bears risk of mix-up of these regions between different mtDNAs, leading to artificial recombinants.[43] Typically laboratory process involves, primary visual examination, sample preparation, DNA extraction, amplification, purification of the amplification products, double-strand sequencing, purification of the sequencing products, and sample preparation

for electrophoresis.[44] Yet in the course of careless individual laboratory steps while handling the tubes or sample sheet generation, mix-ups at the bench can be generated. These errors would result in recombinant mitochondrial haplotypes, consisting of segments that may belong to different haplogroups. Such errors cannot be unmasked by examining the raw data but only through a posteriori investigation using phylogenetic analysis.[45] A repeated full analysis of each sample would indeed help in minimizing this kind of error. The steps of the analysis process along with analysis of the data are briefly discussed.

Primary Visual Examination: Among the commonly used evidentiary materials where nDNA is too scarce for analysis and where mtDNA analysis can be informative includes hair, tooth or bone. Hair (shafts), as source for mtDNA analysis, is followed by a microscopic comparison of evidentiary hair and a sample population of reference hairs. Microscopic characteristics of the sample are compared to known hair standards under a comparison microscope. In case characteristics don't exhibit a similarity; mtDNA analysis is generally not performed. mtDNA analysis is performed only when a similarity of microscopic characteristics is observed, to determine the consistency of hair with reference standards from a particular individual. Where a bone or tooth material is retrieved, it is first of all inspected by an anthropologist together with a forensic odontologist for determination of its human origin. MtDNA analysis can be used in conjunction with medical, anthropological, and odontological examinations to assist in the identification process only if it is of human.

Sample Preparation: For ensuring that the sequence of the DNA obtained from the sample originates from the sample and not from any exogenous human DNA, evidentiary sample prior to analysis is thoroughly cleaned. Hair after detergent treatment is placed in an extraction solution and ground using a mortar and pestle. The homogenate so obtained contains both the cellular material and the released DNA. Similarly a bone or tooth is cleaned, the exterior of which is sanded to remove any extraneous material adhering to the surface. A small sample of the tissue is then removed and ground into a fine powder. A tooth is cross-sectioned, and the dentin and pulp (the inner layers) are used for DNA extraction. In fresh teeth, the DNA is generally extracted from the fleshy pulp. In extremely old teeth, the pulp dehydrates and the DNA may be extracted from the compact dentin

layer. The powdered bone and teeth are placed in a solution to release the DNA from the cells.

DNA Extraction: The cellular homogenate obtained via sample preparation is exposed to a mixture of organic chemicals that separate the DNA from other biological molecules. The mixture is spun in a centrifuge, and DNA remains soluble in the top water-based layer. The rest of cellular components are soluble in the bottom organic layer or in the interface between the two layers. The top layer is filtered and concentrated followed by purification of DNA for PCR amplification process.

Amplification by the Polymerase Chain Reaction: As opposed to other PCR-based forensic methods in terms of contamination, mtDNA testing is an extremely sensitive technique. In order to mitigate the concern of contamination pre-amplification measures should be used.[46,47] In PCR (*in vitro* process) initially, two strands of DNA double helix are separated by heating the sample resulting in what is called as template strands. Each template now on serves as an origin for the synthesis of a new DNA strand using an enzyme that copy the existing DNA molecule. The copying process is repeated a number of times, resulting in theoretically doubled amount of DNA in the reaction tube with many million copies of original targeted DNA at the end.

Post-amplification Purification and Quantification: The generated PCR product is purified and quantified prior to sequencing process. For purifying the sample, filtration devices are used for removing excess reagents used in PCR. The quantification step is performed using capillary electrophoresis (CE) technique which compares the amount of DNA in PCR product to a known DNA standard for determination of DNA concentration in PCR-amplified sample. Amplified and quantified blank samples (negative controls) and known DNAs (positive controls) are also included to indicate the presence of any exogenous DNA and to know the success of amplification. In case the PCR failed to yield product, the sample may be re-extracted and re-amplified. If PCR is successful, products are prepared for DNA sequencing.

Sequencing: The Sanger sequencing or dideoxy terminator method used commonly for mtDNA analysis is able to provide information on the position and base change of every polymorphic position within the analysed region when compared with a reference standard, known as revised Cambridge Reference Sequence or Anderson Reference Sequence, which is basically the first entire human mtDNA sequence

(light strand sequence).[48,49] In addition to the normal bases that elongate the growing strand of DNA, a set of terminator bases are used. These terminator bases lack a chemical group that would normally allow the enzyme to place another base after them. The altered bases also carry a fluorescent dye readily detected by an automated instrument. The normal bases compete with the altered bases for incorporation into the growing DNA strand, resulting in a collection of DNA products that differ in size by one base and have a fluorescently labeled base at the end position. The resulting products of the sequencing reaction are separated on the basis of their length by gel electrophoresis under the influence of an electric field, where the pore size regulates the travelling rate of these fragments with smaller products travelling more quickly than the larger ones. The labeled DNA fragments begin from the same point on the gel, and fluorescence detector records the emitted wavelength of the fluorescent dyes on each base as the fragments travel past the detection area of instrument. The instrument generates a chromatogram, or colored graph, depicting the colors of the labeled fragments one base at a time. The sequence of the mtDNA is determined from a series of cycle sequencing reactions.

Interpretation Guidelines: The “validation” process being an essential tool allows technology transfer from a basic science or medical context to the forensic arena by performing experiments of different kinds that challenge technology’s ability to do what it purports to do. In DNA typing cases this requires demonstration through rigorous tests to show that an individual’s DNA is reasonably constant over time and tissues, and is typed repeatedly as identical. Also such DNA should differ among individuals and that differences are distinguished accurately and repeatedly using the known specimen and potentially contaminated/ degraded samples associated with forensic cases. And accordingly recommendations on the use of mtDNA sequence data in forensics addressed the need for appropriate laboratory practice, the use of negative and positive controls, basic nomenclature guidelines for sequence differences and heteroplasmy, as well as guidance on interpretation reporting and statistics. Mitochondrial DNA sequences are initially generated by computer software and subsequently edited by a DNA examiner using multiple runs from the same template to obtain a final sequence of the DNA. After editing, the sequence is recorded by listing difference(s) from the Anderson reference sequence. The sequences obtained from the samples of

questioned origin are compared to the sequences of the known, or reference, samples to determine if any points of difference are present between the samples. Basically, samples cannot be excluded as originating from the same source if there is a sequence concordance which is the presence of same base (or a common base) at every position analyzed. Human body contains trillions of cells, each of which contains thousands of copies of mtDNA genome. Thus homoplasmy and heteroplasmy occurrences come into play which is briefly discussed. Complete homoplasmy (the same sequence of mtDNA) for each of these mtDNA molecules would be amazing because of the immense amounts of mtDNA present in the body. So, heteroplasmy is expected to be present at some level in all individuals. Several ways in which heteroplasmy can be observed in individuals are: presence of more than one mtDNA type in a single tissue, one mtDNA type in one tissue and a different type in another tissue and heteroplasmy in one tissue sample and homoplasmy in another tissue sample.[50-52] **Heteroplasmy** is co- existence of more than one mtDNA type in a single source at a particular position in a DNA sequence, and there are two forms of heteroplasmy found in mtDNA, that differ in frequency and cause, hence individual consideration is required. **Sequence heteroplasmy**, or **point heteroplasmy (PHP)**, is the occurrence of more than one base at a particular position or positions in the mtDNA sequence. Point heteroplasmy (PHP) which usually exists as a mixture of two bases at a single position is detected in Sanger-type sequencing data. **Length heteroplasmy (LHP)**, is the occurrence of more than one length of a stretch of the same base in a mtDNA sequence in other words variation in the number of bases residing within a homopolymeric stretch (i.e., C-stretches), and is more prevalent in the population than point heteroplasmy. [48] It is imperative to stress that heteroplasmy is an operational term used when the current scientific methods are capable of detecting more than one sequence in an individual. Heteroplasmy was firstly observed, while identifying the putative remains of Tsar Nicholas II of Russia, followed by Tsar's brother, and Grand Duke of Russia-Georgij Romanov.[2,3] The combination of recent improvements in sequencing enzymes and fluorescent dye chemistry has enhanced the heteroplasmy-detection capabilities of the forensic community. When heteroplasmy is observed at the same position in a questioned and a known sample and all of the other bases are the same, the significance of the match is

enhanced. The level of heteroplasmy may not always be the same in various tissues. If different tissues demonstrate heteroplasmy with the presence of common bases at every position, then a sequence concordance is present, and one cannot exclude two samples as originally coming from the same source or maternal lineage.

