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From Editor's Desk

JIAFM

A Quarterly Publication

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I feel immense pleasure to present before you the Fourth issue of 2013. I would like to inform all of you that our esteemed Journal of Indian Academy of Forensic Medicine which is published quarterly since 1991 has been started gaining wide recognition not only in India but globally among the scientific community. I am trying to maintain your faith and trust in me to bring this journal to highest level of its achievements.

I have received many requests from other countries about inclusion of many papers in their indexing data base, including USA Government agencies. JIAFM is indexed not only in **IndMed** and **MedInd Indian indexing** agencies but also in the **SCOPUS**, **IMSEAR** informed by the **Information Management and Dissemination (IMD)**, **World Health Organization, Regional Office for South-East Asia, Indraprastha Estate, New Delhi, India**. It is hoped that once this journal indexed in IMSEAR it would be automatically indexed in the **Global Index Medicus** managed by WHO Headquarters in Geneva as informed.

The title mentioned above has been evaluated for inclusion in **SCOPUS** by the **Content Selection & Advisory Board (CSAB)**. The review of this title is now complete and the CSAB has advised that the title will be **accepted** for inclusion in Scopus. For your information, the reviewer comments are copied below:

This is a well produced journal in an important subject field with interesting content, which deserves a wide readership. The editors are to be commended on their efforts.

I assure you about the quality of research papers and quality of printing in future issues. Your valuable suggestions are always encouraging me and I heartily welcome for future suggestions.

Professor [Dr.] Mukesh Yadav
Editor, JIAFM

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Editorial

Re-Constitution & Composition of Democratically Elected Autonomous MCI

Quality of Medical Education & Healthcare depends on Quality of Decisions, which only Quality persons (Doctors, Medical Teachers) can take. Entry of Quality persons in composition and constitution of Apex Medical Education Regulatory Body i.e. MCI is possible only through participatory and democratically elected process in unbiased, uninfluenced, fair and transparent manner. Competent and experienced members, who are of high moral value and integrity is the need of the hour. Autonomy of professional's body can only be possible through its members who are acting with their wisdom without any influence of whatever nature. It is expected that elected members are able to take decisions in unbiased manner, keeping in mind the prime objective of quality of medical education and quality healthcare and above all the service of humanity.

Background of the Issue:

The Indian Medical Council Rules, 1957, Published in Part II- Section 3 of the Gazette of India, No.F.5-2/57-MI.Government of India Ministry of Health, New Delhi, Dated: the 16th April, 1957. The Central Government had made these rules, in exercise of the powers conferred by section 4 and 32 of the Indian Medical Council Act, 1956 (102 of 1956). Subsequently in the year 1980 and 1992 certain Amendments have been done to smooth conduct of elections and clarification of certain provisions related to constitution and composition of Medical Council of India. Amendments in 1980 were especially done to clarify the election of one member from the University having medical faculty.

Role of Central Government:

The Indian Medical Council Act, 1956 and the Rules of 1957 were made keeping in mind the responsibility given under Constitution of India, as the matter of medical education was falling in the Concurrent List. It is the responsibility of the Central Government to make effort and coordinate activities to remove difficulties in enforcement of provisions of the Indian Medical Council Act, for which it can make Rules and MCI can make Regulations with previous permission of Central Govt.

It is the responsibility of the Central Government to publish the name of elected medical faculty member, intimated by the Registrar of the University for Publication in the Official Gazette by Notification, after which it becomes public document. Recently published Gazette Notification for reconstitution of MCI on 5th November 2013 contains 68 members from elected and nominated category.

Appointment of Returning Officer for Election of President of MCI:

Appointment of 'Returning Officer' for the purpose of these rules and conduct of elections means any officer appointed as such by the Central Government for the purposes of these rules; this provision clarifies that it is the responsibility of the Central Govt. to hold/conduct elections for the Members of MCI in unbiased, uninfluenced and in fair and transparent manner. [Section 2(d)] Role of central Government has been further made clear by the para 25 of the Rules, 1957, which reads:

"Power to declare any election void: The Central Government may, **on objection made by a candidate for any election within a period of thirty days from the date of the election of the candidate, or of its own motive** at any time, declare the election to be void **on account of bribery, undue influence or other corrupt practice** which, in the opinion of the Central Government, has **interfered with the free and fair conduct of the election or for any other sufficient cause, and may call on the electorate to make a fresh election."** [Section 25(1)]

Sub-para (2) of the para 25 talks about the finality of decision of Central Government which reads as: "The decision of the Central Government under this rule shall be final." [Section 25(2)]

I am receiving many mails and phone calls on the conditions of confidentiality exposing irregularities and illegalities done in the conduct of elections (for reconstitution of MCI IN 2013) at University levels in the form of many bias, undue influences and unfair conduct of elections which are not transparent. Even specific provision made for 30 days time between intimation of notification for nomination and election and day on which actual election will be held.

There is no clarity whether a non-medical faculty working in a medical college (with M.Sc. qualification) will be allowed to vote or file nomination for election. Situation with regard to Private Universities is worst, as evident that their names were missing from the previous letter dated 14.06.2013

and Government on 27.08.2013 has issued separate notification for clarifying and declaring election conducted by the 'Deemed Universities as 'Null and Void'.

Indian Medical Register:

For any election in democratic organization eligibility of electoral and awareness of their right to exercise vote is mandatory requirement. To avoid ineligible candidate to contest elections or to be nominated, updated "Indian Medical Register" at the National Level and "State Medical Register" in each State having State Medical Council should be the first step in this direction.

It is the responsibility of the State Government to regulate the practice of medicine and have disciplinary control over the doctors registered with the State Medical Council and take timely action in the welfare of its subjects availing healthcare services. Mandatory Registration with the State Medical Council for contesting election through State Medical Council and University having medical faculty or nominated with consultation with State Government in that particular State.

Need for Code of Conduct:

In Delhi Medical Council election use of SMS or email or social media networking using indecent language and behaviour should be checked at all cost to maintain the nobility of the Profession. This indecent behaviour may amount to professional misconduct and unethical behaviour on the part of contestant and action may be initiated by the concerned State Medical Council or Medical Council of India on the written complaint with evidence, as the case may be. Even rules made by the MCI for student's election have detailed provisions for code of conduct than for election of MCI Members.

Role of Registrar:

Registrar of the University has duty to intimate name of elected person to the Central Government after conduct of election. Who actually vote to elect medical faculty whether 'members of the Senate' or 'members of the Court', as there was confusion on this point that only 'members of Senate / the Court' will use right to vote to elect a member of the medical faculty.

In many cases both contestant (medical faculty member) and members of the Senate/the Court do not know each other. In private universities where there is no transparency in the constitution of the Senate/the Court or not constituted and if constituted not revised as per the prescribed manner and no meeting held for years together. This is not a general election but to elect a body of professional experts who are going to decide the fate of medical education and healthcare of whole India.

Role of Members of the Senate of the University/Members of the Court /Vice-Chancellor of the University:

The members of the Senate of the University or in case the University has no Senate, the members of the Court shall **elect a member in such manner** as the Vice-Chancellor of the University may think fit. [Sec 4] this is the most controversial and wrongly worded clause or wrongly interpreted in holding the election or misusing for vested interests. This clause needs to be clarified to make election process uniformly throughout India. I have used Right to Inform to clarify this clause from the Ministry of Health and Family Welfare, Government of India through online RTI portal (www.rtionline.gov.in) on 23.10.2013. Response is awaited and hopefully we get answer if everything goes right within 30 days of my application.

Types of Universities:

1. Govt. University: A. Central Govt. University B. State Universities
2. Private University
3. Deemed to be University
4. Purely Medical University/Health Sciences University (e.g. Haryana, Punjab, Karnataka, Kerala, Maharashtra, etc.)
5. General University with Medical College as one of the either affiliated college or constituent medical college?

Depending on the type of university composition and constitution of members of the Senate /the Court will change, with reference to whether they are medical faculty or non-medical persons. A university with many constituent /affiliated colleges other than medical college will have predominately non medical faculty as members of the Senate /the Court. How these non-medical members will be able to elect a member for expert body who has competence and knowledge about medical education and its complex requirements. It is important in view of large Private Universities coming up with Private Medical Colleges and many of them are general university and not health universities only (whose majority members are medical persons). Purpose of Election for Membership of MCI u/s 3(1) (b) should be election of medical

faculty to be elected by medical faculty in the better interest of Quality of medical education and healthcare.

Need for Redrafting and Amendment in the Rules for Election:

Need for true participatory nature of the MCI especially under section 3(1) (b): to be elected by the Medical Faculty not by Members of the Senate or Court of the University (If they are non-medical persons, Registration in State Medical Council should be mandatory).

True meaning of Democracy means Government of the People (Doctors and Medical Faculty in case of MCI, an Autonomous Body), for the People (Doctors and Medical Faculty, their interests are at stake) by the People (by Doctors or Medical Faculty, because it is a specialist based professional organization need to discuss and take decisions on complex issues for the welfare of the people of India).

There is need for redrafting of rules in changed circumstances. Law is dynamic and it changes with time and demands of the society for the welfare and protection of society. There is need to understand that what was the purpose of provision for different category of members of MCI i.e. elected members and nominated members. Following questions need detailed deliberations:

- Whether nominated members by the Central Govt. (Category) or Nominated in consultation with State Government can be Non-Medical Person?
- What are the criteria for their nomination in terms of manner of nomination and in terms of Qualification and Experience?
- Who (which authority of the Central Govt.) will initiate the process of nomination and in what manner so that it will be in the better interest of Quality of Medical Education, the object for which the Indian Medical Council Act, 1956 has been enacted?

There is need for transparency and fairness in every process whether election or nomination of member is concerned. If election it should be unbiased and uninfluenced, especially in cases of Private Medical Colleges and Private Universities.

There is need to see whether any “**Conflict of Interest**” is involved or not in terms of election /nomination process or members so elected /nominated in decision making by the MCI during permission given for UG /PG Courses. On the other hand checks and balances needed to avoid any situation of misuse of power against any private management of medical colleges or Private universities.

Why there was need for Elected Members from State Medical Council?

This provision was made probably for following reasons:

- To give representation to hear their voice in cases unnecessary harassment whenever there is a complaint of unethical practices or medical negligence cases.
- To give representation to the private practitioners.

What was the purpose of Nominated members in consultation with State Govt.?

- To give equal representation and making MCI representative body for different States of the India
- To make regional balance and make it truly representative in character.

Fairness of Elections and Transparency in Holding Elections:

Do anybody can think that Registrar of Private University (Returning Officer under section 4a) has power to conduct unfair, unbiased and uninfluenced elections where persons/voters (Chancellor, Pro-Chancellor, Vice-Chancellor, Pro-Vice-chancellor, and members nominated by the Chancellor, all are above in hierarchy to Registrar as per the Organogram of the University) exercising vote against /or favour of any faculty members and we will still call these elections as unfair, unbiased and uninfluenced elections, where everything happening at the mercy of the private management without following principles of natural justice.

Is this not mockery of the democratic process of elections in reconstitution of the Medical Council of India? There is urgent need to think on these issues and rules for election of MCI Members should be redrafted keeping in the mind current scenario and circumstances prevailing after privatization of medical education in India, otherwise result will be disastrous in long run with irreparable losses to Quality of Medical Education and Quality of Healthcare.

In Gazette notification dated 5th November 2013 many Vice-Chancellors have been shown as elected members; even Chairman of Private Medical Colleges has been made elected members in complete violation of “Conflict of Interests” and university rules. Let see the consequences in future of this undemocratically elected so called Autonomous MCI, entrusted with Quality of Medical Education in India.

Dr.Mukesh Yadav
Editor, JIAFM

Original Research Paper

Head Injuries Sustained by Children Due to fall from Height: A Comprehensive Study

*Manoj Kumar, **Munawwar Husain, *Saadia Saeed, *M. Fakhru Huda, ***Jawed A. Usmani

Abstract

The objective of this study was to identify the pattern of head injuries in victims of fall aged 0-10 years and its correlation with height. This prospective study was done at JNMCH, Aligarh, on 173 patients who came to the casualty during a 12-month period (January 1, 2011 to December 31, 2011) sustained a fall from a height ranging from 0-9 feet. Male: female ratio was 1.5:1. Most of the falls (150 cases, 86.71%) were from a height of 6-9 feet. Out of 173 cases, skull fractures were seen in 144 cases (83.24%) and intracranial injuries occurred in 118 cases (68.20%). The most common fracture was linear undisplaced fracture and was observed in 126 cases (126/144; 87.5%) and the most common intracranial injury was extra-axial bleed seen in 70 cases (70/118; 59.32%). The severity of injury was strongly correlated with height of the fall.

Key Words: Head injury, Children, Paediatric group, Height of fall, Skull fracture

Introduction:

A fall from height is one of the external causes of unintentional injury. It is coded as E880-E888 in International Classification of Disease-9 (ICD-9) and as W00-W19 in ICD-10. Falls are extremely common and responsible for many serious and fatal injuries every year.

The primary impact is usually the site of the most severe injury. If the body falls on to the head, there is likely to be a massive fracture. [1] According to the laws of physics, the more is the height of fall, the more will be the amount of kinetic energy acquired during the fall ($K.E. = 1/2 mv^2 = P.E. = mgh$), and the more severe will be the resulting injury due to striking on the ground with a greater momentum.

Fall related deaths ranked as the twelfth leading cause of death among 5 to 9 years old. [2] Falls from short heights do not typically produce clinically significant injuries. [3] Falls were classified as low (<15 feet) or high-level (≥ 15 feet) and it was concluded that risk of intracranial injuries is same in both cases. [4]

In the age group of 0-11 months, maximum injuries (27.4%) were caused due to fall from furniture. [5] Skull fractures in infants, who have thinner cranial bones, may result even from short falls (≤ 3 to 4 ft). [6, 9] The typical skull fracture caused by a short distance fall is single, narrow, linear and located in the parietal bone.

An accidental fall onto an object or against an edged surface from less than 5 feet can result in a depressed skull fracture in a young child. [7, 8, 14, 16] The risk of fall injury increased 2-3 fold for equipment more than 2m high. [10, 11] and 41.18% cases presented with calvarial skull fracture without intracranial haemorrhage and 35.29% cases presented with intracranial injuries after fall from height. [12, 13, 15] This study was aimed at analyzing the pattern of head injuries sustained by fall from different heights and their relationship, if any, to age and gender.

Material and Methods:

This study was carried out in Department of Forensic Medicine in collaboration with consultant in-charge of Neurosurgery and Casualty section of the hospital. It consisted of 173 cases of head injury due to fall from height in children aged 0-10 years who came to the casualty of the JNMCH, Aligarh, for treatment and later referred to higher centres for further treatment between the period from January 2011 to December 2011.

The information about the patients admitted was obtained from the Department of Neurosurgery and then epidemiological features and injury characteristics were entered on a

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predesigned proforma, from the medico-legal case sheets of the patients prepared and maintained by the consultants concerned. In this study we had not included the Head injury cases due to fall from height brought dead i.e. death on the spot or died on the way to hospital, discharged from the casualty after first aid, Incomplete, missing case sheets and LAMA or absconded cases.

Observations and Results:

In our study, maximum number of the cases (150 cases, 86.71%) fell from a height ranging from >6-9 ft. (Table 1) Most of the cases of skull fractures (86.67%) were seen in falls from height of >6-9 ft. and 87.5% of total fracture cases were of linear undisplaced fracture. (Table 2)

Present study showed that Frontal bone fracture was the most common fracture in falls of >6-9 ft height (44/130, 33.85%) followed by parietal bone fracture (27/130, 20.77%). (Table 3) Out of total 173 cases Intracranial injuries were seen in 118 cases (68.21%), out of 118 cases extra-axial bleed was seen in 70 cases (59.32%), subarachnoid bleed in 24 cases (20.34%) and contusion in 53 cases (44.92%). (Table 4) Frontal lobe was the most common part of the brain injured.

21 cases (21/59, 35.59%) of extra-axial bleed, 7 cases of subarachnoid bleed (7/21, 33.33) and 18 cases (18/47, 38.30%) of contusion were seen involving frontal lobe in falls of >6-9 ft height. (Table 5)

Discussion:

Fall from height is responsible for many serious injuries every year but the severity is not directly related to height of fall. As falls occurred most commonly in school going age group, it causes a loss in the studies of a large part of victims of fall.

In the present study out of total 173 cases, maximum number of cases fell from height of >6-9 ft, comprising 86.71% cases. The age of the victims varied from 0-10 years.

0 year age was taken to be the age of 1 day. The peak incidence was observed in the age group 4-5 years comprising 16.76% of the cases. Out of those 29 patients, 27 fell from height of >6-9 ft which is in conformity to other studies. [3, 6, 8, 12, 13, 15]

The reason for the fall to be common in the paediatric age group is that in Aligarh (place of study) a good number of houses, especially of people in the lower socio-economic strata, do not have boundaries on their roof. Children engaged in recreational activities, like kite flying are at increased risk of falling from the roof in

such houses. Pre-school children are also at a risk of falling by either a lack of protective rails on beds, unprotected staircases, and easy access to roofs.

Falls from unprotected rooftops on which children play as well as sleep are common in both pre-school children and school going children.

Maximum number of cases of skull fractures (86.67%) were seen in falls from height of >6-9 ft and out of 144 cases (83.24%), in which a skull fracture is seen, 87.5% were of linear undisplaced fracture and the findings are consistent with the other studies. [7, 8, 14, 16]

The reason for the above is that almost all the cases in the study fell accidentally and on an unprojected surface resulting in a simple linear fracture of the skull except those who fell from stairs, some of those resulted in depressed fracture. In our study maximum the cases was of frontal bone fracture (33.85%) in falls of >6-9 ft followed by parietal bone fracture (20.77%).

This may be due to impact of the forehead on the surface after an accidental fall especially in the children who cannot refrain themselves to protect their head during falling.

In present study we observed that intracranial injuries were seen in 68.21%. Extra-axial bleed was seen in 70 cases, subarachnoid bleed in 24 cases and contusion in 53 cases out of 118 cases of intracranial injuries. Out of those 70 cases of extra-axial bleed, 84.29% were from falls of >6-9 ft height. Simultaneously 87.5% of subarachnoid bleed and 88.68% of contusion cases were seen in falls of >6-9 ft height. Cases of Pneumocephalous and cerebral oedema were also seen in this study.

Frontal lobe was the most common part of the brain injured. 21 cases (21/59, 35.59%) of extra-axial bleed, 7 cases of subarachnoid bleed (7/21, 33.33) and 18 cases (18/47, 38.30%) of contusion were seen involving frontal lobe in falls of >6-9 ft height.

Conclusion and Recommendations:

This study showed that no age group up to the age of 10 years was spared from being fall with a peak incidence in the age group 4-5 years. Male: Female ratio of 1.5:1 was observed comprising 104 (60%) males and 69 (40%) females. Skull fractures along with intracranial injuries were seen in most of the cases in different patterns which may result in lifelong disability. So there must be certain recommendations to prevent childhood falls.

Window guards, roof railings and stair gates should be present in the houses. Local authorities should be notified about open drains,

ditches and wells. Every hidden activity of the children should be under parental supervision.

There should be community-based injury surveys to obtain epidemiological data on fall injuries and then to organize educational and mass media campaigns for its prevention. To prevent long term disability and consequences of falls, acute care and rehabilitation should be available.

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Table 1: Cases According to Height of fall

Age Grps (yrs)	Cases According To Height Of Fall		
	0-3 ft	>3-6 ft	>6-9 ft
0-1	7	0	3
1-2	3	1	17
2-3	0	2	23
3-4	0	0	19
4-5	0	2	27
5-6	0	1	14
6-7	1	2	13
7-8	1	2	16
8-9	0	0	6
9-10	0	1	12
Total	12 (6.94%)	11 (6.36%)	150(86.71%)

Table 2: Skull Fractures

Skull Fracture	Cases according to Height of Fall		
	0-3 ft	>3-6 ft	>6-9 ft
Linear undisplaced fracture	8	6	112
Communated fracture	0	0	6
Depressed fracture	0	0	4
Communated + Depressed fracture	0	0	8
Total	8(66.67%)	6 (54.55)	130(86.67%)

Table 3: Skull Bone Fractured in Patients of fall from Height

Bones of Skull Fractured	Cases according to height of fall		
	0-3 ft	>3-6 ft	>6-9 ft
Frontal bone	1	1	44
Parietal bone	4	1	27
Temporal bone	0	1	19
Occipital bone	0	1	8
Frontal bone + Parietal bone	0	1	13
Frontal bone + Temporal bone	1	0	5
Frontal bone + Occipital bone	0	0	3
Parietal bone + Temporal bone	2	1	11
Total	8	6	130

Table 5: Part of the Brain Showing Intracranial Injuries as seen in CT scan (plain) of Head

Part of the brain	Cases of Intracranial Injuries		
	Extra-axial bleed	Subarachnoid Bleed	Contusion
Frontal lobe	21	7	18
Parietal lobe	7	5	9
Temporal lobe	6	3	3
Occipital lobe	4	0	3
Fronto-parietal lobe	2	0	2
Fronto-temporal lobe	10	2	4
Parieto-temporal lobe	7	4	5
Parieto-occipital lobe	1	0	2
Temporo-occipital lobe	1	0	1
Total	59	21	47

**Table 4
Intracranial Injuries**

Height of fall (ft)	Cases of Intracranial Injuries				
	Extra-axial bleed	Subarachnoid bleed	Contusion	Pneumocephalous	Cerebral oedema
0-3	4	1	2	0	0
>3-6	7	2	4	0	0
>6-9	59	21	47	18	12
Total	70	24	53	18	12

Original Research Paper

Gender Determination Using Fingerprints In the Region of Uttarakhand

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Abstract

This study was conducted with an aim to establish a relationship between sex and fingerprint ridge density in Uttarakhand. The fingerprints were taken from 250 subjects (125 males and 125 females) in the age group of 18-60 years. After taking fingerprints, the ridges were counted in the upper portion of the radial border of each print for all ten fingers, and mean value was calculated. The results have shown that a finger print ridge of < 12 ridges/25 mm² are more likely of male origin and finger print ridge of > 14 ridges/25 mm² are more likely of female origin. The study suggests that there are significant differences in epidermal ridge density between males and females and also support the hypothesis that women tend to have a statistically significant greater ridge density than men. This study will provide additional information for the fingerprint examiners in analyzing finger impressions and narrowing down an investigation involving a large number of samples.

Key Words: Fingerprint, Ridge's density, Sex, Personal identification, Uttarakhand

Introduction:

Fingerprints are unique to every single individual and are formed in the human foetus before birth. It does not change throughout life unless damage occurs to the dermal of the finger skin layer. [1]The patterns of fingerprints become fixed when a person is about 14 years or older. [2] Therefore, no two fingers are found to have identical prints even identical twins, which share the same DNA profile. [3]

Fingerprints of an individual have been used as one of the vital parts of identification in both civil and criminal cases because of their unique properties of absolute identity. [4]Fingerprints found at crimes scenes are important as valuable evidence. Fingerprint identification, can be referred to as individualization, identify individualized patterns that can be used to confirm or reject the association of a suspect with objects found at a crime scene.

In addition, judges put the higher value on such evidence like fingerprints than other physical evidence.

There are many features, which have been studied in fingerprints (ridge count, ridge orientation, etc.) in relation to various factors, but the thickness of a ridge is a feature which has not been studied in detail in relation to various factors of human populations. Gender is one such factor. Ridge's width influences the number of ridges present in a specified area of fingerprints, i.e. the epidermal ridge density.

Since 700 AD, this science of fingerprint has been used in the purpose of identification. [6] Chinese used fingerprints as official documents in 3000BC. [5] The system was first used in India in 1858 by Sir William Herschel to prevent impersonation, but the credit is given to Sir Francis Galton for having it systematized for the identification of criminals. His system was officially adopted in England in 1894, and was further modified by Sir Edward Henry. [5]

Afterwards, the studies have been conducted on fingerprint ridges, mainly its types, classification, methods of lifting fingerprints, recording of fingerprints and materials used to develop a fingerprint. Recently, many studies have been carried out on the method of storing fingerprints in computers for rapid search and matching of fingerprints around the globe, but very few studies are available for this aspect. Therefore, this study is planned to determine the sex from ridge density of fingerprints. Recently,

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a few researches have been carried out on this aspect of fingerprints. [6]

All of these papers have reported higher epidermal ridge density in females as compared to males. Again, this study is also planned to find out such differences in finger ridge density in both sex in Uttarakhand populations because no work on the difference in finger ridge density for sex identification has been reported among this population until now.

Material and Method:

The study was conducted on 200 subjects (100 males and 100 females) in the year 2012-2013. In this study, the subjects were chosen randomly in the age group of 18-60 years from the state of Uttarakhand (Northern part of India) and point of the study was Dehradun (capital of Uttarakhand state).

Subjects with any physical deformity (congenital / acquired) or any previous trauma, which leads to any deformity to any finger, were excluded from the study.

There was no special attempt to choose the subjects, they were chosen on the basis of stability and cooperative nature. The materials used in this study were black ink, horseshoe lens, transparent film strip, pencil, and Performa.

The verbal consent of all the subjects was obtained after properly explained about the objectives of the intended study to them. Before taking fingerprints, the subjects were asked to clean their hands to remove dirt and grease. For collection of fingerprint, fingerprint card is used, keeping in mind the need to minimize possible technical sources of the dimensional artifacts.

The prints were taken with the fingers applied with regular pressure on the Performa. In this way for every single individual, the entire prints of ten fingers were prepared. After taking fingerprints, the upper portion of the radial border of each print was chosen as an area for the data collection because all fingerprint pattern types showed a similar ridge flow in this region.

In this selected area of the prints, epidermal ridges of both males and females were counted carefully within a square of 5mm x 5mm drawn on a transparent film fixed to the lens. [7] Counting started from one corner of the square to the diagonally opposite corner.

Some specific criteria were observed during the counting procedure such as the dots, which were not counted, and the handle of the fork and a lake was counted as two ridges (though lakes were hardly seen). Hence this value represented the number of ridges/25 mm square and would reflect the ridge density value.

The ridge thickness and the furrows are two important factors, which determine the density of ridges. After the ridge, counts were done for all the ten fingers, the mean value is calculated. This new value represented the approximate number of ridges for the particular individual. The significance of this value was determined. Specific comparisons of means were made, and calculations were performed using SPSS software on computer.

The likelihood ratio (LR) was calculated to obtain the probability inferences of gender, based on ridge density values. The likelihood ratio is based on Baye's theorem. [7]

$$LR = \frac{\text{Probability of given fingerprint originating from male contributor (C)}}{\text{Probability of given fingerprint originating from female contributor (C')}}$$

Results:

Present study showed that the males tend to have the lesser number of ridges compared to females with a maximum of 11 and 12 ridges, where nearly 77% of males fall into this category. Beyond 12 ridges, the number of males decreases rapidly and no male was found to have more than 15 ridges. On the other hand, female was found to have more ridges. The number of female's with 14 and 15 ridges (70%) was very high as compared to males. (Table 1)

The ridge density ranges from 11-15 ridges/25mm² in male and 11-16 ridges/25mm² in females. The analysis of variance (ANOVA) results show that males have significantly lesser density than females ($P < 0.001$). The mean value of ridge count for male was 11.9 and that of female was 14.8. (Table 2)

In this study the LR value tends to decrease in males and when we see the other LR value ($C1/C$) in females, it is found that it increases drastically from 14 ridges onwards. (Table 3)

Discussion:

Many studies have been conducted on ridge count but, mainly for race determination and genetic inheritance of ridge pattern. The present study has been conducted to broaden the horizon of ridge count, i.e. sex determination by finger print ridge density. This study demonstrates that there is a significant difference in the epidermal ridge density between males and females of Indian Origin in the Uttarakhand population, northern part of India. It shows similar trends in sex difference as the other studies over the past conducted on other races and region. It also shows that this trend is universal among all races.

The statistical analysis of LR (C/C^1) and the favored odds show that a ridge count of ≤ 13 ridges/25mm² are more likely to be of male origin. Posterior probability using the Baye's theorem and a ridge count of $\geq 13/25$ mm² are more likely to be of female origin. A print showing a count of ≤ 12 ridges/25 mm² will have a high probability to be that of male ($P=0.99$). Similarly a ridge count of ≥ 14 ridges/25 mm² will be more in favor of female ($P=1.0$).

In the past, many studies have been conducted on the finger print ridges with the idea of proving a gender difference in the finger print, but failed in the methodology. According to Reddy [8] the mean ridge count for males is 13.41 and that of female is 12.04. These figures were exactly the opposite of Acree. [7]

A similar study was done on males and females of American Negroes and Caucasian American by Plato et al. [9] Here again they found the mean ridge density in male is more than female. These results could be due to some defect in the counting method as there is no detail of the counting method.

Cummins and Midlo [10] have established proves that females do have the higher mean ridge count (23.4) than males (20.7). These values are higher than the present study. This may be because the number of subjects studied is less and due to geographical variation. Okajima [11] also found that fork index is higher in females than in male in fingerprints.

This again upholds the trend as in this present study. This observed trend of a difference between males and females of various populations may be similar. Studies have been carried out in the past on this very aspect of fingerprints. Cummins et al [12] established that males have coarser epidermal ridges than females. Ohler and Cummins [13] reported that males had a ridge breadth of 0.48 mm, whereas females have 0.43 mm, but none of them have included the furrow breadth.

This was taken into consideration by Moore [14], who reported a higher value of the ridge to ridge distance in males, and thus a lesser ridge density as compared to females, but he studied only 10 males and 10 females.

Thus, the present study supports the observation made by Moore. Based on the obtained results, it can be concluded that there are differences in epidermal ridge density between women and men, and they can be used to determine the gender of the donor. This study can be used as a sorting parameter in cases where there are a large number of fingers prints available in case work analysis.

The results from the study are quite encouraging and this ultimately would be helpful as a useful tool for the fingerprint experts either in the field of Forensic Science or law enforcement field. In fact, the aim of taking the study was to help the authorities concerned to minimize or restrict their field of investigation and concentrate on a particular gender.

This study has proven that there is an increased ridge density in female gender rather than male gender because of less coarseness of ridges. The study of sex identification by density is more specific and highly significant ($P > 0.001$).

Conclusion:

Identification by finger prints is infallible and now with the help with this study it will be further helpful to the fingerprint expert to direct their search to a particular gender and eventually the investigating officers would save time in nabbing suspects.

The present study was conducted in an attempt to describe the densities of epidermal ridges, and it has been successful for supporting the hypothesis that women tend to have a statistically significant greater ridge density than men. The results have shown that a ridge count of ≤ 12 ridges/25 mm² are more likely to be of male origin and that of ≥ 14 ridges/25 mm² are likely to be of female origin.

The outcome from this study is that women have more ridge density than men. This would be universally accepted when these types of studies would be carried out in other parts around the world.

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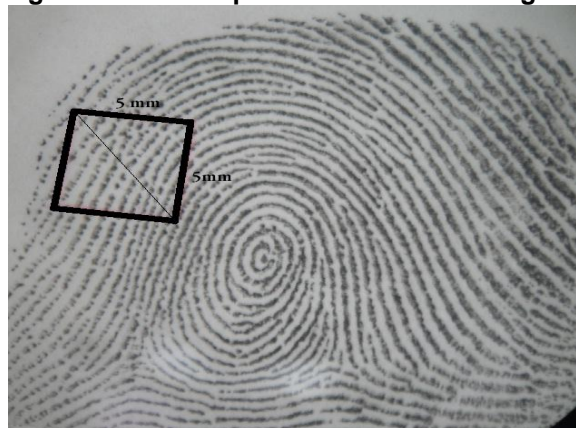
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Table1: Sex wise Distribution of Epidermal Ridges

No. of Ridges	Male (%)	Female (%)
11	49(39.2)	1(0.8)
12	48(38.4)	11(8.8)
13	16(12.8)	19(15.2)
14	10(8)	44(35.2)
15	2(1.6)	43(34.4)
16	-	7(5.6)
Total	125	125

Table 2: Descriptive Statistics of Ridge Density in both Males and Females

	Male	Female
Mean	11.9	14.1
SD	0.9	1
SE	0.088	0.095
Minimum	11	11
Median	12	14
Maximum	15	16

Fig. 1: The technique to count dermal ridges**Table 3****Probability Densities and Likelihood Ratios derived from Observed Ridge Count**

Ridge Count	Probability Density		Likelihood Ratio		Favoured Odds	
	Male (C)	Female (C1)	LR (C/C1)	LR (C1/C)	Males	Females
11	0.39	0.01	49.00	0.02	0.98	0.02
12	0.38	0.09	4.36	0.23	0.81	0.19
13	0.13	0.15	0.84	1.19	0.46	0.54
14	0.08	0.35	0.23	4.40	0.19	0.81
15	0.02	0.34	0.05	21.50	0.04	0.96
16	0.00	0.06	0.02	56.00	0.02	0.98

Original Research Paper

A Comprehensive Study on Homicidal Deaths in Hyderabad

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Abstract

Homicide is a serious crime committed against humans and its detection, solution and adjudication are important to the entire society. This study was therefore taken up, to estimate the incidence of homicides and to determine the trends in committing homicide. This was a prospective, observational study done on alleged homicide cases autopsied between July 2007 and July 2009. All alleged cases of homicides, other than those in which death was caused by rash and negligent act, were included. Data collected was expressed as proportions and/or percentages. Total autopsies done were 9248, of which 300 were alleged homicide autopsies (3.24%). Highest number of homicide victims was in the age group of 21-30 years (42.33%). In 69% & 61.3% of homicides, the assailant was a known person & blunt or sharp weapons caused injuries respectively. As most of the homicides were family centered, early detection and prevention is important.

Key Words: Homicide, Autopsy, Blunt & sharp weapon, Rash & negligent act

Introduction:

Murder of an opponent, for various reasons, is one of the oldest tools of power struggles from Stone Age. [1] Though homicide was there since Stone Age, its incidence and manner has changed a lot over decades.

Homicide is considered as one of the causes of mortality with the steepest social gradient. Nowadays, although the leading causes of death in numeric terms are cardiovascular diseases and cancer, the ranking of causes change significantly when age at death is considered, then, external causes such as unintentional injuries, interpersonal violence which result in homicide become equally and increasingly important. [2, 3] The increase is not only relative, as compared with other health problems, but also absolute.

Homicide is the 6th leading cause of death in the age group 15-29 years and 7th leading cause of death in the age group 30-44 years. Homicide was 21st leading cause in 2002 and is expected to become the 19th leading cause if present scenario continues. [4]

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Worldwide, an increasing number of people die of injuries or are disabled daily. [5] The consistent uptrend both in absolute number of homicides and in homicide rates reflects the general increase in all crimes of violence i.e., homicide, rape, armed robbery, aggravated assault etc. [6] Explanations for this can be found, among others, in the rapid macro-economic phenomenon of internationalization, urbanization, and motorization and their related consequences on people and communities, life styles and practices. [5]

The grave implications of homicide make its detection, solution and adjudication, a matter of vital importance to the entire society. When the society deals with a criminally violent death, it demands that the perpetrators be promptly identified and apprehended.

The failure of the police authorities is due to complexity of the circumstances & motives surrounding the fatal incident. Unlike other serious criminal offences, homicide is to a large extent an intimate, personal crime where the crime is committed by relatives, friends or enemies, only a minor number of homicides are "felony – homicides" and the least attributed to "homicides perpetrated by the state to maintain law & order. [6]

Many cases of homicides go undetected because of lack of suspicion and improper or unscientific investigation. This leads to miscarriage of justice and exerts an additional burden upon the Forensic Pathologist or autopsy surgeon in any given case.