Population Database: The purpose of population databases is to offer valuable information for estimating a chance matching probability when a forensic stain and a suspect share a sequence as well as for inferring (sub) continental origin of an mtDNA lineage. A little bit limitation arises due to reliable insufficiency of mtDNA data for forensic purposes because of major and common types of errors observed in published mtDNA control region data sequence which include base shifts, reference bias, phantom mutations, base mis-scoring and artificial recombination. Hence an urgent need is to make quality data and likewise source of errors is checked keeping in mind the caution exercised at all stages of data collection and proof-reading processes. Though the errors can be detected by phylogenetic analysis for which both strands of the amplified product must be sequenced and a comparison be made with closely related sequences from other published data sets of similar geographic/ethnic origins. However, the database is updated frequently and is constantly growing with parts of the control region outside the two hypervariable segments being analyzed for enhanced discrimination potential.[53-57]

Statistical Report: Reliable frequency estimates for most mtDNA sequences are not possible due to the fact that most of the sequences in the forensic mtDNA database occur a single time (approximately 60 percent), and the total number of mtDNA sequences in the entire human population is not known. The reason being different regions of mtDNA are not independent of each other but are inherited together as a single genetic locus within the entire mtDNA genome. However, to provide estimates of the frequency of occurrence of most mtDNA sequences in the population, a number of accepted practices reflecting different conceptual approaches, to report the frequencies or probabilities of haplotypes based on database searches are followed which can give different results, but with little effect on overall magnitude. In order to avoid underestimates of population frequency an extremely conservative approach is to report the upper bound of a 95% confidence limit calculated by zero occurrences or very few

occurrences in a database of limited size. This upper-bound estimate describes the highest frequency expected for a particular mtDNA sequence using the database. Likewise, point estimates for probabilistic approaches are given by $(X+1)/(N+1)$ or $(X+2)/(N+2)$ where X represents the number of observations in the database and N -the database size. In the latter equation conceptual approach of adding the case profiles to the database is made under the hypothesis that the profiles observed in the case may have come from two different individuals, i.e. the suspect and the unknown offender (as is common in the denominator of Likelihood Ratio calculations). Likelihood ratios for mtDNA are then normally calculated by $1/(\text{match probability})$. Egeland *et al* further elaborated the estimation of rare or unseen mtDNA haplotype frequencies and compared the classical approach with new proposals based on Principal Component Analysis. The population distribution of mtDNA haplotypes is typified by a large number of very rare or unique haplotypes, also termed 'singletons', and probabilistic approaches that empirically take into account the haplotype distribution of the database in question (e.g. the Kappa model) may best represent the strength of the mtDNA evidence.[58-62]

Strength of the study:

Apart from mtDNA's weakness of having a relatively low power of discrimination, forensic mitochondrial DNA (mtDNA) testing has even greater strengths which are. 1). It can be utilized in situations where nuclear DNA typing results fail (degraded source), successful recovery from the source may be achieved by typing mtDNA. 2) In situations where known reference specimen from a victim or immediate family member is not available for comparison. 3) When a male suspect cannot be located or is not willing to provide a sample. In both instances (3&4), a maternally-related individual could be used in place of a direct reference standard for positive identification. And 4). In situations where nuclear DNA is virtually absent mtDNA typing can yield informative evidence (e.g. shed hairs). However the occurrence of heteroplasmy does not invalidate the use of mtDNA for forensic analysis. It is important to note that from the standpoint of interpretation, differences in both PHP and LHP do not constitute evidence for excluding two otherwise identical haplotypes as deriving from the same source or same maternal lineage. In fact, the same PHP observed in identical haplotypes may increase the strength of the evidence. In conclusion, mtDNA sequence analysis can become a routine procedure in forensic casework where standard

nuclear markers cannot provide reliable information. The mtDNA database of control-region sequences can be obtained from EMPOP project, AFDIL and Genbank along with Release 6 now which offers 10,841 entire control-region sequences plus some additional partial sequences for comparison with partial mtDNA sequences from forensic traces. Approximate location of the mtDNA lineage can be determined from entire control-region sequence or its hypervariable segments I (HVS-I) and/or II (HVS-II) and/or III (HVS-III), for the estimation of the global mtDNA phylogeny. This process of allocating partial (or entire) mtDNA genomes to haplogroups (history of mtDNA lineages) is called haplogrouping.[63-77]

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Review Research Paper

Disaster Victim Identification: A strategical approach to set up a Dental Team

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Abstract

The ultimate goal of the disaster victim identification team during a mass disaster situation is to make the correct identification of the victims before social closure to the families. There has been many methods are present to identify the bodies of which DNA analysis, fingerprint analysis and identification using dental records plays utmost role. Among these, the latter considered to be the most effective method and also takes comparatively less time than others. In western countries, there is a separate dental disaster victim identification unit within the team and it readily deploys to the disaster site during mass disasters. This team consists of a group of well-trained forensic odontologists and also works in collaboration with other forensic personnel. There is no such dental disaster victim identification team is present at a national level in countries like India. The aim of this article is to provide information regarding formation of the dental disaster victim identification team and it collates all the information regarding, personnel involved, roles and responsibilities, standard operating protocols, training, and so forth.

Key Words: Mass Disasters; Human identification; Forensic Odontology, Dental Disaster Victim Identification team

Introduction:

A disaster is an unexpected event and causes injury or death to many people. Many numbers of events that happens in day to day life might lead to disasters such as road traffic accidents or natural disasters.[1] Disasters are inevitable, but with effective mitigation strategies, planning, effective training, cooperation and communication are very important to minimize the adverse consequences of a likely event.[2] No matter how many precautions were adopted by the authorities to curb number of deaths during disaster events, still it is unavoidable. Utmost care should be employed by authorities in proper handling and identification of the bodies before social closure to the families.

Forensic Odontology has been a major contributor to the identification of victims of disasters and is considered to be a specialized and reliable method of identification of deceased.

Not only during major disasters, but also in minor disasters in which only few people involved, single primary identifiers, particularly dental identification stands out alone in providing

a match between the missing persons and body remains.[3,4] As teeth are more durable in the human body, and are likewise resistant to various environmental insults such as decomposition or higher temperatures, makes them stand out and an important tool in forensic identification.[5] Disaster victim identification (DVI) following disasters mainly comprises of a series of events starting with rescue and recovery teams and ends with handing over the bodies to rightful families. A national DVI team is a crew of well-trained police, rescue teams, recovery teams, local authorities with DVI training as well as non-sworn scientific personnel such as forensic specialists.[6,7] Every disaster differs from one another. The fundamental requirement or key component of disaster response was the moral, legal and ethical requirement for accurate identification of the individual.[7,8] Initial and prime duty is to rescue the injured and recover the bodies from the disaster site, followed by identification process and social closure. In disasters of greater magnitude, collection of evidence from the disaster site, post mortem examination and ante mortem data collection is often arduous. Not in every situation the bodies quickly handed over to the grieving families, it invariably depends on the type of disaster whether it's major or minor. Forensic Odontology is involved in all five phases of the disaster management such as scene, post-mortem, ante mortem, reconciliation and debrief.[9] Inclusion of Odontology as a part of the national DVI team

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proved vital in the past in many disaster situations. The successful contribution of forensic Odontology has been proven in many disaster management situations such as World Trade Centre attack in 2001, Asian Tsunami in 2004, etc.[10] Even the role forensic dentist proved vital during disaster management, not every country utilizing the expertise of a forensic dentist because of unavailability of the Dental DVI team. Sometimes because of lack of available expertise or severity of the disaster or poor disaster management planning, it is not a practical proposition to even attempt to identify the dead and they may be buried or cremated as rapidly as possible to preserve public health as much as for any other reason. During DVI investigation, a chain of command within the Odontology unit is required.[11,12] This article mainly discusses on how to put up a separate dental DVI team at national level for the countries those doesn't have one.

Development Of Dvi Team

A fundamental requirement for any disaster victim identification is having a proper Odontology identification team in place. Countries like India are vast and the organization of such team should be supported by the concerned team of national disaster management and dental association of that country. Following areas should be considered while organizing the team for DVI response. Those are:

1. Team Organization

For sturdy and conjoint functioning of DVI team, a member should be appointed as team leader. The functioning of this team hinges on the structural framework and through organizational plan. The organizational plan must cover various aspects and embraces written agreements of the participants, job descriptions, various organizations, dental associations and also the willingness of participation of the members both during training as well as in times of disaster management. The team can be structured into various sections for specific training and duties such as ante mortem, post mortem, photography & X-ray and comparison sections. The size of these sections is based on the magnitude of the disaster and will be decided by the team leader. Usually most of the odontologists that take part in DVI response are either private practitioners or works in institutions and they are responsible for their clinic staff, patients and institution authorities. It is appropriate that the DVI Odontology members should be remunerated and it is the responsibility of the DVI lead agency. It is also responsible for the travel &

accommodation and liable for insurance to the personnel.[13]

2. Team Personnel

In order to establish a dental DVI team the first issue needs to be ticked in the checklist is to figure out the number of available forensic odontologists in the country. As disaster management is a strenuous process and those who involved are under influence of physical and mental stress, it is important to list out who are willing to participate in the DVI program. The selected personnel will be categorized according to the experience in the field of DVI. Once the number and experience of individuals sorted out, a team leader should be elected who able to demonstrate considerable DVI experience at managerial level and named as Dental Identification Manager (DIM) or Odontology coordinator. The remaining personnel were categorized as ante mortem, post mortem and reconciliation team members and each team assigned to a team leader. After the team was configured, there should be a single point of contact with telephone numbers. These numbers should be provided to the concerned national disaster management authorities for further communication.

2.1 Roles And Responsibilities [14]

Dental Identification Manager (Dim)

- Establish DVI plan and standard operating procedures
- Decides the strength of the DVI team, depending on the severity of the disaster
- In early phases following the disaster, he needs to visit the disaster site for the collection and preservation of the dental evidence and to look after odontological requirements
- Responsible for formation, execution and coordination of dental DVI team

Ante Mortem Dental Team Leader

- Works in liaison with DIM, also updates him with the activities of the team on a daily basis
- Supervises the in and out transactions of dental records from an ante mortem area by maintaining an AM Dental records register
- Supervise quality control dental record management
- Provide instructions to the family liaison officers and other DVI personnel regarding data acquirement from the families

Ante Mortem Dental Team Member

- Compiling ante mortem data
- Receive and write out the ante mortem data on to the yellow INTERPOL F1 & F2 forms
- Upload the transcribed data on to the DVI database

Post Mortem Dental Team Leader

- Works in liaison with DIM and reports him daily about team progress
- Supervises work flow in the PM dental area
- Determine rotations and duties to the team

- Ensure all personnel aware of protocols and procedures being used
- Liaise with mortuary coordinator regarding body flow
- Supervise quality control and assurance of Odontology examinations

Post Mortem Dental Team Member

- Examine the victim's dentition and record the dental status in the pink INTERPOL form
- Take the photographs and dental radiographs.
- Extraction of tooth for DNA analysis if required.
- Ensure clear separation of clear and dirty stuff in work area.
- Should always work in pairs, one is dirty dentist and the other clean dentist and all the examinations are peer reviewed.