India has earned the dubious distinction of being the country where maximum number of

murders takes place in the world, three times more than its neighbor Pakistan and double the figures in United States. Therefore homicide should be taken as a public health issue, and emphasis has to be laid on reliable data and surveillance mechanisms, so that we can bring a practical and simple approach to homicide prevention. This study was therefore taken up, to estimate the incidence of homicides and to determine the trends in committing homicide in cases whose post-mortem was conducted between 2007 and 2009 at Department of Forensic Medicine and Toxicology, Osmania General Hospital, Hyderabad.

Materials and Methods:

This was a prospective, observational study conducted at Osmania General Hospital, Hyderabad, after taking Institutional Ethics Committee approval. This study was done on alleged homicide cases autopsied at Osmania General Hospital between July 2007 and July 2009. All alleged cases of homicides, other than those cases in which death was caused by rash and negligent act, were included.

Relevant autopsy findings of these cases were taken for analysis. Further details were obtained from hospital case record, police record and inquest report. In certain cases, where further confirmation of data was required, visit to scene of offence was undertaken.

To know the motive behind the alleged offences, other particulars were obtained not only from police but also by direct interrogation with relatives, friends and others accompanying the deceased. Information on various factors involved such as age, gender, socio-economic status, pattern of homicide, place of incidence, assailant victim relationship, method and weapon used for killing, type of injury sustained, cause of death & whether hospitalized or not etc., were noted for each case in a separate proforma. In relevant cases, where poisoning was suspected as mode of death, final opinion was drafted from the toxicological report of the forensic science laboratory. Data thus collected was analyzed statistically and expressed as proportions and/or percentages.

Results:

In the 2 years of study period, the total autopsies done were 9248, of which 300 were alleged homicide autopsies (3.24%). The homicide autopsies were highest in the last six months of 2007 (4.62% of total autopsies done during that period). (Table 2) The identity of homicide victims was known in 89% of cases. Majority of unknown homicide victims were male (54.5%). (Fig. 2)

Of the total 300 alleged homicide cases, in 175 (58.33%) cases the victims were males and in rest of the cases the victims were female. (Table 1) Highest number of homicide victims (127 cases) was in the age group of 21-30 years (42.33%). (Fig. 1) 78% of homicides were observed in victims below 40 years of age.

Majority of homicide victims were married (65%). 54% of married and 72% of unmarried victims were males. (Fig. 2) With regard to socioeconomic status, majority of homicide victims were from lower socioeconomic strata (50%) (Table 1) and that related to literacy, 58.7% of homicide victims were illiterate. 81.3% of literates were males and the rest were females. (Fig. 2)

Out of the total homicide events, 47.7% occurred at house, of which 68.5% of the affected victims were females. Of the homicides reported to have occurred at places other than house and workplace (45.3%), 80.1 % of victims were males. Of the 7% homicides that occurred at workplace, there were no female cases reported. (Table 1, Fig. 2)

Of the total homicide events, 59% happened at night and 20.66% in the morning. 72% of affected victims were reported to have died at the spot and the rest at hospital. (Table 1) In 69% of the total homicides, the assailant was a known or family member of victim. In 20% of cases, the assailant was not related to victim. (Table 1, Fig. 3) In 35.4% of male homicides, and in 26.4% of female homicides, the motive was found to be quarrel. 8% of homicides were recorded as dowry deaths in which victims were only females. (Fig. 3)

In majority of homicides, the inflicting injuries were caused by blunt or sharp weapons (61.3%), followed by strangulation (13.7%). (Fig. 4) In majority of homicide victims, the cause of death was found to be head injury (26.6%) followed by stab injuries (23%). Poisoning as cause of homicide death was found in only 2 victims. (Fig. 4)

Discussion:

In our two year study, there was a decline in the number of homicidal deaths during the July 2008 - June 2009 when compared with July 2007-June 2008, even though there was a slight increase in the total number of autopsies.

The increased incidence of the homicidal deaths in the year 2007 may be attributed to terror related deaths (36 deaths) that have occurred during the month of August 2007. With waving of these deaths also, the actual homicidal incidence has shown a decrease from the year 2007 & 2008 to 2008 &

2009, which is an inviting figure, showing the change in the mind set of the people and improved law and order situation.

The percentage of alleged homicide autopsies was 3.24, similar to rates reported in Shiva Kumar study [1] and differed from a study done at Pakistan, [8] in which 78% were homicide cases which could be attributed to high incidence of homicides in Pakistan and in a study done at Delhi [8] the reported rates was 7.3%. In more than 50% of cases, the victims were males, which is similar to the rates reported in three retrospective studies. [1, 7, 8]

In this study, no age group has appeared to be safe from homicide; an increasing tendency was seen from childhood to middle age and a decreasing tendency from middle age to old age. Majority of the victims were from 21-30 yrs age group followed by 31-40 yrs similar to the incidence reported in 3 studies. [1, 7, 8]

The miniscule homicidal incidents in upper income group, with high incidence in lower and middle income group clearly shows to the monetary influence apart from emotional and environmental factors. Half of the homicidal incidents were in lower socio economic class, which clearly shows the influence of illiteracy, ineptness, insufficient income, inebriation & indecency which differed from findings of study done by Shiva Kumar, in which majority of victims were from upper income group.

Majority of the homicide victims were illiterate but this is in accordance to national literacy rates so doesn't reveal the influence of education on homicidal incidence. Therefore, reason and judgment appears to be more connected with personality rather than with academics. These results differed from study done by Shiva Kumar [1] in which 82.5% of alleged victims were literate.

With respect to marital status, if gender wise consideration of males and females in unmarried and married cases is taken, it is 1:2 and 1:4 respectively, that means the prevalence of getting murdered doubles up in males & quadruples in females after marriage. Only 6% of homicide cases were of unmarried females.

The preferred sites for homicidal attack were areas other than their house or work place in case of males whereas in females, the preferred site was their house. Only males were attacked to death at workplace. In case of victims who were murdered at house, the perpetrators were closely related and those attacked at workplace, the assailants were not related to the victims. The findings were similar in Shiva Kumar study. [1]

In our study, majority of homicides were committed at night when compared to daytime. Less than 1/3rd of the cases were alive, when brought to the hospital and who died subsequently while undergoing treatment. The brief survival period in majority of homicidal deaths casts doubt about the intention of the perpetrator and appears to be end result of an emotional act.

Quarrel, money matters and revenge were the main motivating factors in males; where as dowry demands & infidelity apart from quarrels were the main motivating factors in female gender which were similar to Shiva Kumar study [1] where enmity was found to be common motivating matter followed by financial matters. In our study leading cause was trauma by blunt force or sharp weapons, followed by strangulation and burns. Poison as a homicidal tool was rarely used, as it requires lot of preparation & pre meditation.

These findings were similar to those of Shiva Kumar study [1] where sharp weapons followed by blunt force was commonly used and also similar results were reported in study done by Behera in Delhi [8] but differed from a study done at Pakistan, [7] in which firearms were used in majority (85%) of cases, this may be attributed to easy availability of these weapons in that country.

Head injury was the leading cause of death followed by stab injury, strangulation, burns & multiple injuries. As head is the targeted & vulnerable area for infliction of blunt force in both the sexes. These findings differed from a study done at Pakistan, [7] where chest was the most commonly targeted area followed by head, this could be attributed to increased incidence of use of firearms in their study. In sharp force trauma apart from stab injuries to vital organs, cut throat injury also a preferred method for homicide in our study.

Conclusion:

As most of the homicides were family centered and between closely related family members, more importance should be given for early detection and prevention by establishing family counseling centers in the society. Importance of ethical and moral values should be taught to the children in school life, which will help in strengthening of human relationships.

Not only the law enforcement forces but every individual should feel responsible and help the state in the deliverance of criminal justice system. As most of the fatalities were brought to the medical attention, quick and improved response may prevent death. Intelligence

reports about mass attacks and quick response from law enforcement forces will be of help in preventing tragic terror attacks.

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Table 2: Total Number of Autopsies & Its Relation to Homicide Autopsies

Period	Total Autopsies	Homicide Autopsies (%)
JULY07-DEC07	2207	102(4.62)
JAN08-JUN08	2327	86(3.69)
JULY08-DEC08	2309	43(1.86)
JAN09-JUN09	2405	69(2.86)
TOTAL	9248	300(3.24)

Table 1: Different Parameters taken in the Study (Proportions/Percentage)

S. N.	Homicide Case Characteristics	
1	Total no of alleged homicide cases Total no of autopsies done	300 9248
2	Gender n (%) Males Females	175 (58.3) 125 (41.7)
3	Identity of case n (%) Known Unknown	267 (89) 33 (11)
4	Religion n (%) Hindu Muslim Christian Unknown	173 (57.7) 72 (24) 22 (7.3) 33 (11)
5	Socioeconomic status n (%) Lower Middle Upper Unknown	150 (50) 106 (35.3) 11 (3.7) 33 (11)
6	Marital status n (%) Married Unmarried Unknown	195 (65) 72 (24) 33 (11)
7	Literacy n (%) Literate Illiterate Unknown	91 (30.3) 176 (58.7) 33 (11)
8	Place of incident n (%) House Workplace Other	143 (47.7) 21 (7) 136 (45.3)
9	Duration of day n (%) Night Morning Evening Unknown	177 (59) 62 (20.7) 28 (9.3) 33 (11)
10	Assailant- Victim relation n (%) Related-I (Family members, relatives) Related- II (Neighbors, Friends etc.) Not related Not known	158 (52.7) 48 (16) 61 (20.3) 33 (11)
11	Place of death n (%) Hospital Spot	82 (27.3) 218 (72.7)

**Fig. 1
Gender Wise Age Distribution**

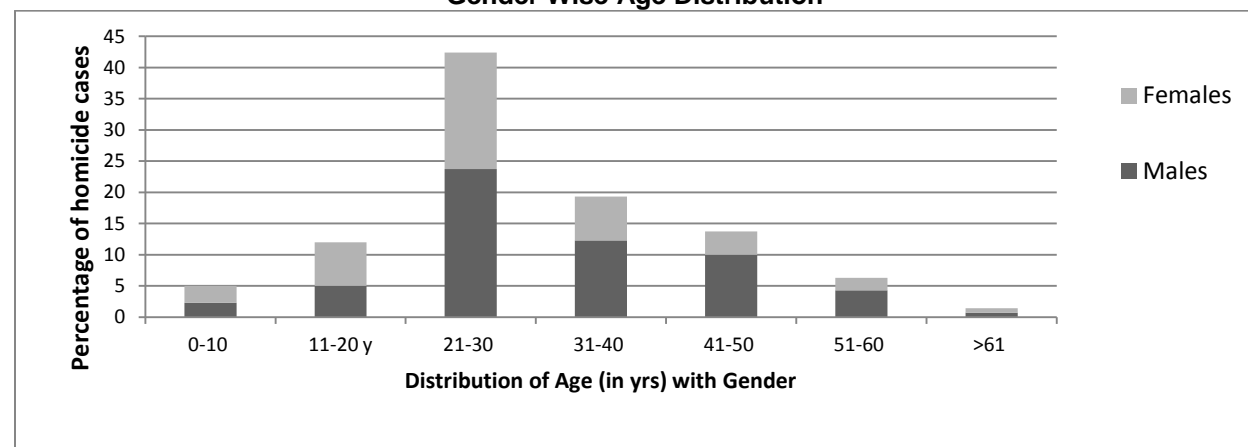


Fig. 2
Demographic Profile of Homicide Cases

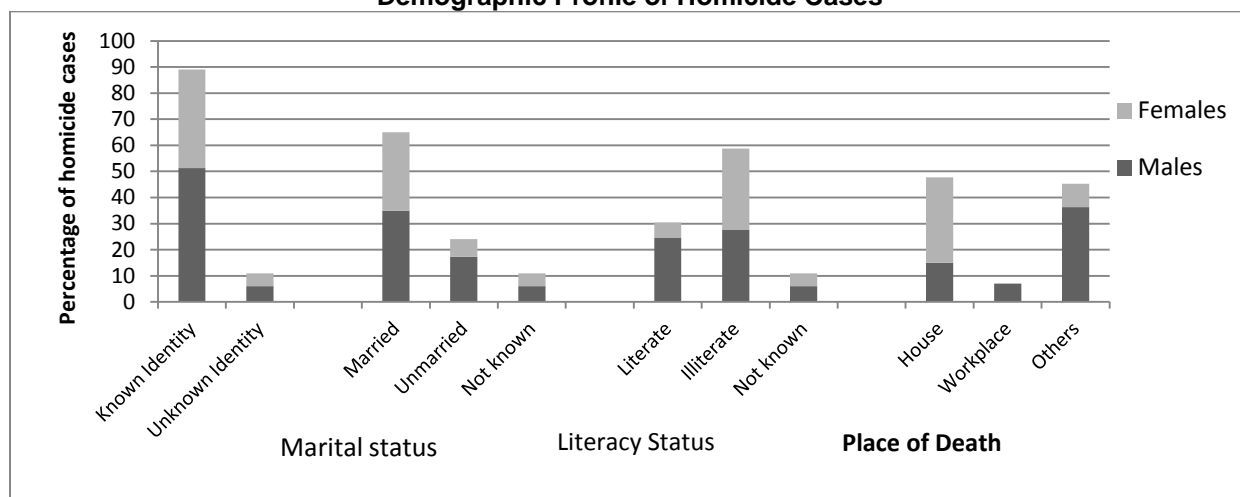


Fig. 3
Gender Wise Percentage of Assailant Victim Relationship & Motive

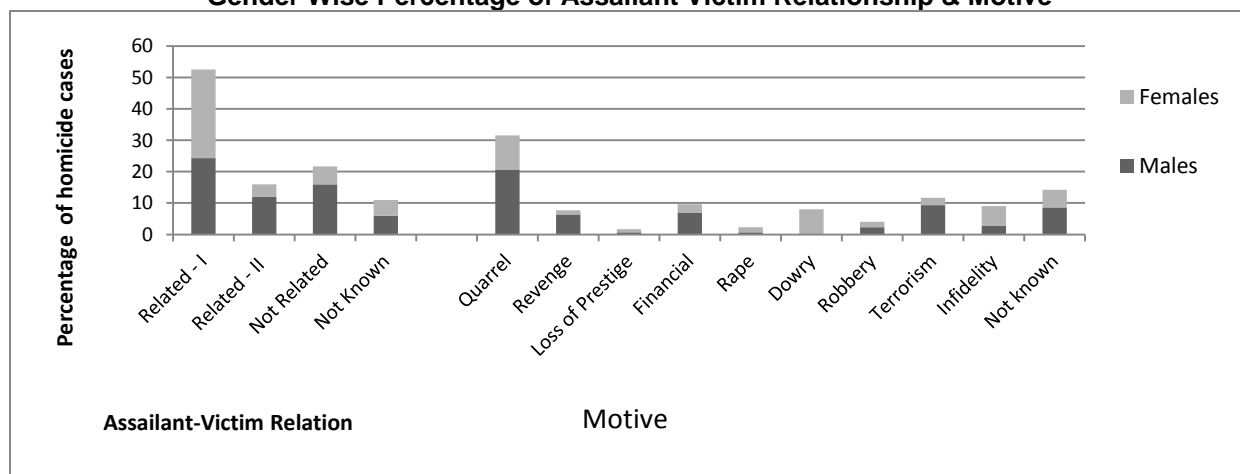
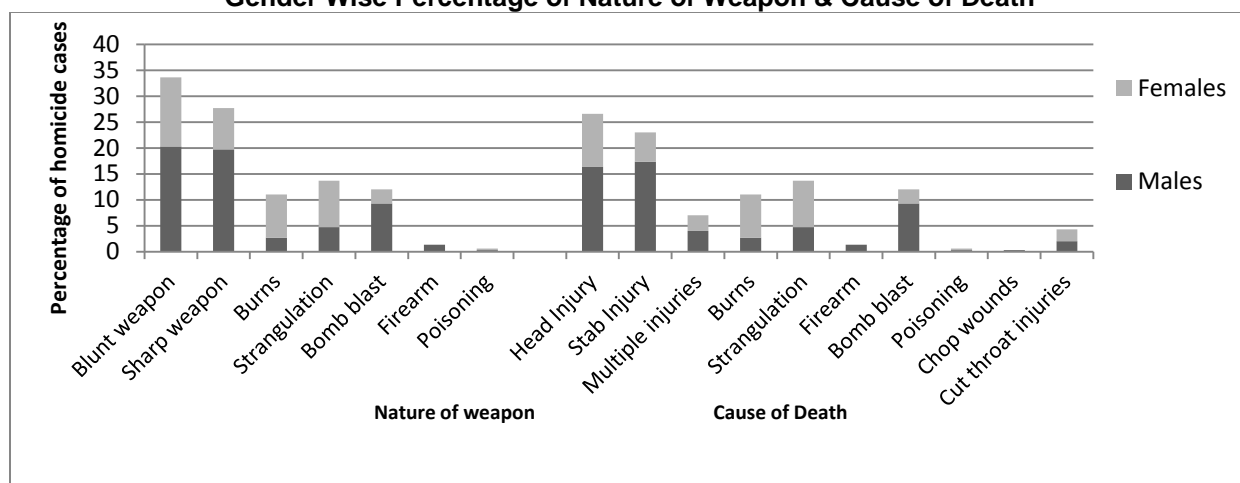


Fig. 4
Gender Wise Percentage of Nature of Weapon & Cause of Death



Original Research Paper

Analysis of Fatal Road Traffic Accidents in a Metropolitan City of South India

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Abstract

Road traffic accident (RTA), a cause of unnatural death is the third major preventable one amongst all deaths. Road deaths in India are publicly glaring, while road safety is professionally lacking and politically missing. A retrospective observational study was conducted in the Department of Forensic Medicine and Toxicology, Kempegowda Institute of Medical Sciences, Bangalore between January 2010 to December 2012, with an objective to study the demographic, injury profile and mortality pattern in autopsy cases with an alleged history of RTA and to draw public attention and awareness in order to prevent/control RTA. Out of 225 autopsied RTA victims, 55.11% victims were between 21-30 years of age, males constituted 78.22% of the total victims, and four wheeler vehicles were involved in 68.44% RTAs. Maximum RTAs occurred during the daytime, between 6 AM to 12 PM. Head injuries constituted 30.22% of the total injuries, followed by injuries involving abdomen, thorax and limb. Haemorrhagic shock caused 63.11% of deaths, while head injury caused death in 30.22% of cases.