Reconciliation Dental Team Leader

- Supervise in and out transactions of files in a reconciliation register
- Updates DIM on a daily basis about the progress of reconciliation team
- Determine initial method of comparison of data, i.e. computer or manually
- Ensure completion of documentation

Reconciliation Dental Team Member

- Participates in the comparison phase of potential identifications
- Maintain the dental reconciliation working register issued and keep the status updated all time

In case of a limited or fewer number of forensic odontologists in the country, the dental personnel with skills in dentistry and having good or limited exposure in forensics can be appointed. The sources for the recruitment of these additional personnel are dental associations or forensic organizations.

3. Standard Operating Protocols and Quality Management

For the purpose of structuring the disaster management, Interpol introduced its first DVI guide in 1984.[1] It provided certain guidelines to the organizational bodies, member countries and forensic specialists in DVI team. These guidelines were reviewed and updated on a timely basis.[12,15] According to the National Fire Protection Association (NFPA), a standard operating procedure is "an organizational directive that establishes a standard course of action." [16] A complete set of SOPs details the importance of organizational operation of DVI response. Without having SOPs dictated prior to DVI response, repurcates to individual improvised decisions and lack of coordination.[17] Authoritative for the planning of DVI response in Odontology sector is the DIM or Odontology coordinator. He reinforces the response by setting up a chain of command, developing and reviewing SOPs and also makes sure they are up to date scientific methodologies.[18] In 2003, the International

Organization of Forensic Odonto-stomatology (IOFOS) established and validated quality assurance guidelines to its members and member countries.[19] The American Board of Forensic Odontology (ABFO) also instituted certain guidelines.[20] Quality management can be divided into two types[18] which are Quality assurance and Quality control. Quality assurance sets up the standards for disaster management such as SOPs and Quality control entails maintaining those provided standards in actual DVI response.

4. Equipment and Supplies

The agencies or the forensic teams that are taking part in DVI response are also in need of equipment and supplies. Allocation of the equipment is the responsibility of the DVI lead agency. DIM or Odontology coordinator will inform DVI lead agencies about required equipment. The list of required equipment can be divided according to the phase of DVI management, such as post mortem or autopsy and comparison sections. A list of detailed equipment and supplies is provided by the American Board of Forensic Odontology, Diplomates Reference Manual 2013.[20]

5. Safety and Health Considerations

The primary purpose of the operating personnel safety is to protect themselves against direct contact with the corpses. Not every disaster is the same. Keeping in mind regarding the local hazards at the disaster site, a special standard safety clothing[1] must be provided for the operating personnel such as surgical clothing, protective gloves, helmets, aprons, goggles, mouth masks etc. Team leaders and members must be properly trained and aware of hazardous debris, chemical substances, radiologic hazards and blood borne pathogens. Immunizations should be provided for operating personnel for tetanus, hepatitis B, tuberculosis and in case of moving abroad as part of DVI response special vaccinations should be administered. A special personal protective equipment (PPE) will be provided to the personnel in case of CBRN (Chemical, Biological, Radiologic and Nuclear) incident.

6. Facilities

The arrangement of the facilities that are required for the identification of the bodies should take care by the DVI commander in charge. Accommodation of all bodies is not possible by local morgues in some disasters, so facilities should be arranged for temporary set up of one. As there have experienced odontologists presence within the dental DVI team, they also provide valuable advice in setting up a morgue. Sanitation facilities must be

present within the morgue. Arrangements for food and rest area for the personnel must be arranged. Travel, accommodation and sustenance of the working personnel should be taken care by the DVI lead agency.

Training and Deployment of Dental Dvi Team

Those personnel, who deployed as part of the disaster management, must be well trained and proficient in their nominated roles. Along with the team members, team leaders should undertake appropriate exercises to build proficiency and experience in readiness for deployment.[21] It is important to make sure that not only the forensic personnel involved in training and exercises, but also all the agencies including police should be included. To keep up-to-date themselves in DVI response all the personnel should pursue continuous proficient development. From the training perspective in order to enable forensic personnel get properly inducted and keep abreast with dynamics of science and its application, they should participate in conferences related to this area and also take part in training exercises.

DIM facilitates the deployment of required odontologists and equipment. The deployment time depends on the incident whether it was open or closed. But irrespective of the disaster, DIM should be ready to deploy in time.

Conclusion:

Successful management of DVI response is mainly based on proper planning, deployment of rescue, recovery and identification teams in time. Incorporation of standard operating procedures not only prevents chaotic environment, but also helps in effective DVI response. Forensic Odontology is considered to be one of the prime identifiers along with DNA and fingerprint analysis. Inclusion of the forensic dental team as a part of an identification team has proven successful in many mass fatality incidents such as tsunami and world trade center attacks. It is important not to ignore the role of the dental team in body identifications during disasters and needed action must be taken by the related authorities to establish one. The key points to be considered are

1. Incorporation of dental team in disaster management team
2. Election of dental team leader to maintain the chain of command
3. Involvement of Odontologists in all phases of disaster management
4. Incorporation of Standard operating procedures and guidelines for quality management
5. Consideration of safety and health of the operating personnel

6. Application of reviewed scientific methodologies in disaster management

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Review Research Paper

Viscera Preservation for Post Mortem Toxicological Analysis: A Review

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Abstract

For years, we have been preserving samples either for toxicological analysis in all cases of sudden, suspicious and unknown cause of death: or, to ascertain the alleged poison used in alleged history of poisoning. In India, procedures of post-mortem toxicological analysis and the common poisons used for suicidal and homicidal purpose have changed drastically during past few years. But the sample collection has not seen much change, especially, since now we can detect these toxins in body fluids too and need tissue samples in specific cases only. Many countries have well established guidelines for specimen collection, storage, analytical procedures to be used, quality assurance, chain of custody, reporting procedures and sample disposal for effective post-mortem toxicological analysis. This article reviews the various standards for amount of viscera to be preserved for post-mortem toxicological analysis followed in other countries and in India, and tries to make some recommendations in relation to the quantity and selection of viscera to be preserved during autopsy, so that effective and efficient toxicological evaluation can be done.

Key Words: Viscera preservation, Quantity, Post-mortem

Introduction:

The preservation of viscera for toxicological analysis is required in all cases of sudden, suspicious and unknown cause of death. Selection and amount of the sample required for toxicology investigations is much more complex and challenging in autopsy cases than in living individual e.g. non fatal poisoning, alcohol intoxication etc. In 1998, Indian National Committee for revised guidelines of sample preservation & analysis in medico-legal cases has suggested changes in the existing protocol of viscera preservation; but not much change has been observed, as the standards followed vary in different states.[1]

Since, now with advent of sophisticated techniques like PCR, DNA fingerprinting

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chromatography etc. an array of test can be performed on small amount of sample, thus, the recommendation made by the committee can further be improvised. This article reviews the various standards that are followed in other countries and make some suggestions that can help in formulating guidelines for efficient post mortem toxicological analysis in India.

BACKGROUND

If classical signs of poisoning are absent, then toxicological investigation on post-mortem specimens are needed to determine the causative agents in cases of death due to suspected poisoning and should exclude presence of alcohol, legal or illegal drugs or other intoxicating substances which may have caused incapacitation in cases of accidents or advanced decomposition and death due to drowning.[1] For this purpose, collection of suitable and representative samples is an essential requirement.

In year 2006, The Society of Forensic Toxicologists (SOFT) and the Toxicology Section of the American Academy of Forensic Sciences (AAFS) had jointly formulated guidelines for the practice of Post-Mortem Forensic Toxicology.[2] They had recommended the following specimens and amount of specimen to be collected at autopsy in cases involving toxicological examination

- Brain - 50 gm
- Liver - 50 gm

- Kidney - 50 gm
- Heart Blood - 25 mL
- Peripheral Blood -10 mL
- Vitreous Humor - All available
- Bile - All available
- Urine - All available
- Gastric Contents - All available

Flagman JR in 2006 had recommended the following samples to be collected post mortem - blood 5ml from two different peripheral sites, preferably left and right femoral veins, urine, vitreous humour from both eyes separately, stomach content and liver (10-20) mg. Preservative to be added only to one sample of blood and urine and rest of the samples are to be stored at 40 C and residual samples after analysis should be stored at -200 C till the investigation of incident are concluded.[3]

The United Kingdom and Ireland Association of Forensic Toxicologists (UKIAFT), in 2010 issued Forensic toxicology laboratory guidelines of specimens and amount of viscera to be collected at post-mortem in suspected cases.[4]

- Peripheral blood — 10 ml
- Urine — all available
- Vitreous humour* — all available
- Cavity/Heart blood* — 25 ml (femoral limited or not available)
- Hair* — cut from the vertex region of the scalp (additional sample pulled from vertex region)
- Bile* — all available
- Liver* — 50 g (low volume of blood available)
- Stomach contents* — all available (or specify if a sample)
- Brain* — 50 g (volatiles)
- Kidney* — 50 g (oxalates)

It further clarified that blood and urine are sufficient for toxicological examination and samples identified with an * should only be submitted for analysis following discussion and agreement with the toxicology laboratory. Also, certain cases may dictate the need for other specimens, e.g. lung and intestine and should be addressed on an individual case basis.