This study emphasizes that interventions in RTA should include combined efforts from the community, public and private sector, governmental and non- governmental organizations.

Key Words: RTA, Autopsies, Injury, Demographic profile, Road safety

Introduction:

The health problems confronting Indian society have been changing significantly since economic liberalization and consequent globalization. The epidemiological transition, demographic changes and societal transformation have led to an increase in motorization during the last two decades.

The rapid urbanization, industrialization and migration along with other social changes have resulted in increasing necessity for travel across all age groups in the entire country. With poor public transportation systems and inability of people to afford cars, the personal modes of transport have increased across Indian cities and in rural areas. This increasing reliance on motor vehicles and motorcycles has also started influencing health of people in a significant way. [1]

Accident is an event, occurring suddenly, unexpectedly and inadvertently under unforeseen circumstances. [2] An accident that takes place on the road involving a vehicle is termed as road traffic accident. [3]

Each year, road traffic injuries take the lives of 1.2 million people around the world and seriously injure millions more. [4] Road traffic injuries are predicted to rise from ninth place in 2004 to fifth place by 2030 as a contributor to the global burden of diseases. [5] Nearly three quarter of deaths resulting from motor vehicle crashes occur in developing country. [3]

India accounts for about 10 percent of road accident fatalities worldwide, 85% of all road accident deaths occurring in developing countries, and nearly half in the Asia-Pacific region. [4]

Injuries due to RTA depend upon a number of factors-human, vehicle and environmental factors play vital roles before, during and after a serious RTA. The important factors are human errors, driver fatigue, poor traffic sense, mechanical fault of vehicle, speeding and overtaking, violation of traffic rules, poor road conditions, traffic congestion, road encroachment etc. [6]. Due to increasing population, and traffic of Bangalore, incidents of RTA are on the rise.

Bangalore city traffic police accident statistics reports a total of 755 deaths and 4475

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people injured in the year 2012. However, a study in Bangalore reported that road deaths and injuries are underreported by 5-10% and more than 50%, respectively. [7] A population survey covering 20,000 households and 96,000 individuals from urban and rural Bangalore reported an annual RTA mortality rate of 240/million population, much higher than the figures reported by police statistics. [8]

The purpose of the present study is to describe the demographic and injury profile in autopsy cases with an alleged history of RTA, thereby drawing public attention and awareness in order to prevent/control Road traffic accidents.

Materials and Methods:

The study consisted of 1512 medico-legal autopsy performed in the Department of Forensic Medicine, Kempegowda Institute of Medical Sciences, Bangalore, Karnataka during the period of 3 calendar years (from 1st January, 2010 to 31st December, 2012). Out of total 1512 medico-legal autopsies, 225 were RTA victims (14.89%)

Necessary information for the study was gathered from Police, inquest report and dead body challan. Interviews of the relatives, friends, and neighbours of the victims were also taken separately to collect the data. In few cases adequate information could not be obtained and such cases were put under "Undetermined/Unknown group".

A detailed proforma for the purpose of recording history, epidemiological data and the details of injuries etc. was prepared for the filling observation of the present study. The information thus collected, was Statistical analysed.

Observations and Results:

During this study period, 1512 cases were brought for post-mortem examination out of which 225 (14.89%) deaths were due to road traffic accidents. (Table 1) The highest number of victims 124(55.11%) belonged to age group of 21-30 years. There were 92 (40.89%) male and 32 (14.22%) female casualties. Maximum sex differentiation was observed in the age group of 51-60 years with male and female ratio of 7:1 followed by 5.57:1 in 31-40 years age group. (Table 2) If we considered age group of 21-40 years, it showed more than 3/4th of total RTA victims (75.55%). The males outnumbered the females in totality and male to female ratio was 3.60:1. (Fig. 1)

In our study most of RTA cases 113(50.22%) were reported during the day time (6 a.m-12 noon) than of RTA cases 12(5.33%) reported during late in the night (12 AM-6AM). A

greater number of accident cases 117(52%) were registered in the winter. Most of accidents 139 (61.78%) took place in city and 103 (45.78%) & 74(32.89%) victims were belong to urban and semi urban area respectively. It was noted that site of primary impact in most of the cases was to the side (46.22%), followed by impact to the front of the body (43.56 %).

Amongst the 225 victims, more than two-third of victims died in the hospital (67.11%) and 23.11% of them died on spot whereas 9.78% succumbed en route to the hospital. It was also found that 52 cases (23.11%) were spot dead, i.e., died on the spot after sustaining injury and 66 cases (29.33%) succumbed to their injuries after 24 hours of hospital stay. (Table 3)

Present study showed that out of total 225 patients of RTA, 151(67.11%) was admitted in hospital for treatment. Amongst 151 victims, more than three-fourth of them underwent specific operative procedures (amputation, fracture reduction, ICD etc) and 18.54 % of the victims received general treatment. (Table 4)

In this study, four wheeler vehicles such as buses, tempo, car etc caused more than two-third of accidents (68.44%) of the total cases. The second major killer was the two wheelers (19.56%). In 6 cases, the offending vehicle could not be identified but it was clear that the victims died due to RTA. The pedestrians were the worst sufferers. A total of 101 pedestrians were killed. The next common category was motorcyclists, which accounted for 42.67% of the cases. (Table 5)

We observed that Injuries to two and more body regions (head, chest and limbs) were found in majority of cases (37.33%) followed by head injury 30.22% of the total number of cases. The cause of death was opined to be haemorrhagic shock in 142 cases (63.11%), followed by head injury in (30.22%).

Discussion:

India has 1% of vehicles in the world; but it accounts for about 6% of the total cases of unintentional injuries. In the present study, males constituted 78.22% and females constituted only 21.78% of the total victims. Males being the breadwinner in majority of family are exposed more frequently to outdoor work than females. This explains the involvement of maximum number of males in traffic accident deaths.

Age between 21-40 years was found to be more vulnerable to RTA. In a study from Maharashtra, maximum cases of RTA were

among males (83.20%), and in the age group of 20 to 39 years (51.20%). [11]

Least fatalities in older people of age 41-60 years and above (16.89%) was noted and it is due to more experience, more traffic sense, less tendency to take undue risks and remaining mostly indoor and leading less active life. Our findings were not in agreement with Gissane and Bull who observed higher incidence of RTA in persons above 60 years. [13]

Analyzing the time of RTA, it was found that, incidents were highest within 6 am-12 noon. The reason for this incidence is due to traffic rush at peak hours as most of the people head from their houses to the offices, colleges and business premises.

The highest number of RTA 117 cases, reported to the Medical College was recorded in the winter season followed by rainy season, 67(29.78%) cases. A possible reason to explain this could be that in these months, there are longer hours of darkness and poor visibility of driver due to foggy weather and poor reaction time due to extreme cold in winter season and due to rains. This is consistent with a study conducted at Ghaziabad. [10]

India is a South Asian developing country where poverty and unemployment push the people towards the urban area. In our study we noted a highly significant relationship between place of accident and residence of the victims. It was observed that incidents were more in city than rural areas with the victims mostly belonging to urban and semi-urban areas. This may be attributed to the process of rapid urbanization that has resulted in an unprecedented revolution in the growth of motor vehicle worldwide.

Poor enforcement of traffic safety regulation, inadequacy of health infrastructure, alcohol intake etc. has contributed significantly to the rise in number of cases of traffic accident deaths. Amongst 151 victims who were hospitalised, more than three-fourth of them underwent specific operative procedures and period of survival beyond 24 hours were noted in 29.33% of total number of cases. This shows the better accessibility and apt management of medical aid.

In our study, amongst the types of offending vehicle involved in RTA, four wheeler is observed to be the culprit. It reveals the reckless driving of four wheeler vehicle by untrained persons. An increase in the number of heavy motor vehicles (government city buses and others) and congested narrow roads contribute to the same. Similar findings were reported by Vorel F et al. [12]

Our study showed a majority of victims being pedestrians (44.89%). A few studies reported pedestrians as the majority of victims involved in RTA, as reported in our study. [9,11] This reflects the ignorance of traffic rules and traffic signal, talking over the mobile phones, lack of assessment of speed of the vehicle by the pedestrians and poor lighting of streets. Injury to two and more than two body regions (head, chest and limbs) were found in majority of cases (37.33%). On considering injury to one body region as the major cause of death, head injury cases outnumbered the rest (30.22%), as reported earlier by Chaudhary B L, et al. [11]

Conclusion:

Road traffic accident continues to be a growing menace, incurring heavy loss of valuable human resources, along with wastage of potential economic growth.

Interventions in RTA should include combined efforts from the community, governmental and non-governmental organizations. Political leadership, good governance and a reliable technical team are the key components.

Few recommendations for the better implementation of the same are as follows.

Separate provision for pedestrian walkways and safe pedestrian crossings is an effective, affordable and sustainable strategy, supplemented with designation of one-way streets, good street lighting, and traffic calming measures in high-risk areas. Creating public awareness by involving the local residents, schools and school teachers can also be sought.

Vehicular standards for the passenger-ferrying buses and trucks needs to be regulated as to the maximum passengers allowed, the materials used and about the safety provision to the passengers.

More importantly there should be legislation against drunken driving. Society should be involved in implementing many campaigns such as Motorcycle Helmet Campaign, Anti-Drunk-Driving Campaign etc. Setting speed limits for all motorists is an effective strategy that protects all road users.

An efficient national injury surveillance system is essential for providing complete details of the RTA. The political leaders need to help formulate policies based on global agenda to reduce the road carnage.

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Table 1: Total Autopsies and RTA Victims in Study Period

Year	Autopsies	RTA Victims (%)
2010	444	70 (15.77)
2011	504	75(14.88)
2012	564	80(14.18)
Total	1512	225 (14.89)

Table 2: Age and Sex Wise Distribution

Age grps (yrs)	Sex		Total (%)	Sex Ratio
	Male (%)	Female (%)		
0-10	5(2.22)	1(.45)	6(2.67)	5:1
11-20	9(4)	2(.89)	11(4.89)	4.5:1
21-30	92(40.89)	32(14.22)	124(55.11)	2.88:1
31-40	39(17.33)	7(3.11)	46(20.44)	5.57:1
41-50	20(8.89)	5(2.22)	25(11.11)	4:1
51- 60	7(3.11)	1(.45)	8 (3.56)	7:1
> 60	4(1.78)	1(.45)	5 (2.22)	4:1
Total	176(78.22)	49(21.78)	225	3.6:1

Table 4: According to Type of Treatment in Hospitalized Victims (n=151)

Type of treatment in hospital	Frequency (%)
General	28(18.54)
Specific	123(81.46)

Table 3: Demographic profile of RTA Victims (n=225)

Characteristics		Frequency	(%)
Time	12 AM-6 AM	12	5.33
	6 AM-12 Noon	113	50.22
	12 Noon-6 PM	42	18.67
	6 PM-12 AM	58	25.78
Weather	Summer	41	18.22
	Winter	117	52
	Rainy	67	29.78
Residence	Rural	48	21.33
	Semi urban	74	32.89
	Urban	103	45.78
Place of accident	National highway	38	16.89
	City	139	61.78
	Village	48	21.33
Site of Impact	Front	98	43.56
	Rear	23	10.22
	Side	104	46.22
Place of death	Spot	52	23.11
	En route to Hospital	22	9.78
	Hospital	151	67.11
Period of survival	Spot death	52	23.11
	< 6hours	50	22.22
	6 hours to 24 hours	57	25.33
	>24 hours	66	29.33

Fig. 1: Sex Distribution

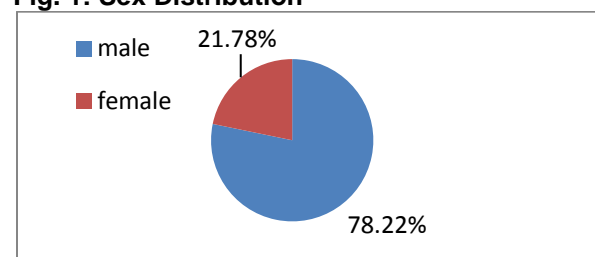
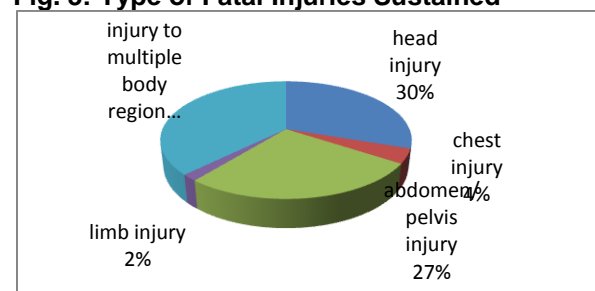


Fig. 3: Type of Fatal Injuries Sustained



**Table 5
Offending Vehicle and Type of Road User Killed**

Offending vehicle	Types of Road user Killed				
	Pedestrian	Bicyclist	motorcyclist	Occupant/Pillion rider	Total
Two wheeler	15	1	21	2	44
Three wheeler	7	-	9	5	21
Four wheeler	74	1	61	18	154
Undetermined	5	1	-	-	6
Total	101	03	96	25	

Original Research Paper

Teaching Methods and Its Efficacy An Evaluation by the Students

*Shreemanta Kumar Dash, **Shubhramsu Patro, ***Basanta Kumar Behera

Abstract

The study was undertaken to elicit the perception of the MBBS students of KIMS, Bhubaneswar regarding the prevailing system of teaching methods, to evaluate the extent to which they are benefited by these & to obtain the views and suggestions of students about various aspects of the current medical education. 337 students were selected from 4 semesters for this study. A set of questionnaires were put and directed to choose the appropriate option as per the likert scale. The response were collected and analyzed. 51.83% of the total respondents agreed that topics during normal lectures are interesting, 77.02% stated normal lecture as the most effective method of teaching followed by group discussion 68.02%. 67.07% are of the view that the faculty members are having good communication skill and 62.96% of them found that the faculty members are approachable, 82.83% of the participants agreed that black board teaching as the better mode of teaching, so also 55.87% agreed that audio visual aids as a useful mode of teaching, 56.10% of the participants agreed that the number of practical (clinical) classes should be more than the theory classes.

Key Words: Teaching Method, Evaluation, Communication Skill, Audio-visual aids

Introduction:

In the last two decades, the importance of teaching evaluation has been emphasized in higher education. Many Medical Schools have searched for ways to effectively and constructively evaluate performances of their faculty members. [1-3] Teaching evaluation has been used to provide diagnostic information for teachers on specific aspects of their teaching to help them improve their performance.

The teaching evaluation system depends primarily on the student evaluation of teachers and courses, and peer faculty reviews. Indian medical education system has seen rapid growth in the last two decades. From a miniscule number, private Medical Colleges have grown to account for more than half of the all Medical Colleges of India in 2011 and consequently, India has the highest number of medical educators in the world.

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To enhance successful communication, medical teachers are increasingly using teaching-learning media. It is well known that the students learn when they are involved actively in learning than when they are passive recipients of instruction. [4] Active learning strategies can be designed to target visual learners through models and demonstrations, auditory learners through discussion, debates, games and kinesthetic and tactile learners through models and role playing.

There is very little documentation of the effectiveness of various active learning strategies, and often faculty are reluctant to incorporate such new strategies into the teaching curriculum. [5] There has been a growing concern among medical educators about the quality of medical graduates trained in medical colleges in our country.

Several committees have recommended restructuring of the undergraduate curriculum so as to address the health needs of the community and the country. Unfortunately, significant changes are not taking place for various reasons. [6]

Objectives:

The present study was undertaken to elicit the perception of the MBBS undergraduate medical students of Kalinga Institute of Medical Sciences, Bhubaneswar regarding the utility of the prevailing system of teaching, to evaluate

the extent to which the students are benefited by these teaching methodologies & to obtain the views and suggestions of students about various aspects of the current medical education.

This study will help to promote the science and art of teaching of medicine and the betterment of the public health through improved teaching and training of medical students so also to

- Identify and implement strategies for effective lecturing/teaching.
- Identify the critical elements that define a good lecture.
- Identify issues of professionalism in students and colleagues and respond effectively.
- Use information resources to encourage development of critical thinking in students.
- Provide appropriate and constructive feedback to students in the clinical setting

Materials and Methods:

The four semester MBBS students (2nd, 4th, 5th & 7th) were selected for the study. A total of 337 respondents were selected by random sampling from the total student strength of 400 after having obtained their informed consent. Permission was granted by the appropriate authority, that medical students could be approached and asked if they would take part in the study. The questionnaire devised for the present study consisted of twenty questions with five options each.

Participants were asked to anonymously indicate the degree to which they agreed with each statement on a Likert scale ranging from 1 to 5 (1 = strongly disagree to 5= strongly agree) using a self-administered questionnaire. The students were instructed to pick the option to each question which they felt was most appropriate. The respondents were also encouraged to furnish their independent and unbiased opinion regarding certain other aspects of teaching methods, suggestions for improvement and any other remarks in suggestion paragraph of the questionnaire.

The participants were instructed not to provide any personal information, nor to reveal their identity in the questionnaire. Further, the students were discouraged to put in writing any individualized comment about the faculty members or their way of teaching. The completed response sheets were collected and statistically analyzed to compute the results using Microsoft Excel.

Observations and Results:

Three hundred thirty seven students participated in the "Evaluation Process". It was observed that a few students did not attempt

some of the questions, whilst in some cases, as expected; more than one option was ticked were not considered for calculation. In the observation it is found that 51.83% (n=326) of the total respondents agreed to the fact that topics covered during normal lectures are interesting. When asked about the preferred method of teaching 77.02% (n=322) agreed that the normal lecture as the most effective method of teaching followed by group discussion 68.02% (n=319), tutorials 58.94% (n=319) and seminars 49.05% (n=323). (Table 1)

In response to the question that the teaching faculties are making the lectures interesting, only 43.96% (n=323) of the participants agreed to it, while 32.82% of the participants kept themselves away from the discussion by putting tick mark over the undecided or neutral column.