For preservation it recommended that as a minimum, blood and urine samples collected for alcohol (ethanol) analysis should be stored in a vial containing fluoride oxalate. Otherwise, as number of drugs are unstable, so, where possible samples should be stored in a vial containing fluoride oxalate (≥ 1.5 %). For preservation of other samples refrigeration is recommended. [4]

According to the Guidelines of the Society of Toxicological and Forensic Chemistry,

Germany; recommendations for sampling postmortem specimens for forensic toxicological analyses and special aspects of a postmortem toxicology investigation are as follows:[5]

- Blood from the vena femoralis, alternatively, from the vena subclavia - 10-20 ml
- Vomitus from the scene – 50 ml or total amount
- Heart blood - 50 ml or total amount
- Gastric contents - 50 ml or total amount in case of non-homogenous contents, the total amount should be collected. Tablets, plant components etc. should be collected separately.
- Urine - 50 ml or total amount

According to these guidelines, in cases where the cause of death could not be determined, additional samples of bile (total amount); liver (50gm), lung (50gm), brain (50gm), kidneys (50gm) and hair (a pencil thick tuft) have to be preserved in addition to the regular specimens. And for preservation, one blood sample should be preserved in 1-5% sodium fluoride and one without preservative.

For determination of alcohol in vitreous / aqueous humor addition of sodium fluoride is recommended. For rest of the samples, they should be collected without additives. All the samples combined into one package should be stored at a temperature of -18°C . Hair samples should be stored at room temperature, and a sample of femoral vein blood at 4°C . If it is necessary to transport the samples, then the cold chain and the chain of custody must be maintained according to the safety regulations and requirement.[5]

Recently, in India, UP, the State Forensic Science Laboratory has issued a directive in relation to submission of samples for toxicological analysis in all autopsies, which is as follows:[6]

- Stomach tissue- 50 gm
- Small Intestine- 50 gm
- Liver- 50 gm
- Kidney- 50gm
- Spleen – 50 gram
- Gastric content – 50 ml
- Blood – 20 ml
- Urine – 20 ml

Discussion:

Most of the researchers support that the tissue of most importance is blood, as with advent of technology, almost all the drugs and their metabolites can now be detected in blood.[7] It is recommended that blood should be collected from peripheral blood vessel, preferably femoral vein, the next vessel of

importance being subclavian vein. Blood should not be taken from the heart or great vessels in the chest as post-mortem diffusion of drugs and alcohol from the stomach or from aspirated vomit in the air passages can easily and rapidly contaminate the blood in these vessels.[3,8] However, heart blood sample would be the preferred specimen as opposed to urine for screening of drugs that are extensively metabolized.[7] Blood should not be taken from the heart cavities, the inferior vena cava, or the portal or hepatic veins, as these may also give concentrations that are at variance with those in the peripheral vascular system due to contamination with gastric content of other fluids.[3] Any sample of blood that was collected ante-mortem which is usually seen in trauma cases, blood transfusion cases and hospitalised individual should be retrieved and sent along with post-mortem samples.[9,10]

In Road traffic accidents, due to massive trauma to a body, blood cannot be collected from the vasculature although there is free blood in the body cavities, in such cases, this effused blood can be used as a sample. However, in these cases, we can only exclude drug intoxication, if it is negative for tested toxins. A positive test, on the other hand, must take into account the possibility of contamination, and another material such as vitreous or muscle must be analyzed to evaluate the accuracy of the test results on the blood.[7]

In a study done by Cook DS, it was determined that post-mortem concentrations of toxins differs widely from ante mortem concentrations and it has also been seen that many people may have unusually high concentrations of some toxins or drugs during life without any obvious symptom.[11] Thus, post-mortem concentration of poison is sufficient proof only in cases where a drug concentration is clearly in the fatal range and poisoning is evident from the circumstances surrounding death, otherwise, it should only be used to support known clinical or pathological findings.

Other than blood, the fluids that can help in determination of toxins in acute cases of poisoning are urine, bile, gastric content and vitreous. Urine, unlike blood, is mostly free of proteins and lipids, and therefore, when blood analysis fails to detect a foreign substance, urine analysis will reveal recent exposure by identification of its major metabolites such as of organophosphate compounds or of toluene, xylene and trichloroethylene.[7] However, the level of a drug in the urine is usually of no significance in the interpretation of the cause of death and is just a qualitative indicator.

Many drugs have been shown to accumulate in bile. It represents a reservoir for many xenobiotics and corresponding metabolites that have biliary excretion and are subject to enterohepatic circulation. The qualitative findings of drugs and/or major metabolites in bile may indicate previous or chronic exposure to a drug or poison.[7] It is usually used in cases of chronic heavy metal poisoning or when drugs such as morphine, chlorpromazine or colchicine had been implicated[7]

In cases of a suspected oral overdose of drugs, the entire stomach contents should be retained. It is especially useful in case of oral ingestion.[3,12] An estimate of drug present in gastric volume can help in differentiating overdose from therapeutic dose. In case of heavy metal poisoning contents of small intestine should also be taken.[7]

Cerebrospinal fluid is not often required for toxicological analysis, though it may be needed for microbiological and virological studies. [10] The fluid in the eye resists putrefaction longer than other body fluids as it is sterile and remains well protected in eye. It is useful in investigation of deaths due to diabetes mellitus, insulin, alcohol, digoxin, lithium, many psychotropic drugs and biochemical tests like urea, creatinine, glucose, lactose and alcohol and where the body has been burnt extensively.[12]

It is a usual practice to collect portions of liver, kidney and muscle for subsequent toxicological analysis in cases of deaths due to drug overdose or suspected drug overdose. However, it has been seen that the drug can be easily detected in the vitreous, bile or urine and it can be detected even in cases with prolonged survival period after consumption of poison. Thus, viscera should be preserved only in the cases with extended postmortem time period, whenever body fluids are not available or difficult to obtain and where forensic expert sees or expect some changes in the anatomy.[7,9]

Liver is favoured as a specimen when blood is not available. Analysis of a liver tissue specimen may help to differentiate acute overdose from therapeutic use of drugs with a narrow dosing window. [7] It has been demonstrated that drugs from the stomach can diffuse into the liver, principally the left lobe during post-mortem period. Thus, it is advisable to collect sample from the right lobe.[7,10,13]

A kidney is a useful specimen for drug identification as it is the route of excretion for most metabolites. Also, in suspected heavy

metal poisoning it may also serve as a toxicological specimen [7]

In cases of suspected poisoning by volatile substances specimen of brain and lungs (apex) have been said to be of importance.[3] Especially, in cases of intravenous poisoning lung tissue may have higher concentrations than liver.[7] Samples of hair and nail are useful in cases of long term or episodic exposure, drug abuse and cases where poison may have been eliminated from other commonly sampled fluids and tissues; especially in exhumed bodies. Bone sample is useful in cases of chronic poisoning and bone marrow may help when all the tissue has disintegrated.[3]

Although adipose tissue acts as a reservoir for many lipophilic substances, it is not favoured as a sample in analytical toxicology due to apparent difficulties in sample handling and processing.[7] Pleural fluids can be used in cases of advanced putrefaction when no other fluid is available.[7]

And the tissue that has most potential for toxicological analysis and remains untapped is muscle.[9] The within-case variability has been observed in muscle specimens and it has been found that drug analysis on skeletal muscle is rather qualitative than quantitative in nature.[7] Cases where we can use muscle tissue as sample are exsanguinations, advanced putrefaction and severe burning. Sampling performed should be such that, specimens collected represents part of the whole.

Summary & Conclusion:

The preservation of viscera is a crucial step in post-mortem investigations. Due to shortage of forensic medicine and toxicology experts in India, post-mortem is conducted by the government doctors posted at district level in many districts of India and they often face challenges in viscera preservation.

After reviewing the literature extensively, suggestions for the sample selection are as follows

For general analytical toxicology i.e. in all autopsies

- Whole blood - 20 ml preserved in potassium oxalate and sodium fluoride (2% w/v)
- 10 ml preserved in EDTA for DNA analysis
- 20 ml without preservative
- Urine - 10- 30 ml without preservative
- Gastric content - 50 ml or total amount (without preservative)

In cases where cause of death is not known (in addition to above samples)

- Bile - available amount

- Gastric content – 50 ml or total amount
- Liver - 50 gm
- Kidney - 50 gm
- Vitreous - all available from both the eyes and preserved in sodium fluoride- 2% w/v
- Hair and nails – pencil thick tuft of hair, to be pulled out as whole

In case special cases

Clonazepam, cocaine, nitrazepam and alcohol – preserve 5 ml urine in fluoride if quantity is small then whole amount should be preserved. Also preserve vitreous humour.

Suspected volatile poisons- lungs and brain should also be added -50 gm each and separate glass containers or nylon bags should be used.

In case of injectible poisons - Skin (Injection site as well as control specimen) sample should include fatty layer beneath the skin.

Chronic or heavy metal poison – bile and bone should also be included.

In cases of severe trauma - cavity blood (50 ml) can be used when vascular blood is not available

Putrefaction (when blood and tissues are not available) – muscles, fluid from chest cavity and maggots, bone (5 cm long piece) and bone marrow (1 gm), hair and nail.

Advanced putrefaction (exhumed bodies) – bone (5 cm long piece) and bone marrow (1 gm), teeth, hair and nail and fluid from chest cavity.

Burnt bodies – if aforementioned samples are not available then muscle, vitreous, teeth, bone and bone marrow.

No preservative should be added to tissue specimens and all samples should be stored at 40 C and cold chain maintained till the analysis is complete. Residual samples should be freezed at -180 C. Disposable hard plastic or glass containers should be used and leave at least 10-20% of head space in tubes.

Since, it is difficult to maintain cold chain at each and every district, it is suggested that every state should be divided into zones where submission of post mortem samples should be done on day to day basis from district mortuary. Furthermore, special containers that can maintain the temperature should be provided at the mortuary and dispatch should be made within these boxes only. Till the facility of additional cold storage is provided, instead of continuing practice of adding random amount of common salt, guidelines should be formulated for adding the right amount and right kind of preservative and calibrated preservatives should

be provided at the each and every mortuary to prevent decomposition of samples .

Thus, for uniform and standardised investigation in India, need of the hour is to form an Indian Society like SOFT and AAFS that should have forensic experts as well toxicologist as its members. And, it should formulate guidelines for specimen collection, storage of specimen, analytical procedures to be used, quality assurance, chain of custody, reporting procedures, sample disposal and other address other issues related to Forensic toxicological analysis, so that, there is better utilisation of services, and unnecessary burden on toxicologist is avoided and better results are delivered. These guidelines should be approved by the government bodies and applied all over the country. Also, regular training with standard guidelines should be given by this organisation to the concerned staff for effective investigations. Furthermore, regular appraisal of these guidelines should be done.

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Case Report

Left Ventricular Free Wall Rupture and Hemo-Pericardium in Sudden Death- A Case Report

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Abstract

Sudden deaths may involve almost any organ system and the most common system involved is cardiovascular system. Death may be the initial manifestation of certain cardiac pathology. Myocardial rupture is one of the rare cardiac event, which is usually fatal and the outcome depends on the size of rupture and rate of pericardial blood collection. Myocardial rupture can occur in various traumatic, non-traumatic and iatrogenic conditions. A 40-year old male, with no previous history of coronary artery disease, was brought dead to casualty. At autopsy, hemopericardium and a tear in left ventricular free wall was noted. Left coronary artery was stenosed. Histopathological section from the heart showed numerous neutrophil infiltrates suggestive of acute myocardial infarction. In myocardial infarction, a number of factors like age, gender, previous myocardial infarct, site of infarct, ventricular hypertrophy, wall thickness affected and intake of non-steroidal anti-inflammatory drugs, play a role in rupturing the myocardium.

Key Words: Left ventricular free wall rupture, sudden death, acute myocardial infarction, hemopericardium

Introduction:

Forensic experts in addition to unnatural deaths has to deal with a wide range of natural deaths when the death is abrupt, unexpected or when the terminal event is not witnessed. Sudden natural death is a condition where a person is found dead or dies within 24 hours after the onset of terminal event, when the person does not suffer from any serious disease, injury or poisoning.[1] The most common cause of sudden death is cardiogenic. The left ventricular free wall is the region of the ventricular wall which is not in continuity with the interventricular septum.[2,3] The myocardial ruptures were first documented by William Harvey in 1647. Myocardial rupture (MR) is a sporadic cardiac event which is usually fatal. They are classified as acute, sub-acute and chronic with pseudo-aneurism depending on its clinical progression.[4]

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Case Report:

A 40-year old male pharmacist, a known diabetic on self-medication with no history of hypertension and coronary artery disease was brought to casualty with acute onset of chest discomfort and difficulty in breathing. On examination the person was unconscious, pulseless and blood pressure was not recordable. The patient was declared dead after resuscitative measures. Since it was a case of sudden death medico legal autopsy was conducted. On examination built was normal, no external injuries were found on the body. On opening the thoracic cage, a bluish hue was noted on the pericardial surface and 140 gram of clot was present in the pericardial space without any pericardial injury. The heart weighed 361 gram and on the postero-lateral aspect of left ventricular free wall a 2.5 cm tear (Figure-I, II and III) communicating with the ventricular cavity was present with extravasation of blood into the surrounding myocardium. Left ventricular wall thickness was 1.5 cm. Patches of pale regions were seen on the cut section of the lateral wall of left ventricle. Left coronary showed 90% stenosis. Histology revealed numerous neutrophil infiltrates in the myocardium suggesting acute myocardial infarction (Figure IV). All internal organs were congested. The cause of death in this case was due to hemopericardium consequent to left ventricular free wall rupture in acute myocardial infarction.

Discussion:

MR occurs in various iatrogenic, traumatic and non-traumatic conditions. It may occur in blunt trauma and penetrating injuries to heart. In penetrating injuries as a rule pericardium is involved. MR occurs as a complication of acute myocardial infarction, myocardial abscesses, rarely in infections like tuberculosis,[5] cardiac tumours like angiosarcoma,[6] infiltrative diseases of heart like sarcoidosis,[7] fatty infiltration[8] etc. In myocardial infarction left ventricular free wall rupture accounts for about 2% of cases.[9] Myocardial infarcts are usually caused by atheromatous lesions rarely by embolism, vasculitis, occlusion of ostia and congenital anomalies. In a case of acute myocardial infarction factors promoting MR are female gender, age more than 60 years, history of hypertension, no previous myocardial ischemia/infarction,[10] absence of ventricular hypertrophy, diminished collateral circulation, infarct involving twenty percent of wall thickness, infarct in lateral wall of left ventricle, intense neutrophil infiltration[11] and non-steroidal anti-inflammatory drugs after acute myocardial infarction.[12] Abhishek D et al[13] reported a case of 60-year old male who suddenly fell down from the staircase after having a sudden syncopal attack and was unresponsive since then.

The rupture usually occurs at the site where the wall was thinned out or dilated due to ischemia or infarct.[14] The most common site of rupture is ventricular apex followed by left ventricular free wall, interventricular septum and right ventricle.[11] The MR may complicate an infarct at any time but usually occurs within 3 to 7 days of acute infarction since there is maximum lysis of connective tissue associated with minimum collagen deposition which cannot strengthen the wall.[10] In ten percent of cases, the rupture occurs in 24 hours.[11] When a person consumes non-steroidal anti-inflammatory drugs(NSAIDs) after myocardial ischemia, the inflammatory response is suppressed, which delays or impair the healing of infarct.[12] In the present case, the deceased took self-medicated NSAIDs, frequently for body ache.

The factors determine the clinical outcome in cardiac rupture are the volume of leaked blood, the rate of blood collection and pericardial compliance.[15] the normal pericardial fluid measures about 15-50 ml. After rupture the initial 80 to 120 ml of blood can be accommodated without compromising the intra cardiac pressure but an additional 20 to 40 ml

can double the intra-cardiac pressure leading to acute decompensation.[16] Rapid accumulation of 150 to 200 ml[17] of fluid in pericardial space is more dangerous than gradual collection of 500 to 2000 ml[14] of fluid as abrupt stretching of myocardium is not possible. In most of the cases of free wall there is acute onset of circulatory shock is followed by electromechanical severance leading to death of the individual.[18] In some cases the blood clot seals the defect forming a pseudo-aneurysm[19] or repeated bleeding may occur.[20]

Sometimes the hemopericardium may compress the layers of the track and stem the defect.[21] If a person could survive the acute episode then the classical features of cardiac tamponade will be present. Sudden death due to Left Ventricular Free Wall Rupture following AMI leading to hemopericardium is very rare, even though Acute Myocardial Infarction (AMI) is the commonest cause. Left Ventricular Free Wall Rupture is almost always fatal yet there are reported cases of pericardiocentesis followed by successful surgical repair.[13] In the present case study the following risk factors were present: lack of ventricular thickening, infarct more than 20% of wall thickness with intense neutrophil infiltrate, history of frequent intake of NSAIDs, no previous infarct and left lateral wall involvement.

Conclusion:

This case was discussed exhaustively for all probabilities and possibilities with experts of different faculties including Surgeons, Plastic surgeons, Gastroenterologists, Pathologists. So also the police officials, medical and paramedical staff of concerned hospital along with detailed examination of previous medical history, investigation and treatment record papers. But the exact conclusion and possibility of fatality is still awaited for concluding research.

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Fig. 1: Posterior view of heart with left ventricular free wall rupture.



Fig. 2: Gross appearance of myocardial rupture in the left ventricular free wall. (Arrow)

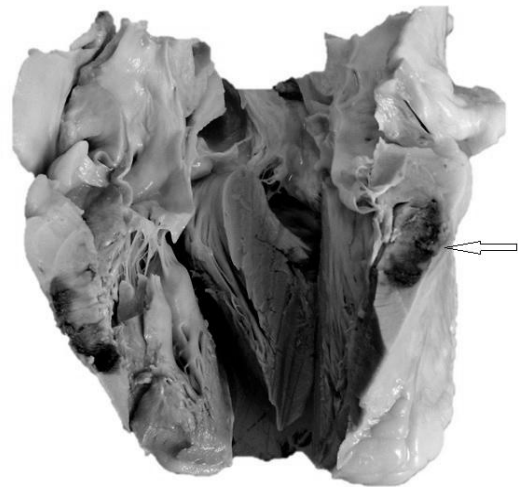


Fig. 3: Microscopic picture from the left ventricular rupture region showing areas of haemorrhages and breakdown of cardiac muscle fibre

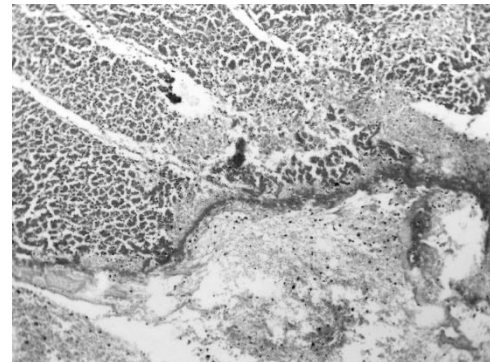
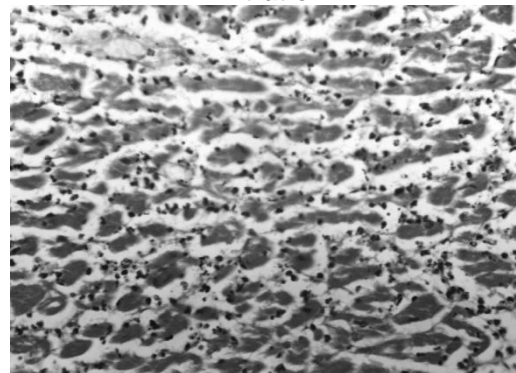


Fig. 4: Microscopic picture from left ventricular wall with dense neutrophilic infiltration



Case Report

Missed Diagnosis: Fate or fault?