About the communication skills of the faculties, 67.07% (n=328) of the respondents agreed that the faculties are having good communication skill and 62.96% (n=332) of them agreed that the faculties are approachable and clarifying the doubts as & when required. (Table 2) Discussing the reason for absence of students from the classes it is observed that 42.18% (n=320) of the participants agreed that the teaching method is not interesting, 46.94% (n=311) of the respondents disagreed to the point that the lessons can be learnt from the text books or internet even without attending the classes and about timing of the classes.

55.24% (n=315) of the participants did not agree to the point that class timing as a factor for absence of students from the class rooms, asked about their attitude 44.80% (n=308) of them disagreed that careless attitude as a reason for absence of students from classes. (Table 3)

Responding to the questionnaire in relation to the teaching modes and methodologies 82.83% (n=326) of the participants agreed that black board teaching as the better mode of teaching, so also 55.87% (n=324) agreed that audio visual aids as a useful mode of teaching and only 51.85% (n=324) of them agreed to the point that the teaching faculties are well versed with the rational use of audio visual aids as effective tool for teaching. Replying to the questions about the duration of teaching hours, 56.10% (n=328) of the total participants agreed that the number of practical classes should be more than the theory classes. (Table 4)

About the most preferred method of evaluation, the participants preferred the methods of evaluation in the following order,

multiple choice questions 88.18% (n=313), brief notes 85.31% (n=313), short notes 77.02% (n=309), and a combined form of all types 78.80% (n=316). (Table 5)

Discussion:

An evaluation made by students can provide the teacher with useful feedback information, obtained through informal mutual communication or preferably by a designed questionnaire. Many psychometric studies have revealed the validity and accuracy of students' opinion as well as their close correlation with 'objective' measurements of the instructor's effectiveness. [7] The many biases which were earlier ascribed to the student evaluators have mostly proved to be of negligible importance. [8]

Therefore the present study has been designed in the form of a questionnaire with the objective to elicit the perception of the students regarding the utility of the prevailing system of teaching and to evaluate the extent to which the students are benefited by these methodologies.

The present study indicates that half of the total participants expressed that the topics covered during normal lectures are not interesting as the faculties are not able to make the lectures interesting.

The reason for this may be attributed to the fact that many of the faculties in KIMS are not exposed to NTT Programme and are lacking the skill to make the topics more palatable. Reason for absence of students from the classes, the participants pointed out that teaching method of faculties as a major factor.

Though there is adequate availability of audio visual aids in the lecture theaters of KIMS and most of the faculties are availing the facility for teaching but the students felt that black board teaching a better mode of teaching in comparison to others.

At the same time participants suggested that the teaching should be done by both black board and audio visual aids which correlates with the study done by Kaushik Bhowmick et al. [7] Audio visual aids can be effectively used to show the photographs and the animated pictures related to the topics taught.

Reason behind reluctance of the students to accept audio visual aids a better mode of teaching may be due to that the faculties who are using the audio visual aids are not well versed with the rational and effective use of the tools. One reason for this could be ignorance regarding the advantages of computer assisted learning (CAL).

In one study by Bhavsar et al, [9] on the use of CAL it was pointed out by the authors that

a large number of students expressed the advantages of CAL and that if properly introduced, CAL can go a long way in teaching undergraduate medical students in future. Regarding the distribution of teaching hours for theory and practical (clinical) classes most of the participants preferred for allotment of more hours for practical / clinical teaching which matches with the observations in the study conducted by Garg, A. et al. [10]

About the evaluation methods, most of the participants expressed multiple choice questions as preferred method of evaluation might be due to the trend amongst the students for the preparation of post graduate entrance examinations from 1st Professional MBBS onwards.

Conclusion:

Thus, it may be concluded from the present study that the feedback from the students had facilitated a change in the preconceived notions about teaching learning principles on the part of the faculty. This result can be used in planning teacher training and designing teacher-training programs.

Planning for effective faculty development programs that are to be tailored to teachers needs about their ability to guide students' learning. We hope that this paper will encourage other faculty to work with their students in establishing what the students' preferred and least preferred teaching styles are and the reasons for it.

This will provide data that can be discussed by staff with the knowledge that the information is provided by the students they teach and can be the beginning of the involvement of students in the learning process.

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Table 1
Methods of Teaching

	Strongly Disagree	Disagree	Undecided/Neutral	Agree	Strongly Agree
Topics covered during normal lectures are interesting (n = 326)	7(2.15%)	29(8.90%)	121(37.12%)	149(45.70%)	20(6.13%)
The method of teaching you feel more effective (a) Normal Lecture(n=322)	10(3.10%)	19(5.90%)	45(13.98%)	180(55.90%)	68(21.12%)
(b) Tutorial (n = 319)	22(6.90%)	45(14.10%)	64(20.06%)	140(43.89%)	48(15.05%)
(c) Group Discussion (n= 319)	16(5.02%)	35(10.97%)	51(15.99%)	118(36.99%)	99(31.03%)
(d) Seminars (n = 314)	31(9.87%)	47(14.97%)	82(26.11%)	107(34.08%)	47(14.97%)

Table 2
Opinion about the Faculty Members

	Strongly Disagree	Disagree	Undecided/Neutral	Agree	Strongly Agree
The faculties are approachable and helping to clarify the doubts (n= 332)	27(8.13%)	50(15.06%)	46(13.85%)	133(40.06%)	76(22.90%)
Faculties are having good communication skill (n=328)	3(.92%)	36(10.98%)	69(21.04%)	177(53.96%)	43(13.11%)
Faculties are making the lectures interesting (n= 323)	10(3.10%)	65(20.12%)	106(32.82%)	119(36.84%)	23(7.12%)

Table 3
Reasons for Not Attending Classes

Reason for staying absent from the classes	Strongly Disagree	Disagree	Undecided/Neutral	Agree	Strongly Agree
Teaching method is not interesting (n = 320)	26(8.12%)	76(23.75%)	83(25.95%)	90(28.12%)	45(14.06%)
Lessons can be learnt from the text books / internet (n=311)	43(13.82%)	103(33.12%)	47(15.11%)	90(28.94%)	28(9.01%)
Timing of the class is not appropriate (n= 315)	67(21.27%)	107(33.97%)	69(21.91%)	50(15.87%)	22(6.98%)
Careless attitude (n= 308)	52(16.88%)	86(27.92%)	68(22.08%)	65(21.10%)	37(12.02%)

Table 4
Medium of Teaching & their Application

The method of teaching you feel better	Strongly Disagree	Disagree	Undecided/Neutral	Agree	Strongly Agree
Black board Teaching (n = 326)	7(2.14%)	23(7.05%)	26(7.98%)	117(35.89%)	153(46.94%)
Audio visual aid Teaching (n=324)	26(8.02%)	39(12.03%)	78(24.08%)	120(37.04%)	61(18.83%)
Faculties are well versed with the usage of Audio Visual Aids (n=324)	16(4.94%)	65(20.06%)	75(23.15%)	146(45.06%)	22(6.79%)
The duration of practical(clinical) classes should be more than theory classes (n=328)	29(8.84%)	59(17.99%)	56(17.07%)	115(35.06%)	69(21.04%)

Table 5
Pattern of Evaluation

The method you feel better way of evaluation	Strongly Disagree	Disagree	Undecided/Neutral	Agree	Strongly Agree
Long Essay Question (n = 309)	47(15.21%)	87(28.15%)	74(23.95%)	83(26.86%)	18(5.83%)
Short Essay Questions (n = 309)	7(2.26%)	18(5.83%)	46(14.89%)	185(59.87%)	53(17.15%)
Brief Notes(n= 313)	6(1.92%)	12(3.83%)	28(8.94%)	182(58.15%)	85(27.16%)
Multiple choice Questions (n= 313)	9(2.88%)	12(3.83%)	16(5.11%)	116(37.06%)	160(51.12%)
A combined form of all the above (n = 316)	7(2.21%)	16(5.07%)	44(13.92%)	123(38.92%)	126(39.88%)

Original Research Paper

Age Estimation from Distal End of Tibia Epiphysis

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Abstract

Identification of an individual, whether living or dead can be done by many techniques. Age estimation of living is one of the most important issues for the courts as well as for the medicolegal experts. The identification of a living person is based on known finger prints, birth marks, characteristic gestures, movements, shape and other features of the teeth, eyes, hair or voice but these are susceptible to mistakes. Photographs and handwriting may also help in the identification of a living person. This significant oversight can lead to exclusion of persons of interest in a Forensic investigation.

The range of variation in epiphyseal fusion in Punjabi population has not been sufficiently established. The present study was undertaken on 100 individuals from Punjab (50 males and 50 females) between the age group of 16 to 25 years. Radiological examination of ankle joint was done to know the age at which epiphyseal fusion of the distal end of tibia takes place. The study showed that in males in age group 16-17 years, the centre appeared but no union occurred in three cases (30%), and in five cases (50%) complete union occurred. In all other age groups studied, complete union occurred in 100 % of the cases. In females, complete union of the epiphyses at distal end of tibia and fibula occurred in all the age groups studied.

Key Words: Epiphyseal fusion, X- ray, Age Estimation, Identification

Introduction:

The establishment of any person's identity, whether living or dead has been a challenging task since ages. More effective and accurate methods of personal identification are constantly being sought. The initial methods of personal identification involved verbal description of suspects and criminals.

It is claimed that the ancient Egyptians and some early Chinese civilizations applied painstaking approaches for describing the physical characteristics of wanted criminals and prisoners. The practice of branding some convicted criminal offenders was widespread in Europe, Asia and the Americans in the past centuries as means of permanent identification e.g. the rod 'A' was sometimes used to brand adulterer in colonial times.

The first scientific method of criminal identification was developed by Alphonse Bertillon of the Paris criminal investigations department in 1880. [1] The identification of a dead body is required in cases of fires, explosions, accidents, foul play etc.

Identification of a dead body victim often enables the police to trace the victim's movements, discover his background, talk to his friends and uncover his enemies. [2]

To narrow the wide age range union of epiphysis of bones in present study is done with the help of fusion of epiphysis in distal end of tibia. Age of each individual studied was confirmed from birth certificate, service record, driving license, passport, ration card or voter's card etc.

Material and Methods:

In present study, 100 cases were studied including both males and females. The cases studied were between age group of 16-25 years who were exposed to x-ray at Rajindra Hospital, Patiala.

Male and Female individuals were studied with age interval of two years and ten cases from each age interval were taken.

The cases were studied with the help of X-ray of ankle joint- antero-posterior view for distal end of tibia. Status of epiphyseal union was divided into following four stages (Table A)

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Table A: Stages of Epiphyseal Union

Stage	Appearance and fusion	Grade
I	Centre not appeared	A
II	Centre appeared but no union	+
III	Union started but incomplete	++
IV	Complete union	+++

Study has been carried out by Roentgenographic technique. The technique included standardization of -

1. Time of exposure
2. Positioning of the part
3. Distance of film from X- Ray tube and
4. Processing and time of developing the films.

Positioning of the Epiphysis during X- Ray:

Clark's radiographic technique (3) has been followed in this investigation

AP view for Ankle joint-

1. **Positioning of Patient and Film:** The patient should be lying supine or seated with support and with a small sandbag under the knees to allow slight flexion for comfort. A non-opaque pad under the tendo-calcaneus serves to prevent discomfort due to pressure of the heels on the couch.

The ankle is supported in dorsi-flexion and the limb rotated medially until the medial and lateral malleoli are equidistant from the film thus ensuring a clear joint space on the radiograph between tibia fibula and talus. A 90 degree angle block supported by sandbags is used to maintain the foot in position.

The film size should be large enough to include the lower third of the leg. The foot is placed so that its plantar aspect is at level with the lower edge of the cassette.

2. **Direction and Centering of the X- ray Beam:** Centre midway between the malleoli with the central ray at right angles to an imaginary line joining the malleoli.

Observations:

Present study showed that in males age group 16-17 years, in three cases (30%) centre appeared but no union occurred, in two cases (20%) union started but incomplete & in five cases (50%) complete union occurred. In age group 18-19 years, 20-21 years, 22-23 years, 24-25 years, in ten cases (100%) complete union occurred. (Table 1)

Our study showed that in females in age group 16-17 years, 18-19 years, 20-21 years, 22-23 years, 24-25 years, in ten cases (100%) complete union occurred. (Table 2)

Discussion:

Findings are close to Stewart [4] for epiphyseal union of distal end of tibia in males only while other studies are not in confirmatory with present study for male and female while KrishanVij [5] gave 16-17 years for both male and female individuals but in present study it is in confirmatory for females only. Age of earliest union findings are not in confirmatory with any other study. (Table 3)

In our study for males in 16-17 years age group five cases (50%) show complete union, in 18-19, 20-21, 22-23 & in 24-25 years age group ten cases (100%) show complete union. For females in all age groups 16-25 years all ten cases (100%) show complete union. (Table 4)

Conclusions:

Epiphysis of distal end of tibia fused in majority of cases at 16-17 years in both male and females. Earliest union occurred at 16 years in both male and female. Our findings are close to Stewart [4] for epiphyseal union of distal end of tibia in males only while other studies are not in confirmatory with present study for male and female while KrishanVij [5] gave 16-17 years for both male and female individuals but in present study it is in confirmatory for females only.

In case of age of earliest union, the findings are not in confirmatory with any other study compared with.

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Table 4: Age of Incidence of Complete Union

Agegrps(yrs)	Case Examined	Complete union (%)	
		Males	Females
16-17	20	5(50)	10(100)
18-19	20	10(100)	10(100)
20-21	20	10(100)	10(100)
22-23	20	10(100)	10(100)
24-25	20	10(100)	10(100)

Table 1
Incidence and Extent of Fusion of Distal End of Tibia in Different Age Groups for Males

Extent of fusion	Age Group (Yrs.)				
	16-17	18-19	20-21	22-23	24-25
	Cases (%)	Cases (%)	Cases (%)	Cases (%)	Cases (%)
Centre not appeared	0(0)	0(0)	0(0)	0(0)	0(0)
Centre appeared but no union	3(30)	0(0)	0(0)	0(0)	0(0)
Union started but incomplete	2(20)	0(0)	0(0)	0(0)	0(0)
Complete union	5(50)	10(100)	10(100)	10(100)	10(100)

Table 2
Incidence and Extent of Fusion of Distal End of Tibia in Different Age Groups for Females

Extent of fusion	Age Group (Yrs.)				
	16-17	18-19	20-21	22-23	24-25
	Cases (%)	Cases (%)	Cases (%)	Cases (%)	Cases (%)
Centre not appeared	0(0)	0(0)	0(0)	0(0)	0(0)
Centre appeared but no union	0(0)	0(0)	0(0)	0(0)	0(0)
Union started but incomplete	0(0)	0(0)	0(0)	0(0)	0(0)
Complete union	10(100)	10(100)	10(100)	10(100)	10(100)

Table 3
Comparison of Time of Fusion (in years) with other Authors [1, 4-8]

Author	Year	Race	Gender			Earliest Union(years)
			Male	Female	Mixed	Male/Female
Hepworth (7)	1929	Punjab (India)	-	-	16.5-17.5	
Pillay V.V. (8)	1936	Madrassies (Indian)	-	-	14-17	-
Galstaun (6)	1937	Bengalis (Indians)	16	14.1-14.4	-	-
Stewart (4)	1973	U.S.A.	Above 18	-	-	-
Parikh (1)	1990	Indian	-	-	16-18	-
KrishanVij (5)	2001	Indian	-	-	16-17	-
Present study	2001	Punjab (Indian)	18-19	16-17	-	M = 16, F = 16

Original Research Paper

Blunt Injuries of Abdomen in Warangal Area An Analytical Study

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Abstract

Injuries to the abdominal viscera, caused by blunt trauma, are particularly common in civilian life. The blunt trauma differs from penetrating trauma, as the different organs are characteristically injured by compression from blunt straining. The solid organs such as spleen, liver, kidney, pancreas, etc., are the most vulnerable, while the hollow viscera like stomach, intestines and bladder are less likely to be involved. The outstanding features of injury to solid organ are the haemorrhage and shock, while in hollow visceral injury shock follows with the development of peritonitis. The aim of this study is to analyze the pattern of visceral injuries in blunt abdominal trauma, and find out the cause of death and preventive measures.

The present study was undertaken on 55 victims who died due to blunt abdominal injuries which were autopsied at Kakatiya Medical College mortuary Warangal during the 2012. This study shows that number deaths due to blunt abdominal trauma is more in young males than others. Major cause for this is RTA. Majority of victims shows liver injury next is spleen. Maximum number of deaths occurred within 6 hours due to haemorrhagic shock.

Key Words: Blunt abdominal trauma, abdominal organs, Haemorrhage, Shock

Introduction:

Since prehistoric times, the abdomino-pelvic cavity has been looked upon as one of the most vulnerable regions of the body and injuries involving it have always been considered very serious. As early as 460 BC, Hippocrates was aware of the danger to life caused by injury to liver and spleen.

Blunt abdominal trauma is one of the leading preventable causes of the unnatural death in developed and developing countries. [1] In civilian life 75% of abdominal trauma is non penetrating injuries.

Blunt trauma is particularly deceptive as the clinical manifestations of the injury may be delayed for hours or days even though internal damage is serious and sometimes lethal.

In open cases of abdominal trauma the clinical manifestations, diagnosis and management will be easier but closed cases of abdominal trauma offers a great challenge to the treating surgeon.