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Abstract

Negligence is a pre-condition for fastening any liability on a medical practitioner for damages and compensation. In comparison with the other fields of medicine, litigations in obstetrics and radiology are very common now-days and one such example is in antenatal screening procedures. Neural tube defects are common birth defects with a prevalence of 4-5 cases per 10,000 live births. Prenatal diagnosis of neural tube defects has implications in obstetric management whereby early detection and if needed, the termination of pregnancy could successfully reduce their incidence. The majority of claims involving neural tube defects involve allegations of delayed diagnosis. This present case of a child who was born subsequent to missed diagnosis of neural tube defects with complications, despite vigilant antenatal checkups and serial ultrasound scans which were taken up by her mother. This was considered as failure on the part of radiologist in detecting neural tube defect which could have been detected as late as 14-16 weeks. Here, we have discussed neural tube defects, their diagnosis and their medico-legal aspects.

Key Words: Negligence, Ultrasound, Neural Tube Defects, Wrongful Birth

Introduction:

Everybody is subject to the rule of law. It is the price that everybody has to pay for the corresponding benefits of the free and protected society. Keeping this in mind, the principle that doctors and indeed all professionals should be accountable for their failures is entirely acceptable.

Such professional failures on part of a medical professional, known as medical negligence, have been made punishable since the code of Hammurabi, which was developed by Babylon's king, some 20 centuries before the Christian era. Medical negligence may be defined as want of reasonable degree of care and skill or willful negligence on the part of a medical practitioner in the treatment of a patient with whom a relationship of professional attendant is established, so as to lead to his bodily injury or to the loss of his life.[1]

Such litigations are seen in almost all clinical setups but those in obstetrics are far more common than in any other subspecialty of

Medicine. In obstetric care also, there are a number of areas where suits can be filed for deviation from standard care and skill.

It can be in providing antenatal care for high risk pregnancy, errors or omissions in antenatal clinical screening and diagnosis, errors or omissions in antenatal ultrasonographic screening and diagnosis etc.[2] Here is a case where an ultrasonologist is being held responsible for such negligence.

In the present case, such an error was made in diagnosing a congenital anomaly, a neural tube defect (NTD), on ultrasound, which lead to birth of a child with gross malformation.

Fetal ultrasound, which is now an established part of standard obstetric care in many countries, is offered routinely in the first trimester of pregnancy to establish the gestation and viability and again later (around 20 weeks) to examine the anatomy in detail.

Routine screening for fetal structure anomalies has the potential to reduce peri-natal mortality by elective termination of pregnancies complicated by serious congenital anomalies, to reduce morbidity by intrauterine treatment and to optimize management of delivery and early neonatal treatment.[3]

Among the congenital anomalies well appreciated on ultrasound, NTDs are one of the most common structural congenital anomalies and imply a failure of proper closure of Neural tube and covering mesoderm and ectoderm. This defect can be detected as early as late first trimester by ultrasonography and missing such diagnosis in our case, led to birth of the child with life expectancy of few days.

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Case History:

A patient of 30 years of age was in her second pregnancy. She underwent routine obstetric checkups. She had undergone ultrasonological exam on four separate occasions - at 8-9 weeks, 17 weeks, 26 weeks and at 32 weeks. All these reports stated "No congenital anomaly detected". The fifth USG done at 36 weeks by different radiologist detected a hydrocephalus and spina bifida. She had no choice but to go for the delivery.

She delivered on 14/8/13 at our institute, only to be referred to higher institute for management but was sent back with a diagnosis of "ruptured meningocele with paraparesis with congenital hydrocephalus". The male child ultimately died at home after 10 weeks. The child was autopsied at PGIMS, Rohtak.

Autopsy Findings:

The child was cachexic. On external examination, besides the tell-tale signs of hydrocephalus, a grayish black coloured skin patch was present over the lower back region, measuring 5x4 cm in size. The skin was wrinkled and thinned out. On dissection of this region, a vertebral column defect was seen. The vertebra below the level of L2 vertebra was absent.

The spinal cord below the level of L1 was protruding out and was attached and covered with overlying skin with a small tuft of hair. Brain was pulpy with increased amount of CSF and light green pus, which was sent for histopathological examination. It showed oedema and congestion, along areas of necrosis surrounded by dense inflammation comprising of neutrophils, lymphocytes, plasma cells and macrophages. Rest of the viscera was congested. This autopsy confirmed the clinical diagnosis and its further complications.

Discussion:

NTDs occur in about 1.5/1000 live births and the risk in 2nd sibling is 5/100 births. Its incidence in North India is as high as 3.9-9/1000 live births.[4] A high prevalence has been reported among the Sikh community in India.[5] Periconceptional use of antiepileptic drugs such as Valproate and Carbamazepine and deficiency of folate is associated with a high incidence of these defects. Maternal DM, Hyperthermia, Prenatal rubella infection have also been associated with these defects.[6,7] However, prevalence of NTD has shown a declining trend in recent past.[8] This could be due to antenatal detection of NTD followed by MTP and folate prophylaxis.[8-10]

NTD can be classified into Primary or Secondary types.[6] Primary NTD is due to

failure of neural tube to close or disruption of an already closed neural tube between 18 and 28 days of gestation (meningocele and encephalocele). Only 5% of all NTDs are secondary. These result from abnormal development of caudal cell mass and usually occur following primary neural tube closer (meningocele, lipomeningocele, sacral agenesis, diastematomyelia and myelocystocele).

The exact procedure for detection of NTDs before birth isn't available but several prenatal diagnostic tests have been evaluated which include:

- 1) Assessment of maternal serum markers such as maternal serum alpha fetoprotein (MSAFP), serum oestriol and acetylcholinesterase activity.
- 2) Prenatal Ultrasonography.
- 3) Amniocentesis in selected cases.

None of the above mentioned tests have been evaluated adequately in the first trimester of pregnancy, when the information is most desired. Though, many countries have successfully implemented programme for prenatal detection of NTDs.

In Pregnancy, the commonly followed regimen followed for fetal wellbeing is that around 14-16 weeks, USG is conducted which if appears abnormal, the pregnant is counseled. If the USG is normal, MSAFP levels are checked. If the levels are high, it is considered to be a case of NTD and the pregnant lady is counseled. If the levels of MSAFP are normal and the pregnant is in low risk group, the patient is followed up. If the pregnant is in high risk group, a repeat USG is conducted at 18 weeks. If the scan is abnormal, the diagnosis of NTD is considered and pregnant is counseled. If the scan is normal, amniocentesis is done which if normal, pregnant is followed up vigilantly and if abnormal, she is counseled for the diagnosis of NTD in her unborn child.[11]

Prenatal Ultrasound is a simple, non-invasive technique that is widely available and routinely practiced. Fetal screening on USG may be performed as either a part of basis exam ("level 01") or a detailed scan ("level 02" or higher). A basic or "level 01" scan does not need to make a specific diagnosis but should be able to tell when something is wrong, resulting in a referral for a detailed or "level 02" scan. [16]

Defects such as anencephaly and encephalocele can be visualized directly. However, identification of spinal deformities such as meningocele may be difficult. Presence of spinal dysraphism can be inferred from certain indirect cranial sonographic features. The incidence of overt hydrocephalus and enlarged

atria is more. In posterior fossa, an obliterated cistern magna and abnormally low cerebellar transverse diameter are indirect features. Scalping of the frontal bones has been described as the "lemon sign". Even in the late 1st trimester, the "acorn" sign i.e. narrowing of the frontal bones and flattening of the occiput can be evident in open spina bifida.[12,13]

Counseling, both pre and post-test are integral part of any screening programme. On detection of malformation, especially major malformation such as anencephaly, termination of pregnancy may be logical choice where as in cases of less severe malformation such as meningocele, damage to spinal cord and risk of paralysis are increased with vaginal delivery. This can be reduced to certain extent by performing caesarian section. Recently certain centres have attempted in utero correction of myelomeningocele either by endoscopic surgery or by open procedures.[14]

Even though, many screening tests are available for prenatal detection of NTDs but a standardized protocol is lacking. They can be diagnosed with a reasonable accuracy by the judicious use of proper tests in an individual case. A high incidence of congenital neural tube defects reported in east Delhi when analysed, was attributed to their late diagnosis which in turn was found to be a result of late booking of antenatal cases.[15]

However, missed diagnosis of fetal anomalies, account for over a quarter of obstetric suits.[2] If missing recognizing such cases like ones having such fetal anomalies as the one described in our case especially when information of ultrasound is so common that it is rare for an obstetric patient not to have at least one scan during antenatal period whether prescribed by a qualified obstetrician or the patient going for the examination on her own and allowing them to be brought into this world, they are termed as "a wrongful birth."

A wrongful birth is an alleged claim against a clinician for the birth as opposed to a specific birth injury which is usually brought by patients after a birth of an infant with serious, disfiguring disabilities such as CNS defects e.g. Hydrocephalus, meningocele or various chromosomal abnormalities e.g. Trisomy 21, Tay Sachs' disease or cystic fibrosis.[2]

The parents usually allege that the genetic or hereditary basis for potentially serious condition was not recognized by the clinician, or that the appropriate diagnostic testing was not offered early enough for pregnancy prevention or termination. In these proceedings, the parent must prove that if they had been informed of the

potential for a defective fetus prior to pregnancy or the existence of an abnormal infant during pregnancy.[2]

In cases where the malformations in the newborn child are severe but compatible with life after multiple surgeries and long years of hospitalization, a civil negligence suit can be filed by the child's parents against the radiologist or obstetrician under "a wrongful life".[2] Wrongful life is an action claiming that negligent prenatal testing on the part of the health care provider resulted in the birth of a 'damaged' child. Wrongful life differs from wrongful birth in that claim is brought in the name of the physically or mentally disabled child and not of the parents. Such claims usually involve devastated infants with serious genetic disorders or those born with major injuries as a result of undiagnosed maternal disease or early pregnancy drug exposure. The legal theory for these claims is that the duty of clinician owed to the unborn child is similar to that owed to the parents.[2]

Conclusion:

The above mentioned medico legal scenario has been highlighted where in spite of regular ultrasonography scans done at 8-9 weeks, 17weeks, 26weeks \pm 2days, 32weeks, it was the scan at 34 \pm 1 weeks, which led to the revelation that the unborn child had hydrocephalus with spina bifida with moderate oligohydromnios which should have been detected on earlier scans and appropriate management could have been undertaken but was missed by radiologist. Such radiologists are liable for civil negligence suits and are liable for payout. Radiologists should be aware of the responsibility they owe to the society at large and the law of land.