Sometimes it may escape detection or lead to an error in diagnosis; from medico-legal point the same is true with autopsy pathologist where in closed cases of abdominal trauma, the autopsy findings may sometime be trivial, complex and frustrating. The anatomic abnormalities may be difficult to interpret the mechanism of death, may require a lengthy explanation. The object of this paper is to make a comprehensive study of abdominal injuries in blunt trauma. Blunt traumata are caused by the force, a form of energy. [2-4] Application of blunt force to human target create a variety of injuries ranging in severity from trivial to massively destruction. These heterogeneous lesions fall into two major groups. [5]

1. "Closed" includes bruises (or contusions), hematomas, simple fracture and visceral lacerations. [6]
2. "Open" includes scratches, abrasions, lacerations and avulsions, and compound fractures. [6]

Causes of Blunt Abdominal Injuries:

Road traffic accidents, Warfare injuries, Battering, Fall from Heights, Sports accidents, Martial arts, Athletics, Mountaineering etc. [2, 5]

Two sets of factors, endogenous and exogenous, determine the types and degree of visceral damage sustained when blunt force traumatizes the abdomen. [7]

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- **Endogenous Determinant in Blunt Abdominal Trauma:**

Significant intrinsic factors, which help to determine the outcome of blunt abdominal injury, reside in the viscera and their vasculature. The former comprises organs and tissues, whose morphology, configuration, location and supporting structures confer on them widely differing degrees of vulnerability to this modality of violence. [5]

Solid organs (e.g. liver and spleen) are more readily lacerated by blows than are such hollow organs as the (empty) stomach, intestines, and (empty) urinary bladder. [5] Readily moveable or displaceable organs have considerable capacity to absorb the force of a blow, without serious injury, because of their ability to 'ride with the punch'. Thus a blow to the abdomen or compression less readily damages normally attached ileum and jejunum than the fixed retroperitoneal duodenum.

The more distended a hollow viscus, the greater is its vulnerability to externally applied blunt force. A stomach filled with food and drink or a urinary bladder bulging with urine are more readily torn by a blow to the epigastrium or suprapubic region respectively than that when either is empty or only partially filled. [5]

- **Exogenous Factors:**

Exogenous factors which influence severity and nature of visceral lesions resulting from violence includes: [5]

- i. Size and consistency of the traumatizing object, e.g. first, foot etc.
- ii. Site of impact, e.g. epigastrium, hypochondrium, inferior rib cage, suprapubic area, costovertebral angle, flank, etc.
- iii. Speed and weight (force or energy) of the traumatizing object.
- iv. Nature of the traumatizing force, e.g., sharp impact or slow compression.
- v. Strength of the abdominal wall.
- vi. Degree of abdominal "guarding" i.e., extent of protective contraction of abdominal musculature.
- vii. Pre-existing visceral status.

The blunt force injuries of the abdominal organs are divided into (1) Injuries of the parenchymatous viscera and (2) injuries of the hollow abdominal viscera and their attachments. [8, 9]

1. The Parenchymatous Viscera:

The most important organs in this group are the liver, spleen, kidneys, and pancreas. Since ordinarily their consistency is firm, they are not easily ruptured by blunt force. They are also protected by bones like the ribs or are

located deep in the abdomen, so that they are not easily reached except by severe violence. The principal complication, which causes death in injuries of the parenchymatous organ, is haemorrhage into the abdominal cavity. [2, 5]

2. The Hollow Abdominal Viscera:

The hollow abdominal viscera, including the gastrointestinal tract, the urinary bladder and the pregnant uterus, are injured by the same types of blunt forces as are the parenchymatous abdominal viscera, but the traumatic lesions which are produced and the complication which ensue, are characteristic and dependent on their anatomic structure and exposed position in the abdomen. The stomach, duodenum and contracted urinary bladder are fairly well shielded by the skeleton or by their position in relation to other structures, but the intestine and the distended urinary bladder are protected only by the anterior abdominal wall and are therefore vulnerable to violence applied to the lower abdomen. The structure of the hollow viscera is much more fragile than that of the parenchymatous organ and serious injury may be inflicted on them by a comparatively slight degree of violence. [10]

Complications of Abdominal Injury:

The most common fatal sequel to intra-abdominal trauma is haemorrhage from any of the contained organs. The spleen and mesentery tend to bleed most copiously and quickly, though even there can be a delay of many hours before serious symptoms are obvious, and in the case of sub capsular lacerations of the spleen the time can be far longer. The liver tends to ooze more slowly unless a major injury opens a large vessels or an extensive area of hepatic tissue.

Perforation of the gastrointestinal canal is another serious complication of trauma. As in natural perforated peptic ulcer, penetration of the stomach or duodenum will cause a chemical peritonitis that can be cause of severe and immediate shock, perhaps a major factor in a rapid death. In addition to infection, trauma to the intestines may cause an intractable ileus; if the pancreas is damaged there may be widespread fat necrosis in the mesentery and omentum. [11-13]

Materials and Methods:

The present study was conducted in K.M.C mortuary Warangal. Total 55 cases of deaths of all age groups and both sex from blunt abdominal trauma during 2012 were taken up for study. Death due to head injury, chest injuries where abdominal injuries are minor and badly

decomposed bodies where significant injuries were not visible also not included in this study.

Routine information like age, sex, occupation brief facts of the cases collected from the inquest report. Clinical history like time of admission, and deaths and other relevant data was collected from the hospital case sheets and death summaries. Pattern, nature of injuries, complications, cause of death and mechanism of death were obtained from a detailed follow up and study of the autopsy cases and reports. Finally all the data thus collected, compiled and presented in the tables.

Results:

The most likely person to have an abdominal trauma is a healthy young adult. Out of the 55 cases 27 cases were in the age group of 20 to 40 years (nearly 50%). There were only 10 cases below 20 years and 18 cases above 40 years. Males outnumber the female (9). (Table 1) Most of the injuries were due to road traffic accidents (35 cases). The next comes accidental falls (15%) from height like from trees, roof tops, and accidental falls during walking particularly in old aged group more so under the influence of alcohol. These constituted 15% of the deaths from blunt abdominal trauma.

Assault occupies a back seat only five cases are reported. (Table 2) Most of the deaths have occurred on spot or within 6 hours after sustaining abdominal trauma. In 24 cases (45%) death occurred within 6 hours. Out of 45% cases again in 50% cases death occurred on the spot only within a few minutes after sustaining injury.

In 80% cases death has occurred within two days after sustaining trauma. In the remaining 20% cases again 50% cases died within one week. So this indicates out of danger zone for hospital admitted cases is about 1-2 days and safety zone after about one week. (Table 3) In this study out of the 55 cases with significant intra abdominal injury, the commonest organ injured was liver with 35%, intestine 31%, and spleen 18%, Kidney and bladder 18% with relatively low accounting for stomach and omentum (7%).

In most of the cases multiple organ involvement was very common. Involvement of uterus in female cases was very rare. In all cases bladder involvement is seen in 9% cases associated with fracture pubic symphysis. (Table 4) Present study showed that out of 55 cases 50% had only abdominal injury and associated head injury was present in about 7% cases, chest in 17% cases, and fracture of extremities in 11% cases. It was noticed that about 18% had more than two system injury.

(Table 5) Internal Haemorrhage was commonest cause of the death (55%), followed by infection in 40% cases. Haemorrhage is more common with parenchymatous injury where death has occurred within 12 hours after sustaining trauma (53%). Infection is more common with hollow visceral injury where death is delayed. In males out of 46 cases haemorrhage is seen in 25 cases and in females in 5 cases, where as infection cases 18 cases are of males and four of females. Death due to shock from neurogenic shock or multi organ failure is seen in 3 cases out of 55 cases that is about 5%. (Table 6)

Discussion:

The most likely person to have an abdominal trauma is a healthy young adult. Out of the 55 cases 27 cases were in the age group of 20 to 40 years. 20-40 years age group people are active physically and socially, therefore they are more vulnerable for injuries than others. Number of cases below 10 years and above 50 years are less because most of the time they remains indoor only. Males are more in number (46) than female (9). It is due to greater exposure of males on streets and the personal and behavioural characteristics of males.

Most of the injuries were due to road traffic accidents (63%). The next comes accidental falls from height like from trees, roof tops, and accidental falls during walking particularly in aged group more so under the influence of alcohol (15%). Assault occupies a back seat only five cases are reported i.e., 9% of the total cases. The most outstanding feature is absence of female victims is assault group.

In most of the assault cases the trauma was inflicted mostly with hands and feet. In other group, 3 cases were reported where trauma was sustained due to accidental falls from bullock carts and being run over by the bullock cart wheel over the abdomen. Our findings in general are well supported by other workers in this field. [14, 15] In 80% cases death has occurred within two days after sustaining trauma. In the remaining 20% cases again 50% cases died within one week. So this indicates out of danger zone for hospital admitted cases is about 1-2 days and safety zone after about one week.

The present study showed that parenchymatous visceral injury is common than hollow visceral injury in both sexes (2:1). This is because consistency of parenchymatous viscera and hollow viscera has some capacity to absorb the force of blow. In most of the cases multiple organ involvement was very common.

Involvement of uterus in female cases was a rare phenomenon as it is strongly

protected by pelvic cage. In all cases bladder involvement is associated with fracture pubic symphysis. The most commonly associated part along with abdomen involved is chest due its close proximity with abdomen. It showed rib fractures and lung injuries. It was noticed that about 18% had more than two system injury.

Haemorrhage is more common with parenchymatous injury where death has occurred within 12 hours after sustaining trauma (53%). Infection is more common with hollow visceral injury where death is delayed.

The ratio of incidence between haemorrhage and infection is more or less common in both males and females. In males out of 46 cases haemorrhage is seen in 25 cases and in females in 5 cases, where as infection cases 18 cases are of males and four of females. Death due to neurogenic shock is more common in males because intake of alcohol increases the sensitivity and in females thick abdominal wall act as protective layer.

In this study it was observed that an increase in the time lapse before surgery adversely affected the prognosis of the patients in terms of both morbidity and mortality. Those patients who were operated within 24 hours of injury had a mortality of 4.4%, whereas if the operation was delayed further than 24 hours, mortality increased to 33.3%. Similarly early operation within 12 hours was associated with low morbidity of 20.7%. However, when the operation was further delayed, morbidity raise to 83.3% as the time mortality also proportionately increases.

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Table 1: Age Wise Distribution

Age group (Yrs)	Male	Female	Total (%)
0 to 10	03	02	05(9%)
10 to 20	05	00	05(9%)
20 to 30	13	03	16(29%)
30 to 40	10	01	11(20%)
40 to 50	09	01	11(16%)
>50	06	03	09(16%)
Total	46	09	55

Table 2: Nature of Violence

Type	Males	Females	Total (%)
Assault	05	00	05(9%)
RTA	30	05	35(63%)
Fall from height	06	02	08(15%)
Industrial	02	00	02(4%)
Others	03	02	05(9%)
Total	46	09	55

Table 3: Period of Survival

Period of survival	Males	Female	Total (%)
0 to 1 hours	10	03	13(24%)
1 to 6 hours	09	02	11(20%)
6 to 12 hours	04	01	05(9%)
12 to 24 hours	05	01	06(11%)
1 to 2 days	07	01	08(15%)
2 to 7 days	06	00	06(11%)
1 to 2 weeks	02	00	02(4%)
2 to 4 weeks	03	00	03(5%)
>1month	00	01	01(2%)
Total	46	09	55

Table 4: Abdominal Viscera Involved

Viscera	Cases (%)
Stomach	03(5%)
Omentum	01(2%)
Intestine	17(31%)
Mesentery	04(7%)
Liver	19(35%)
Spleen	10(18%)
Kidney	05(9%)
Uterus	00(0%)
Pancreas	00(0%)
Total	60

Table 5: Associated Injuries

Associated Injuries	Cases (%)
Head injury	04(7%)
Chest injury	06(17%)
Other bony injuries	06(11%)
Multiple	10(18%)
Abdominal injury alone	26(47%)
Total	52

Table 6: Mechanism of Death

Type	Male	Female	Total (%)
Shock Neurogenic(or)Visceral	03	00	03(5%)
Haemorrhage and Vascular	25	05	30(55%)
Infection	18	04	22(40%)
Total	46	09	55

Original Research Paper

Medico-legal Examination of Accused of Alleged Rape Cases A Prospective Study

*Shrikant Sidram Shinge, **Manish Baburao Shrigiriwar

Abstract

Sexual offences are the most heinous crimes against women. During examination of an accused of alleged sexual assault preservation of evidences is an important task. In India, owing to poor collection of medical evidences, conviction rate of accused is low.

This study aims at recording results of medical examination and knowing injury patterns of alleged sexual assault accused along with preserving proper medico-legal evidence. A consecutive series of 41 accused, were examined in the head-to-toe manner including genitals. Accused were referred from emergency department with proper requisition for examination by investigating police officer. After careful medical examination, samples were collected for chemical analysis. We concluded that most of the accused were young unmarried males from the age group 21-30 years. Fifty six percent accused were friend and 29.2% were known to the victim. Only about a fifth of them were presented for examination on the day of incident itself and none of them had evidence of any struggle injuries.

Key Words: Sexual assault, Medical evidences, Accused examination, Injuries

Introduction:

Among all the crimes, sex related crimes are most barbarous and humiliating. [1] Rape is considered to be the most obnoxious and gravest form of human right violation. [2] Ancient societies counted rape among the crime listed in their law codes and even Bible contains stories on rape. It is one of the most prevalent and fast growing crime affecting all nations in the world today. For decades, the crime of rape has been known as the easiest the world today.

For decades, the crime of rape has been known as the easiest criminal allegation to make by the alleged victim and the harder to disprove by the defendant. [3] Medical examination is a crucial piece of information which is required for collection of medical evidences, their documentation and interpretation in court. It becomes more valuable where there is no other witness to the incident. [4]

Many important legal reforms are underway but statistics show a persistent rise in rape incidence with poor conviction rates.

This knowledge, along with the vast multitude of emotional sequelae of rape and self-perceived inferior legal status of women, results in a high percentage of unreported cases. [5] It is imperative that health care providers understand the horrific nature of sexual assault in order to provide appropriate care. All medical care personnel involved in the care of potential rape victims should be briefed in historic and modern legalities of sexual assault.

Specific training in emergent and chronic care, both physical and mental, in conjunction with an understanding of rape legislation is vital if health care professionals are to appropriately care for victims of rape [5] Yet, there is no national sexual assault prevention program nor is there sexual assault crisis centre which provides early clinical evaluation and could give bio-psychosocial support to the victims.

The objective of this research work is to study accused of alleged sexual assault cases as under age distribution, marital status, relation with the victim, time interval between the act and examination, injury pattern over the body and genitals along with proper collection of medico-legal evidences.

Materials and Method:

The current study was carried out at Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical

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College, Nagpur, Maharashtra during September 2009 to October 2010. Forty one accused in alleged sexual assault cases were examined. A standard protocol was prepared which included all the relevant information such as preliminary details of accused along with identification marks, date and time of incident, age, marital status and relation with the victim.

An informed consent was obtained from the accused for medical examination. Detailed history was obtained from the accused person and the police. Cloth examination was done in the cases where time elapsed between incidence and examination was not more than 24 hours and without history of change of cloth. General examination including anthropometry, secondary sexual characters and local examination of the genitals was done.

Injuries, if any, over the body were noted. Materials needed for laboratory examination such as blood, pubic hairs, fingernail clippings were sent to the Regional Forensic Science Laboratory, Nagpur, Maharashtra.

Results:

Out of 41 cases studied, 24(58.5%) cases belonged to age group 21-30 years followed by 8(19.5%) cases from age group 31 to 40 years. The minimum age of accused was 15 years and maximum age was 54 years. (Fig. 1)

In this study 17(41.4%) accused were married and 24 (58.5%) were unmarried. Considering the relation of accused with the victim, the accused was a friend of the victim in 23 (56.09%) cases, 12 (29.2%) were known to the victim and 04(9.7%) were strangers. We had two cases where in the accused was a family member of the victim, father in law in one case and grandfather in the other. (Table 1)

In most of the cases the offender was single but there were two cases involving two accused. Out of 41 cases, 08 (19.51%) accused were examined within 24 hours of the incident and 23 (56.09%) cases were examined after six days of the incident. (Table 2) We found that out of 08 cases brought for medical examination within 24 hours of the act, none of them had any stain, foreign body or signs of struggle on their clothes. Injuries over the body of the accused were found in 22 cases. Most of the injuries were present on the extra genital areas.

Among them 08(36.3%) accused had injuries over lower limbs and 07 (31.8%) had injuries over upper limbs. (Fig. 2) One case had a tear over the penis at the coronal Sulcus of size 2.5 cm× 0.5 cm and subcutaneous tissue deep. (Fig. 3) All injuries were simple in nature.

None of the samples of the pubic hairs

collected for Forensic examination showed presence of foreign hairs, semen or spermatozoa, so also the analysis of the finger nail clippings of the accused was insignificant.

Discussion:

In 1993, the United Nations General Assembly resolved "that violence against women is an obstacle to the achievement of equality, development and peace, that violence against women constitutes a violation of rights and freedom of women, that violence against women one of the crucial social mechanisms by which women are forced into a subordinate position compared to men". [6]

In current study forty one cases of accused of alleged rape cases were studied. We found that 24 (58.5%) cases were from age group 21 to 30 years followed by 8 (19.5%) cases from age group 31 to 40 years. The youngest accused was 15 years old and oldest being 54 years. (Fig. 1) Sagar M.S. et al [7] in their study had 64% cases from 16 to 25 years age group and maximum age of the accused was 40 years. Sarkar S et al [2] study had 39% accused from 21–25 years age group.

The lowest age of the accused was 14 years and highest was 73 years. These findings are consistent with our study. This shows that sexually active males of younger age were most commonly involved in the act of sexual assault.

In our study out of 41 accused 17(41.4%) were married and 24(58.5%) were unmarried however Sarkar S et al [1] study had 86.32% unmarried and 13.67% married accused. The involvement of single unmarried males is more in such crime. As far as relation of the accused with the victim was concerned we found that in 23(56.09%) cases the accused was a friend of victim and 12(29.2%) accused were known to the victim.

There were only 4(9.7%) cases where the accused were strangers. There were two cases in record in which the accused was a family member of the victim, father in law in one case and grandfather in the other. Sarkar S et al [2] had 44.4% accused known to the victim, 30.76% accused were close friends and 18.80% accused were strangers to the victim.

In Lackew's Z [4] study 27% accused were neighbours, 42% were strangers and 6.5% were relatives of the victims. Sexual assaults by friends and persons known to victims are more common than from strangers. [8] The findings of our study are consistent with other studies. [2, 4]

Present study showed that the, only 08 (19.51%) accused of alleged rape were examined within 24 hours of the incident. As

many as 23 (56.09%) cases were examined when more than 06 days have elapsed since the incident took place. In Sarkar S et al [2] Study 10% of the accused was examined on the first day and 61.11% were examined after 06 days, which are similar to our study findings. The late reporting in this study is probably due to the stigma and taboo regarding sexual assault in this part of the world. Such an incident is taken as a blow on the family honour. The unfortunate victim first discusses it with her mother or other elder female. Further reluctance and thought goes into the incident before it is brought to the notice of the men of the house and here again delay occurs in decision making as reporting the incident amounts to making it public and an insult to the family. Long time after that it is reported to police and then the accused is searched for.

This delay in reporting the cases of sexual assault thereby resulting in loss of valuable Forensic evidence is one of the main reasons behind low conviction rates of accused. Examination of clothes is important when the accused has been brought for medical examination within 24 hours of the act or not washed his clothes. [3]

Out of 08 accused examined in this study within 24 hours of the act no one's clothes had any stain struggle signs or any foreign material. Considering the injuries over the body, in this study 22 accused had injuries over the body. Most of injuries were present over the extra genital areas i.e. lower limbs followed by upper limbs. (Fig. 2) All injuries were simple in nature and most of them were abrasions and contusions. One case had an injury over the penis as a tear at the coronal Sulcus, which might have occurred due to forceful sexual intercourse or disproportionate size of penis and vagina. Minimal struggle injuries may be due to the fact that 85.36% of the accused were acquainted with the victims implying that most of these acts were consensual.

Samples for Forensic examination were collected from all 41 accused of alleged rape and sent to the Regional Forensic Science Laboratory. None of the samples of pubic hairs showed presence of foreign hairs, semen or spermatozoa. Also the analysis of fingernail clipping of the accused was insignificant. Similar results with insignificant laboratory tests findings were found in Sarkar S et al [2] study in which only 0.85% of the samples were positive on analysis. Lugol's iodine test is done to detect the squamous epithelial cells from the vaginal epithelium which might be present on the glans.

But because of the possibility of exfoliation of glycogenated male cells and

transfer to the penile surface a Lugol-positive reaction in epithelial cells on penile swabs can no longer be assumed to prove the presence of vaginal cells. [9, 10] Out of 08 cases presented for examination within 24 hours of the incident; 02 cases had presence of smegma. Smegma accumulates if no bath is taken for 24 hours. [11] However; the absence of smegma is not necessarily a conclusive proof of the fact of recent intercourse having been committed. [11]

Conclusion:

Sexual violence is a tragedy, a serious human right violation and a significant problem. The biggest threat is not from the strangers but from the known persons and friends. There is a need for early reporting of these cases and early medical examination along with proper collection of Forensic evidence. Medical faculty should follow the protocol for examination and collection of evidence. There is a need for research on every aspect of the sexual assault.

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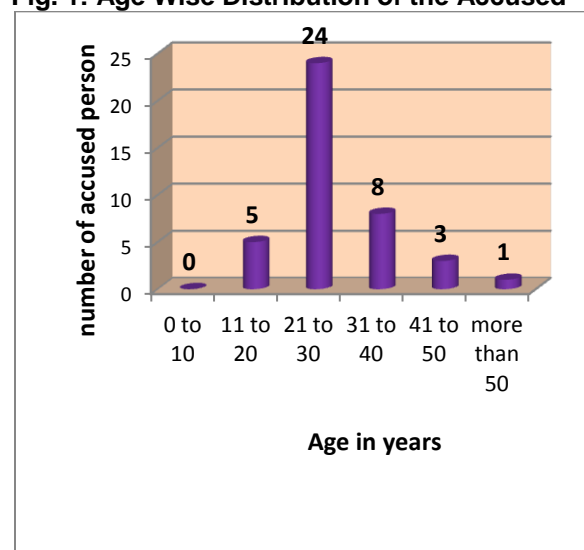
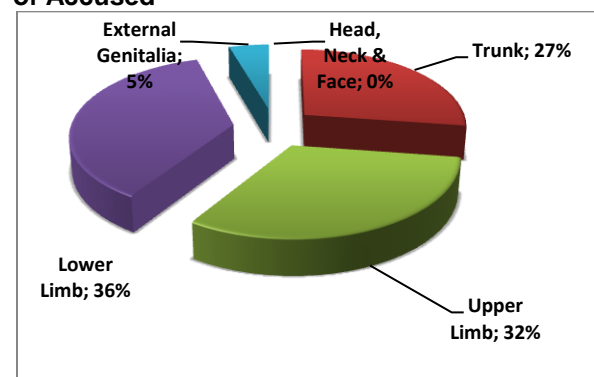
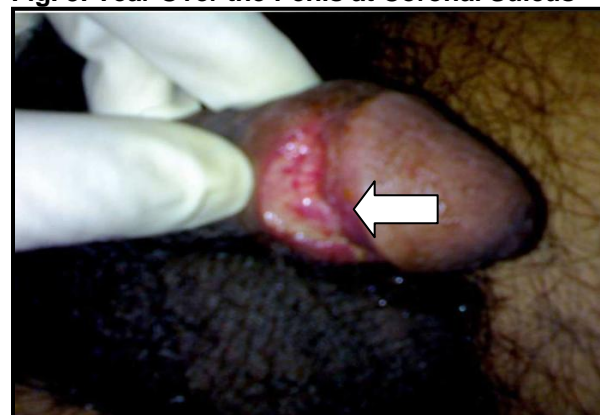
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Table 1: Relation of the Accused with the Victim

Relation to victim	Cases	%
Friend	23	56
Known to victim	12	29.2
Stranger	04	9.7
Relatives	02	4.8

Table 2: Time Interval between Incident and Examination

Time interval between incident and examination	Cases	%
< 1 day	8	19.5
1-2	4	9.7
3-4	3	7.3
5-6	3	7.3
>6 days	23	56

Fig. 1: Age Wise Distribution of the Accused**Fig. 2: Distribution of Injuries over the Body of Accused****Fig. 3: Tear Over the Penis at Coronal Sulcus**

Original Research Paper

Pattern of Skull Fractures in Cases of Head Injury By Blunt Force

*Raja Rupani, **Anoop Verma, ***Shiuli Rathore

Abstract

The study of pattern of skull fractures is important as head being the most exposed and prominent part of body; it becomes most susceptible to injuries, as a result of criminal violence or accident. The skull fractures, especially by blunt force offer varying diagnostic and medico-legal problems to the medical jurists as well as to the clinicians. 100 cases of intracranial head injury by blunt force for the present study were selected from the dead bodies which were sent to the mortuary, King George's Medical University, Lucknow for medico-legal post-mortem examination. In 100 cases of intracranial lesions, 4 cases sustained fracture of the skull without any injury to the scalp and in 36 cases injuries of both scalp and skull were present. Maximum cases were in the age group of 41-50 yrs while the cause of fracture in maximum number of cases (90%) was direct trauma. Of the various cases with skull fracture, 50% cases were of fissured type, while 30% were depressed and 20% comminuted.

Key Words: Head injury; Blunt trauma; Skull fracture, Fissured fracture, Scalp

Introduction:

The history of trauma parallels the history of the evolution of man, with his aggressive instincts, creative ability and endless ambition to conquer the environment without regard to the price he must pay to achieve his goals. "Head Injury" as defined by National Advisory Neurological diseases and Stroke Council, is "a morbid state resulting from gross or subtle structural changes in the scalp, Skull and/or contents of skull, produced by mechanical forces."

Injury to brain without fracture of skull is not uncommon, though fracture of skull is usually accompanied by some degree of injury to the brain. [1] The study of pattern of skull fractures in these cases is important as head being the most exposed and prominent part of body; it becomes most susceptible to injuries, as a result of criminal violence or accident.

The skull fractures, especially by blunt force offer varying diagnostic and medico- legal problems to the medical jurists as well as to the clinicians.

This subject has its importance not only because of fatal results, which occur frequently, but also because of many other important medico- legal implications which arise.

It has been truly said by Polson [2] that no injury to the head is too trivial to be ignored or so serious as to be despaired of. Nowadays, cases of head injury due to blunt force are increasing at an alarming rate in all world communities especially in more densely populated areas with fast and heavy traffic flow along with rapid growth of industrialization. These head injuries are generally sustained by vehicular accidents, fall from height, and assault by blunt force, fall of masonry etc.

Material & Method:

In present study 100 cases of intracranial head injury by blunt force were selected from the dead bodies, which were sent to the mortuary, King George's Medical University, Lucknow for medico-legal post-mortem examination. Only those cases were selected for the present study which had definite history of head injury by blunt force e.g. fall from heights, vehicular accidents, assaults by blunt weapon, and fall of masonry.

Cases of head injury where the skull and brain were completely destroyed were not selected for the present study. A detailed post-mortem examination was carried on every case. A brief history pertaining to injury was recorded from relatives & eye witnesses regarding cause and manner of injury, time and place of injury, whether homicidal or accidental, any lucid

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interval, period of survival after following head injury and approximate age of the person.

External examination of the whole body was done, approximate age was confirmed, general built was noted, external injuries on the dead body were examined in detail with special attention towards the injuries of head, nature of injuries like abrasions, bruises, lacerated wounds and fractures with their location and dimension as well as type (i.e. fissured, depressed, comminuted, compound & gross) were carefully noted. Evidence of bleeding from natural orifices was also noted.

Head injuries were examined methodically. The inner aspect of scalp was examined for evidence of any bruise or hematoma. Fractures of the skull were examined in detail as to the type, extension and location. Injuries to meninges and their blood vessels were noted. Dura at the base of the skull was stripped off to visualize the fractures if any.

Observation and Results:

A total of 100 cases were included in the study and observed. It is significant to note that in 100 cases of intracranial lesions, 42 cases sustained injuries of the scalp alone while 4 cases sustained fracture of the skull without any injury to the scalp and in 36 cases injuries of both scalp and skull were present. (Fig. 1)

Skull sustained fractures in 40 cases with maximum no. of cases in the age group of 41-50 yrs (Fig. 2), while the cause of fracture in maximum no. of cases (90%) was direct trauma. (Fig. 3) Out of 40 cases with skull fracture, vault was fractured in 22 cases (55%) where as both vault and base was involved in 35% cases.

In 10% cases (vehicular accident), only base of the skull was fractured involving the anterior and middle cranial Fossa and there was no evidence of any direct trauma to head. (Fig 4)

In Present study out of the various cases with skull fracture, 50% cases were of fissured type (Fig. 6 & 7), while 30% were depressed and 20% comminuted. (Fig. 5)

Discussion:

The incidence of head injury is increasing everyday so it is imperative that knowledge of this subject must increase rapidly both in its preventive and practical aspects as well as its scientific aspects because many of these cases are either preventable or curable.

Thangaraj M [3] in a study of cranio-cerebral injuries by blunt force observed that most of his cases were due to fall from height (34%) and vehicular accidents (32%). In the present study however, vehicular accidents accounted for 70% of cases and fall from height

only 10%. Gradwohl and Camps & Purchase [4] have mentioned that external injuries may or may not be present in all cases of head injury. Simpson [5] is of the view that wounds of the scalp due to blunt force must be looked upon as potentially serious no matter how they are produced. These statements hold well in the present study also. In 22% of direct or indirect trauma to the head there were no external injuries on the head but these had severe intracranial lesions which proved fatal.

The dominant type of skull fracture found was linear (fissured) fracture in 43.04% cases followed by basilar fracture in 17.73%, comminuted fracture in 7.6% and depressed fracture in 3.78% cases in a study by Pathak A [6] which is consistent with the present study.

Manish k et al [7] from Davangere, in his study showed that linear fracture (38.8%) was the commonest fracture followed by Comminuted fracture (27.7%) and depressed fracture (11.1%), where as in the present study while linear fracture was commonest (50%), depressed fracture followed with 30% and comminuted fracture were least with 20%

In another study by Mukesh K Goyal et al [8] out of 140 cases 16% doesn't have bone injury while 84% presented with fractures of skull. Fracture of skull were detected in 118 (84%) cases fractures of skull of various types i.e. linear (77) cases, depressed (13) cases, comminuted (7) cases and base of skull 21 cases. Ravindra S Honnunar et al [9] study showed that out of 403 head injury cases, 313 cases (77.7%) had a fatal skull fracture.

The bones involved were Temporal (40.3%), Occipital (36.4%), Parietal (46.9%), Frontal (56.2%), Sphenoid (14.1%) and Base of skull (22.1%). Our findings are consistent with these studies. In a study by Ranjit M. Tandle et al [10] out of 113 cases skull fracture was found in 95 cases. Among them linear fracture of skull with basal fracture was commonest (24.21%) followed by linear fracture (16.84%), Basal fracture (15.79%) and Depressed fracture (14.74%). Skull vault fracture was seen in 80 cases with linear fracture as the commonest one. Location wise Temporo-parietal region (20%) was followed by Fronto-parieto-temporal region (17.50%).

Conclusion:

- Common causes of intracranial lesions due to blunt force are vehicular accidents, assault by blunt weapons, and fall from height etc.
- Maximum numbers of cases are due to vehicular accidents.

- No age is exempted.
- Skull fractures in majority of the cases are due to direct trauma and few are due to indirect trauma.
- Fractures can occur without any evidence of injury to scalp.
- Intracranial injuries can occur with or without fracture of the skull.

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Fig 1: Incidence of Skull Fracture

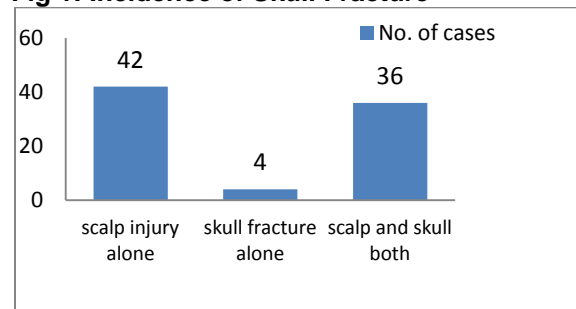


Fig 2: Age incidence of Skull Fracture

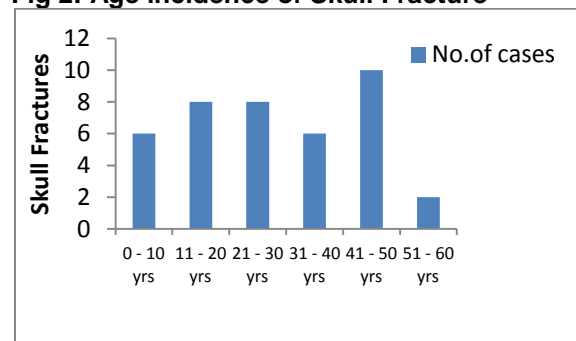


Fig 3: Skull Fracture according to Type of Trauma

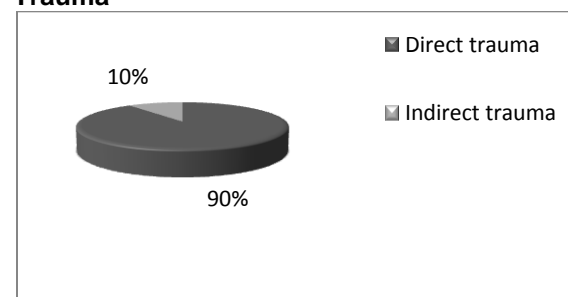


Fig 4: Site of Skull Fractures

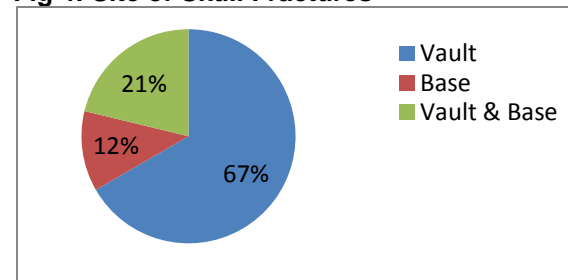


Fig 5: Type of Skull Fractures

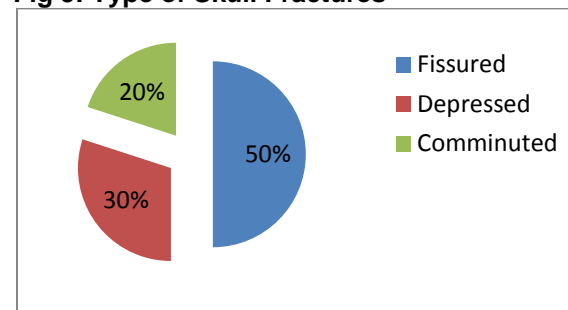
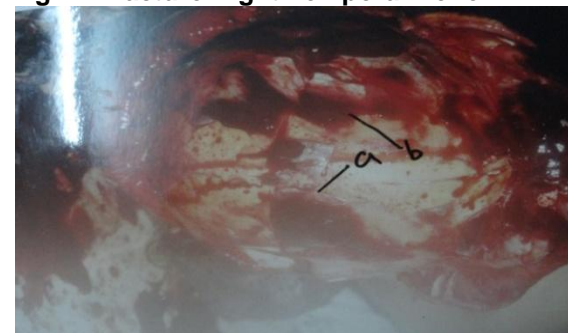


Fig. 6: Fissure Fracture



Fig. 7: Fracture Right Temporal Bone



Original Research Paper

Study to Evaluate Correlation of Serum Cholesterol and Serotonin Levels in Suicidal Deaths

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Abstract

Suicide is emerging as a major public health problem globally for all ages. It has been hypothesized that lowered levels of total serum cholesterol may cause a decrease in brain serotonin thereby leading to enhanced suicidal tendency in depression. The present study was conducted with an aim to find out the correlation of serum cholesterol level with serotonin level in cases of suicidal death and matched controls. Blood samples for cholesterol and serotonin levels were obtained from the 88 dead bodies during autopsy and 9 healthy volunteers who served as controls. Serum cholesterol and serotonin levels in the suicidal death cases were significantly lower than in the controls. Moreover, we found a significant positive correlation between these two variables in suicidal deaths. These findings indicate that the serotonergic system may be associated to serum cholesterol in suicidal deaths. However further investigation is necessary to establish these two variables as predictors of suicidality.