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Fig. 1: Lemon Shaped Skull



Fig. 2: Banana Sign and Obliterated Cisterna Magna



Fig. 3: Myelomeningocele



Case Report

Anatomical Reconstruction to establish identity in cases with cranio-facial crush injuries- A familiar yet unexplored area

¹S.Janani, ²Sanjeev Lalwani

Abstract

Crushing craniofacial injuries are not uncommon in cases of run over vehicular accident. Road accidents constitute a major proportion of accidental deaths and head injuries are the most common causes of death and disability in the injured. Recent trends in increased demand for speed driving among youth along with other factors have lead to further increased incidence of crushed head injuries due to static forces. This pattern causes significant problem in establishment of identity of individual by direct visualization. In this article, we present a case of anatomical reconstruction with manual repositioning of catastrophic head injury.

Key Words: Crush injuries, Craniofacial, Reconstruction

Introduction:

It is a universally well known fact that road accidents constitute a major proportion of accidental deaths and head injuries are the most common causes of death and disability in the injured. Severe traumatic brain injuries due to dynamic force load like acceleration and deceleration are encountered in everyday practice whereas head injuries due to static force load are comparatively less common. But recent trends in increased demand for speed driving among youth, lack of awareness and concern of safety, changing dynamics in work timings among working population and an alarming rise in heavy vehicle population on the roads have lead to further increased incidence of crushed head injuries due to static forces which at times are causing difficulty in establishing the accurate identity of the deceased. Urbanization, improvement in standards of average roads and flyovers to enable speedy travel altogether has added fuel to the burning issue of road accidents. The ethical, emotional, social and forensic aspects of anatomical reconstruction of crushed craniofacial injuries are discussed in detail in this paper.

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Case History:

A young adult male, chef by profession met with an accident while riding a two-wheeler on his way back home from his job at around 3.00am. The left rear wheel of a heavy vehicle with containers ran over him and his vehicle while taking a left turn while getting off a flyover. Being a relative blind spot, the heavy vehicle dragged the injured to a considerable distance before realizing the accident and stopped to check. The victim was released from under the heavy vehicle and brought dead to Casualty of Trauma centre. The history of the incident was given by colleague of the deceased who was riding in another two wheeler just a few meters behind him.

Autopsy was conducted after the routine inquest. Head, neck and thorax were crushed. The vault of skull was open with multiple comminuted fractures of the vault and base of skull with contents of the cranial cavity missing. Parts of the skull vault were also missing. Right orbital tissues were protruding out of the bony orbit and tongue was torn into pieces. Thoracic and cervical viscera were contused and seen protruding out of the oral cavity (**Fig 1**). There were multiple fractures of the cervical vertebrae and the thoracic cage. Cause of death was due to shock and hemorrhage consequent to multiple crush injuries of head, neck, and thorax.

The thoracic and abdominal cavities were closed. Facial and cranial cavities were packed with cotton and cloth material to bring about the shape of skull and facial features. Approximation of skin and underlying tissues was brought about in the best possible manner leaving defects due to skin loss. Sutures were made along facial hairlines to avoid further

disfiguration (**Fig 2**). The body was then handed over to the investigating officer who in turn handed it over to the next of kin

Discussion and Conclusion:

Traffic and road accidents being a common manner for inflicting injuries and head injuries being the commonest cause of mortality and morbidity is a well documented fact.[1-7] Head injuries can be caused both due to dynamic forces and static loading; Dynamic forces causing shear strains consequent to rotational movement and static loading when the head is fixed against a rigid structure.[8] Crush injuries in which there are extensive soft tissue lacerations, fractures of skull, associated with lacerations of brain or prolapse of brain tissues have been well discussed in literature and reconstruction of devastating head injuries for identification of dead bodies have also been reported.

Hejna et al (2011) [9] have reported reconstruction of catastrophic craniofacial injuries caused by contact shot from rifle and burial under slate and soil at construction site. However such literature is scantily available as identification by re-approximation of cranio-facial tissues cannot replace other factors like personal belongings, fingerprints, dentition, etc. Furthermore most often severe crush injuries are associated with loss of soft and bony tissues, in which cases identification based of solely post-reconstruction anatomy can be misleading.[9]

The medical and legal aspects of head injuries have kept health care professionals busy keeping them away from the emotional and social aspects of the injuries. To be called to identify a loved one in the cold room of the mortuary is itself a trauma and to look upon the crushed remains will surely lead to an emotional catastrophe. Even those who claim to be emotionally strong have collapsed at the look of the unidentifiable mangled remains. It is a heart wrenching scenario where such remains are handed over to the next of kin for cremation. Such people may go on to develop anything from nightmares to severe stress disorder. To part from a loved one causes deep anguish and do to so without getting a chance to look at them can lead to psychological trauma due to lack of closure.

There are no questions regarding cause of death in such a case and usually there is no debate about the severity of injuries as it is obvious even to laypeople. The body after autopsy is reconstructed as much as possible and handed over to the relatives for their final rites. In most of the centres where autopsies are done, closure of the body, washing after closure

and handing over the body are done by mortuary assistants and technicians who use crude methods. The role of the Autopsy surgeon in such cases is paramount. Apart from closing up of the thoraco- abdominal and cranial cavities, special care should be taken for surgical reconstruction of the face and identity of the individual.

Bony and soft tissue apposition as much as possible and suturing with finer suture materials will reconstruct the facial features to an extent. Where there is a large defect due to loss of tissues such as in this case where part of the skull vault along with brain tissues were absent, packing of the cavity with available materials like cotton, clothes etc can give a better appearance. Surgical finesse and technical precision along with the autopsy surgeon's patience will get excellent outcomes for sure. Though finer suture materials give better results, there mere absence need not be a dampener.

Conclusion:

In the modern era, there are schools offering Cosmetology for dead and Schools in Mortuary Science which offer various programs and people chose to become Funeral make -up artists who prepare the dead for funeral. People want their loved ones to appear as they did in life so it will be less traumatic for those who pay their final visits just before cremation/funeral. It is the duty of the Forensic Expert to offer their best possible services not only to the investigating authorities but also to the relatives of the deceased.

Having been the connecting link between medicine and law since long, autopsy surgeons have always given their legal responsibilities a top priority. By putting anatomical and surgical knowledge and skill into proper use, a medico-legal expert can also contribute a great deal to his Moral and social responsibilities.

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Fig.1.Craniofacial crush injury



Fig.2.Craniofacial crush injury-after anatomical reconstruction



Case Report

Castration in a Case of Railway Accident: An Unusual Case of Malice

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Abstract

Castration or Bobbitisation, as either a punishment or treatment for sex offenders, has been used throughout history and persists to the present day. After the brutal incident of gang rape in capital city of India that shocked the country, there was even demand of emasculation or castration as a punishment of rape. However, castration, that too in a case of railway accident is an unusual case of malice. Here, we are presenting an interesting and unusual case of animosity that was evaluated and later on confirmed, based on our observations. During post-mortem examination on a dead body of a male recovered from the railway track, multiple ante-mortem injuries involving vital areas like head and thorax were noted, but to our surprise, the victim's penis and scrotal sac were also missing, without corresponding tears on the garments. On careful evaluation, it was concluded that the injuries noticed all over the body were consistent with railway accident except that of amputation of penis along with scrotum. These amputation injuries were also ante-mortem and were caused by sharp edged weapon.

Key Words: Castration; Bobbitisation; Homicide; Genitalia; Railway

Introduction:

Railway accidents are not an unusual occurrence in developing countries like India, which may be due to wide network and unprotected crossings.[1] The pattern and type of injuries depend upon the mode of railway accident, whether passenger falls off from the moving train or is hit by it, while crossing the railway line. The usual injuries seen in railway accident are a combination of abrasions, contusions, lacerations along with mutilation of body as a whole or of its parts. The body is usually soiled by grease and dirt from the wheels and track.[1] Usually the railway fatalities are accidental in nature followed by suicidal and rarely homicidal.[2] It is presumed by the investigating agencies that the apparent cause of death in bodies recovered from or around the railway track is due to railway accident. However, this may not be the fact in all the cases. Many a times, the victim of homicide is placed on the railway track to mislead the investigating agencies with an attempt to simulate the case as of an accident.[1] In a case

of animosity, a predator can do anything to his prey and up to any extent in retaliation which may be unpredictable. An unusual case of malice is discussed here where castration is seen in railway accident.

Case History:

Railway police recovered a dead body few steps away from the railway line, in suspicious circumstances. The external genitalia of the body were missing, along with other injuries over head and face region. There was no eyewitness to the incident, as per inquest report. The deceased was subjected to post-mortem examination to know the cause of death along with queries to comment whether railway accident was the cause of death and whether the external genitalia were severed before death or post-mortem and the type of weapon used.

On Examination:

It was the dead body was of an average built middle-aged male, with clothes torn at places and having blood stains all over them at places.

Following fatal injuries were noticed:

1. Skull was crushed and fractured into multiple pieces. Overlying scalp showed lacerations. Duramater was torn. Brain matter was missing.
2. Right maxilla and right ramus of mandible was fractured.
3. Right clavicle was fractured in its middle, 1st to 8th right rib and 2nd to 8th left rib were fractured into multiple pieces. Body of

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sternum was fractured. Underneath pleura and lungs were lacerated. Heart was showing laceration over right atrium. Thoracic cavity and pericardial cavity was full of fluid blood.

4. Fracture shaft radius was seen in its upper half.
5. Fracture shaft of right femur was observed just below its neck.
6. Penis was amputated, leaving a stump of 4 cm. Both testes and scrotal sac were missing and surrounding skin was missing in an area of 14x8 cm.(Fig. 1). The exposed ends showed regular margins with infiltration of blood as an evidence of ante-mortem injury.

It was opined that all the injuries described were ante-mortem in nature. Injuries [no 1-5] were caused by a hard and blunt object/surface impact and could be due to railway accident, as alleged. Injury no. 6 was caused by a sharp edged weapon. After the post-mortem examination, police produced the scene of crime report along with scene photographs for further review.

Discussion:

Removal of penis and castration, often termed as "crime below the belt", is known from the ages. Lorena Bobbitt amputated the penis of her husband who had forced sexual intercourse with her one night. Traumatized by that incident, she cut off almost half of the penis of her sleeping husband with an eight inch carving knife during the same night.[3]

The gruesome incidence of gang rape of twenty-three year old girl in the capital city of India in December 2012 that shocked the whole country forced people of all ages from all around the world to protest against that ghastly incident and demanding justice for the victim, who lost her life after being brutally assaulted and gang-raped. Voices were raised by many that chemical castration as a punishment for sexual assault should be introduced in the country.[4] After that incident, a committee was constituted by the Government of India on sexual offences against women, and as per its report, mutilation of the body is not permitted under the Constitution and handing down the punishment of chemical castration would violate human rights.[5]

Castration, as a form of punishment, is known from ancient times. The Indian Vedic texts, such as Dharma Shastras and Dharma Sutras, talk about castration as a form of punishment for sexual offences such as adultery and rape. It becomes clear, while analysing criminal justice regimes around the globe, that

Scene of Crime Report:

The spot of occurrence was near a railway track. The dead body was lying in bushes around 100 feet away from the railway track. A motorcycle, which later on was identified to be of deceased, was parked near the track, 90-100 feet away from the dead body. Bloodstains, along with the blood spurting, were observed on the track and on the stones outside the track. Small bone pieces and flesh was observed scattered on the track. Bloodstains and blood stained drag marks were observed on the way at places, from the railway track to the spot, where the dead body was found lying. Head portion was totally smashed and without brain matter. Scratch marks were observed on the abdomen. The pant and underwear were found opened and down up to thigh. (Fig.2) Penis was observed to be cut with a sharp edged weapon. Cut portion was not found in the surroundings. The amount of blood was not much around the cut area. Two broken pieces of blade were stated to be found lying on the lower abdomen portion, which had been taken in possession by the police.(Fig.3)

castration as a punishment for sexual offences is not a new innovation.[6] Castration as a punishment of sex offenders has been in existence since the early 20th century in Europe. The first castration laws against sex offenders in 1929 was formulated by Danish, soon thereafter, Germany (1933), Norway (1934), Finland (1935), Estonia (1937), Iceland (1938), Latvia (1938), and Sweden (1944) followed similar laws.[7] Many studies on castration came from Germany (under the Nazi German Act of Nov. 24, 1933) and Denmark, who were the biggest proponents of castration.[7] In a recent instance, in one of the Indian city, the angry mob hacked off the penis of a man with a meat cleaver in butcher shop when he was caught attempting the rape of teenager in a cornered street. The mob did this as a punishment for a sex crime.[8] In a similar incident, a 78 year old man was bobbittised at Dubai in a fit of rage by his 26-year-old housemaid in recent past using a kitchen knife. The maid who was originally hired to look after the man was being sexually harassed by him for long.[9]

What was the motive behind the castration in present case is not known. But from the examination of the body and analysis of crime scene reports along with photographs, it can be presumed that mob might be behind the deceased who while crossing the railway track collides with moving train. As a result of that the deceased sustained fatal injuries over the head and thorax. After that, he was dragged and his

external genitalia were severed with blade which recovered from the lower abdominal portion of the body. The affirmative reason behind this unusual case of malice is still unclear. The crux is that castration is more about revenge out of sexual animosity. No women or person would castrate anybody unless threatened sexually.

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Fig 1: Groin area with amputated penis and scrotal with clean margins; stump of penis is visible



Fig 2: Pieces of blade recovered from scene of crime



Fig 3: Photograph from scene of crime depicting drag marks over front of the body with derangement of clothes around genitalia



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Ethics: A statement of the Ethics Committee Permission must be included in all research articles under the "Materials and Methods" section. Ensure confidentiality of subjects by desisting from mentioning participant's names, initials or hospital numbers,

especially in illustrative material. Authors should remove patients' names/ identifying features from figures unless they have obtained written informed consent from the patients. When informed consent has been obtained, it should be indicated in the article and copy of the consent should be attached with the covering letter.

The journal will not consider any paper which is ethically unacceptable.

Study design: The study design should be described in detail using standard methodological terms such as retrospective or prospective cohort study, case control study etc. Describe your selection of the observational or experimental participants clearly, including eligibility and exclusion criteria and a description of the source population. Technical information : identify the methods, apparatus (give the manufacturer's name and address in parentheses), and procedures in sufficient detail to allow other workers to reproduce the results. Give references to established methods, including statistical methods (see below); provide references and brief descriptions for methods that have been published but are not well known; describe new or substantially modified methods, give reasons for using them and evaluate their limitations. Statistical methods used for analyzing data should be described in detail. Avoid non-technical uses of technical terms in statistics, such as "random" (which implies a randomizing device), 'normal', 'significant', 'correlations', and 'sample'.

Results : Present your results in a logical sequence in the text, tables, and illustrations, giving the main or most important findings first. **Do not repeat in the text all the data in the tables or illustrations;** emphasize or summarize only important observations. Restrict tables and figures to those needed to explain the argument and to assess its support. Use graphs as an alternative to tables with many entries; **do not duplicate data in graphs and tables.** Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text.

Discussion : Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence. What this study adds to the available evidence, effects on patient care and health policy, controversies raised by this study; an future research directions.

Statements/ conclusions for which adequate data has not been obtained should be avoided, contributors should avoid making statements on economic benefits and costs unless their manuscript economic data and analyses. New hypotheses may be stated if needed, however they should be clearly labelled as such. About 30 references can be included.

Review Articles:

It is expected that these articles would be written by authorities who have done substantial work on the subject or are considered experts in the field. The prescribed word count is up to 2500 words (excluding tables, references and abstracts). The manuscript should have an unstructured Abstract (250 words) representing an accurate summary of the article. The section titles would depend upon the topic reviewed. Authors submitting review article should include a section describing the methods used for locating, selecting, extracting and synthesizing data. These methods should also be summarized in the abstract.

Case Reports : New interesting and rare cases can be reported. They should be unique, describing a medical challenge and providing a learning point for the readers. Cases with clinical significance or implications will be given priority. These communications could be of up to 1000 words (excluding Abstract and references) and should have the following headings : Abstract (unstructured), Keywords, Introduction, Case report, Discussion, Reference, Tables and Legends in that order.

The case reports could be supported with up to 10 references. Case Reports could be authored by up to four authors.

Letter to the Editor:

These should be concise and decisive observations. They should preferably be related to articles previously published in the journal or views expressed in the journal. They should not be preliminary observations that need a later paper for validation. The letter could have up to 300 words and 5 references. It could be generally authored by not more than three authors.

Other :

Editorial, Guest Editorial and Commentary are solicited by the Editorial Board.

References References should be numbered consecutively in the order in which they are first mentioned in the text (not in alphabetic order). Identify references in the text, tables, and legends by Arabic numerals in **brackets []**, just after the punctuation marks. References cited only in tables or figure legends should be numbered in accordance with the sequence established by the first identification in the text of the particular table or figure. Use the style of the examples below, which are based on the formats used by the NLM in Index Medicus. The titles of journals should be abbreviated according to the style used in Index Medicus. Use complete name of the journal for non-indexed journals. Avoid using abstracts as references. Information from manuscripts submitted but not accepted should be cited in the text as "unpublished observations" with written permission from the source. Avoid citing a "personal communication" with written permission from the source. Avoid citing a "Personal communications" unless it provides essential information not available from a public source, in which case the name of the person and date of communication should be cited in parentheses in the text. The commonly cited types of references are shown here, for other types of references such as newspaper items please refer to ICMJE Guidelines (<http://www.icmje.org> or http://www.nlm.nih.gov/bsd/uniform_requirements.html).

1. Standard Journal Article

It less than six authors, list all the authors.

Halpern SD, Ubel PA, Caplan AL, Solid-organ transplantation in HIV – infected patients. N Engl J Med. 2002;347:254-7

It more than six authors, list the first six authors followed by et al.

Rose ME, Huerbin MB, Melick I, Marion DW, Palmer AM, Schiding JK, et al. Regulation of interstitial excitatory amino acid concentrations after cortical contusion injury. Brain Res. 2002;935: 40-6

2. Books and other monographs

Personal author(s)

Murray PR, Ropsenthal KS, Kobayashi GS, Pfaller MA, Medical Microbiology. 4th ed. St.Louia: Mosby; 2002

Chapter in a book

Meltzer PS, Kallioniemi A, Trent JM, Chromosome alterations in human solid tumors. In : Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York : McGraw-Hill; 2002.p. 93-113.

Sending a revised manuscript The revised version of the manuscript should be submitted online in a manner similar to that used for submission of the manuscript for the first time. However, there is no need to submit the "First Page" or "Covering Letter" file which submitting a revised version. When submitting a revised manuscript, contributors are requested to include, the 'referees' remarks along with point to point clarification at the beginning in the revised fire itself. In addition, they are expected to mark the changes as underlined or coloured text in the article.

Proofs Proofs will be sent to the corresponding authors by email approximately 2 weeks before the publication date.

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