Key Words: Suicide, Serum cholesterol, Serum serotonin, Suicidality

Introduction:

Suicide is a voluntary and deliberate act of self annihilation. It is emerging as a major public health problem as it is the tenth-leading cause of death globally for all ages. Approximately one million people die from suicide every year.

The estimated annual mortality is 14.5 deaths per 100 000 people amounting to an average of one death every 40 seconds and an attempt every three seconds. [1, 2] The suicide rate is rising in Asian countries too. For different parts of India, suicide rates vary between 8.1 and 58.3/100,000 population. [3]

The sharp increase in global suicide rates is very alarming as the extent of unnatural deaths is a gross indicator of the socioeconomic condition and mental health of the society. The major factors contributing to suicide are mental illness, primarily depression and alcohol use disorders, abuse, violence, loss, cultural and social background. [1, 2]

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Although suicide risk factors vary from person to person or culture to culture, systematic profiling of risk factors has been attempted in a bid to develop a prevention strategy. Moreover analysis of different risk factors, besides reducing the workload on the health care institutions, law enforcing agencies and judiciary, will also help the policy makers while planning for better living conditions for the future generation thereby contributing towards a better future. Large primary prevention trials have established that lowering serum cholesterol concentration reduces incidence of coronary heart disease, [4, 5] however no study provided evidence that lowering cholesterol extends survival.

This failure to affect the total mortality in primary preventive trial is due, in part, to the fact that these studies witnessed higher rates of death due to suicide/accidents. Various studies have shown a relationship between low cholesterol concentration and violent deaths. [6, 7] A study has suggested that low serum cholesterol concentrations may lead to behavior that increases the risk of violent deaths. [7]

Moreover low serum cholesterol concentrations have been reported to be associated not only with a decline in death from coronary heart disease but also with an increase in deaths due to suicide. [8] Various studies have shown a significant correlation between lower serum cholesterol concentration and suicides. [9-14] Furthermore low cholesterol

levels have been observed in violent antisocial personality disorders. [15-17]

Previous study conducted in our department too has shown that cholesterol level is low in cases of suicidal death. [18]

On the other hand, serotonergic dysfunction has been reported to be involved in suicide attempts too. [19, 20] It has been demonstrated that the suicidal behaviour is at least partially genetically determined and serotonin related genes have been implicated therein. Thus it has been hypothesized that lowered levels of total serum cholesterol may cause a decrease in brain serotonin thereby leading to enhanced suicidal tendency in depression. The hypothesis that impairment of serotonin neurotransmission is linked to reduced serum cholesterol was tested and found to be true in hyper-cholesterolemic patients undergoing simvastatin therapy. [21]

However, some studies have reported controversial results too. [22, 23] As no published data is available on Indian subjects in general and Chandigarh zone in particular, the present study was conducted with an aim to find out the correlation of serum cholesterol level with serotonin level in cases of suicidal death.

Materials and Methods:

The present study was conducted in the departments of Forensic Medicine and Pharmacology, Postgraduate Institute of Medical Education and Research, Chandigarh, India. The study was carried out in two segments. The first segment involved the estimation of serum cholesterol and serotonin levels in post-mortem samples (n=88) obtained from autopsies of suicidal deaths. While another segment involved the estimation of serum cholesterol and serotonin levels in the samples obtained from healthy volunteers (n=9).

Medico-legal autopsies of suicidal deaths cases, whose demographic details were available, with no H/O drug therapy (selective serotonin reuptake inhibitors, SSRI) and hyperlipidemia as well as Healthy volunteers willing to give an informed consent for participation in the study with no H/O metabolic disorders and psychiatric illness with drug therapy (SSRI) were selected for this study.

Collection of Blood Sample:

Ten cc of blood was collected from the right femoral vein from the dead body during autopsy and from the right cubital vein of the control groups and it was immediately transferred to a sterile glass vial. For control samples, blood was collected from the healthy volunteers after taking their consent while for

postmortem samples, due consent was obtained from the legal heirs of the deceased. All the samples were stored at 4°C till analysis.

Estimation of Serum Cholesterol:

Serum was separated by centrifuging the blood after clotting for 10 minutes at 1500 rpm. Estimation of serum cholesterol in the post-mortem as well as control samples was carried out by an enzymatic method using the kit 'Infinite cholesterol Liquid', supplied by Accuex biomedical Pvt. Ltd. Thane, India. [24, 25]

Estimation of Serum Serotonin:

Estimation of serum 5HT in the post-mortem as well as control samples was carried out by using the ELISA kit.

Data was expressed as mean \pm SD. Group data were analyzed using one-way analysis of variance (ANOVA) followed by appropriate post hoc test (Bonferonni's test). Pearson correlation coefficients were calculated to test for a linear relation between the variables. The p value <0.01 was considered as statistically significant.

Result:

• Serum Cholesterol;

A total of 88 cases of suicidal deaths were included in the study. (Table 1) And nine healthy volunteers were included as controls. The mean serum cholesterol level in suicidal deaths was 97.40 ± 41.97 mg% while the controls showed a mean cholesterol level of 170.50 ± 25.31 mg%. (Table 2) There was a significant decrease in the serum cholesterol level in suicidal death cases ($p < 0.006$). (Table 1)

• Serum Serotonin:

The mean serum serotonin level in suicidal deaths was found to be 4.85 ± 1.09 pg/ml while the controls showed a mean serotonin level of 21.30 ± 2.15 pg/ml. (Table 3) Thus there was a significant decrease in the serum serotonin level in suicidal death cases when compared with control ($p < 0.006$).

A correlation between serum cholesterol level and serum levels of serotonin in both the groups was made. A coefficient of $r = 0.290$ was found in cases of suicidal deaths while $r = -0.445$ was found in control cases. The correlation between serum levels of cholesterol and serotonin was significant as compared to controls at the 0.01 level.

Discussion:

In this study, we found that cases of suicidal deaths had lower serum total cholesterol levels than healthy control subjects. So these observations suggest that there is an association between suicidal tendency and low serum cholesterol levels. This association

between low serum cholesterol level and suicidal behavior has been reported earlier also by several studies. [9-14, 18] Similarly we found significantly lower levels of serotonin in serum samples of suicidal cases as compared to controls. These results are again consistent with previous studies which have observed lower serotonin concentrations in depression and suicide. [19, 20] Thus low serum cholesterol concentration may be employed as a marker of suicidal behavior. Therefore it has been suggested that there is a relationship between suicidal behavior and lowered cholesterol as well as serotonin levels.

The role of cholesterol in serotonin reuptake has been implicated for this association. [26] The role for serotonin metabolism was suggested by Engelberg [27] and subsequently elaborated by Salter [28] to explain a possible association between low cholesterol levels and violent death. An in vivo primate study has reported that reduction in plasma cholesterol increases the tendency to engage in impulsive or violent behaviour through a mechanism involving central serotonergic activity. [29] Similarly other studies have reported that patients with mood disorders have lower cholesterol levels. [30]

Based on these findings we conducted this study to determine the correlation of serum cholesterol level with serotonin level in cases of suicidal death. Our results showed a significant positive correlation between serum cholesterol and serotonin levels in the suicidal deaths.

Mean values of serum levels of cholesterol, and serotonin were lower in suicidal death cases as compared to healthy volunteers. This is consistent with the earlier studies whose results show that the serotonergic system may be associated to serum cholesterol in cases of suicidality. [21, 31, 32] Some studies have reported the controversial results. [22, 23, 33] However, the findings of this particular study suggest that suicidality is associated with low serum cholesterol and serotonin.

Conclusion:

Suicidal behaviour is emerging as a major public health problem but the neurobiology of suicide is still unclear. Suicidal tendency has been related to decrease central serotonergic (5-hydroxytryptamine) function and reduced cholesterol levels.

The present study has associated lower serum cholesterol and serotonin levels with suicidality. In addition to this, serum cholesterol and serotonin levels have showed a significant positive correlation.

Therefore the results indicate that the serotonergic system may be associated to serum cholesterol in suicidal deaths. And the study suggests that concentrations of serum cholesterol and serotonin may be useful in predicting the suicide risk.

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Table 1: Age and sex wise Distribution of Cases

Age(yrs)	Male	Female	Total
<18	1	1	2
18-29	27	19	46
30-39	16	7	23
40-49	8	1	9
50-59	7	0	7
≥60	0	1	1
Total	59(67.04%)	29(32.95%)	88

Table 2: Serum Cholesterol Concentrations in Control as Well as Suicidal Deaths

Groups	Cases	Mean cholesterol level (mg %)
Control	9	170.50±25.31
Suicidal death	88	97.40±41.97

Table 3: Serum Serotonin Concentration in Control as well as Suicidal Deaths

Groups	Cases	Mean serotonin concentration (pg/ml)
Control	9	21.30±2.15
Suicidal death	88	4.85±1.09*

* All values are expressed as mean ± SD.* p<0.006 compared to control

Fig. 1: Serum Cholesterol level

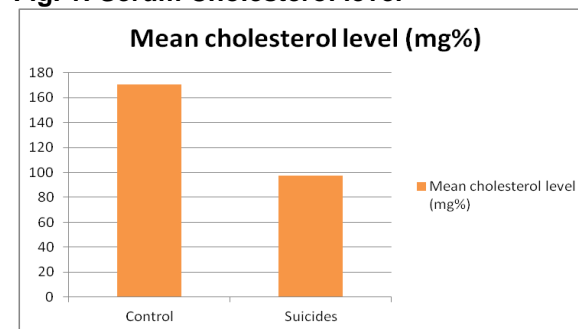
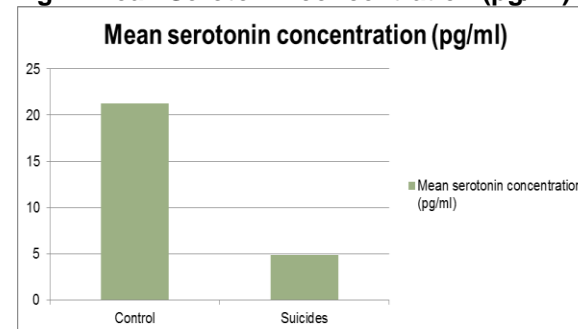


Fig 2: Mean Serotonin concentration (pg/ml)



Original Research Paper

Trends of Homicidal Deaths in Indore (M.P.) Region One Year Retrospective Study

*Ashok K. Rastogi, *Bajrang K. Singh, **Sanjay K. Dadu, ***Pramendra S. Thakur, ****Anil K. Lanjewar, ****Prasant P. Raput

Abstract

This study was done in Department of Forensic Medicine and Toxicology, Mahatma Gandhi Memorial Medical College, Indore (MP) from January to December 2012. Out of total 1931 post-mortem conducted in 2012, 82 cases were alleged homicidal in nature. Purpose of this study was to know the cause of death, pattern of weapon used for homicidal purpose, gender distribution, age distribution and seasonal distribution in homicidal death. Males were victim in 78.95 % (64) of cases and females in 21.05 % (18) of cases included in our study.

In present study 64.63% (53) of total victims were in age group of >18-40 years. Most of the cases, 46.34% (38) were seen in summer (March-June) season. Most common cause of death was hemorrhage and shock 46.34 % (38) followed by asphyxia and cranio-cerebral injury 20% each. Blunt weapons were most commonly used for homicidal purpose 31.71% (26). No case of homicidal death was seen in female by fire arm. Maximum number of autopsies were conducted on Thursday 20.73 % (17) of cases & least number of autopsies were conducted on Monday 07.32 % (06) of cases in our study.

Key Words: Homicidal death, Blunt, Sharp, Firearm, Ligature, Autopsy

Introduction:

Homicide is defined as killing of one human being by another human being. Unlawful killing of human being is murder (S.300 IPC). Culpable homicide cases may be amounting to murder (S.299 IPC) or not amounting to murder (S.304 IPC). Punishment of murder (S.302IPC) is death or imprisonment for life and also fine. [1]

The various patterns of homicidal deaths include assault by sharp weapon, blunt weapon, firearm, strangulation, homicidal hanging, smothering, drowning, burns, poisoning etc. [2] Killing of an individual is the highest level of aggression found in all the cultures.

Since ages the very reason or motive for these killings has remained the same v. i. z. lust for money, women and land. To commit murder, two elements (Mensrea, which means preplanning or afore thought and Actus reus, which means the actual execution) should work together to constitute the crime. [4]

Cases of homicidal death are increasing; this is probably due to rapidly increasing population, urbanization, poverty, unemployment, frustration, illiteracy, prevalent economic, social and political environment, insurgency, terrorism, drug addiction, easy availability of weapon, and the widening gap between the rich and the poor.

Young offenders are becoming increasingly violent and this is a cause for concern, as they are future generation. [3]

Material and Method:

This study was conducted in MGM Medical College Indore (MP) from January to December 2012. 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 photocopy of inquest report, F.I.R. report, requisition form, photographs at the scene of crime by the police, copy of post mortem report and other relevant documents preserved as records.

We included in this study the cases with clear history of homicidal death according to police, autopsy report showing that death was homicidal in nature and in which court prove that death was homicidal in nature records.

Suspicious death according to circumstances strongly suggestive of homicidal in nature but in autopsy report not clear opinion

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given by the autopsy surgeon were also included in this study.

Death due burn injuries, poisoning, road traffic accidents and fall from height which has no clear history about nature of death and difficult to determine nature at time of autopsy were not included in this study.

Observation & Discussion:

During the study period from January to December 2012, Total 1931 medico-legal autopsies were conducted, out of which homicidal deaths constituted 82 cases (4.25%).

The factors contributing for highest incidents in the >18-40 Years age groups (64.63 %) (Table 1) were due to marital disputes, property dispute, unsuccessful romantic disputes, infidelity, dowry death in females, gang rivalry, unemployment and heated arguments. Study done by Basappa et al. at Bangalore also showed that, this age group was accounted for 61.50 % cases of homicidal death. [4]

In our study male were 78.95% and female cases were 21.95 % of total homicidal death, similar finding that males (80.83%) were more commonly victimized as compared to females (19.17%) in homicidal cases was found in Santhosh CS. Study in Belgaum. [5]

Distributions according to seasonal variation showed that maximum cases were found in summer (March-June) 46.34%, followed by in winter 29.27% and monsoon 24.39% of total cases. (Table 2)

Similar finding were seen by Pradeep K. Mishra et al in Bhopal that 33.94% homicidal cases occur in summer followed by 33.03% cases each in monsoon and winter. [6] Our finding differ with the study done by Sisti D et al in Italy, which showed that homicidal death occurs with a bimodal pattern, summer (July and August) and winter (December and January) seasons were accounted for maximum number of homicidal death. [7]

Our observation also differ from study done by Dhaval J Patel in Bastar region of Chhattisgarh, in which 36.71% homicidal cases occur in the monsoon followed by 34.18% cases in summer and 29.11% cases seen in winter season. [8]

Maximum number of autopsies for homicidal death were conducted on Thursday (20.73%) followed by on Tuesday 17.07%, on Saturday 15.85%, on Sunday 15.85%, on Wednesday 12.20% and on Friday 10.98% cases. Least number of autopsies was conducted on Monday 7.32 %cases. (Table 3)

In our study there is no specific pattern according to days in contrast to western

countries where maximum numbers of homicidal death occur on Sundays and Mondays. [7]

In present study most common cause of death was shock and hemorrhage 46.34% followed by asphyxia 20.73% and cranio cerebral injury 19.51% of total cases. (Table 4) Same finding was seen in the study done by Dhiraj Buchade et al. in greater Mumbai. [9] In our study, most common cause of death was shock and hemorrhage in male victims and mechanical asphyxia in female victims.

In female commonest cause of death was asphyxia by throttling, manual strangulation, smothering or by other means. In our study, 08 out of total 18 cases of female death were due to asphyxia. Similar finding was found in study done by Vij A et al at Mangalore, in which Homicide by strangulation was seen in 8 cases out of total 89 cases and involved mostly women. [10]

In this study death due to blunt object injuries (31.71%) was the commonest pattern followed by sharp object injuries (21.96%), ligature application in (13.42%), throttling (3.66%), firearm (7.32%) and miscellaneous (21.96%). Out of total 18 miscellaneous cases, in 11cases cause of death remains open during the autopsy, 02 cases were due to drowning, 03 cases were due to burn and 02 cases were due to aspiration of food content in respiratory passage. Death due fire arm injuries was found in 06 cases, all victims were male. (Table 5)

Commonly used object were blunt and sharp objects, reason behind it might be due to most of the homicidal death are unplanned and these object easily available everywhere, consistent with the findings of Dhiraj Buchade et al study in greater Mumbai which showed that hard and blunt objects were the weapons of choice in 37.2% of homicidal death, followed by sharp edged & pointed weapons 32.8% of homicidal death [9].

Contrast observation was found by Basappa S. Hugar et al and BC Shivkumar et al. both observed that death due to sharp weapon injuries was the commonest pattern followed by blunt weapon injuries in homicidal death. [3, 4]

Results and Conclusion:

- Homicidal deaths constituted 4.25% of total autopsies conducted in year 2012.
- Maximum numbers of homicide occurred in the age group >18-40 years in both sexes constituting 64.63 % of total cases.
- Most of the homicidal death occur in the summer (46.34%) followed by winter (29.27%) and monsoon (24.39%).

- In maximum cases cause of death was shock & hemorrhage 46.34% followed by asphyxia 20.73% and cranio cerebral injury 19.51%.
- Blunt object (31.71%) was the commonest weapon, followed by sharp object (21.96%), ligature application 13.42% and fire arm 7.32%.
- No firearm case was found in female in our study.
- Maximum numbers of autopsies for homicidal death were conducted on Thursday 20.73% followed by on Tuesday 17.07%, on Saturday 15.85%, on Sunday 15.85% and on Monday 7.32 %.

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Table 1: Distribution of Cases by Age and Sex

Age(Yrs)	Male (%)	Female (%)	Total (%)
0-18	05(06.10)	02(02.44)	07(08.54)
>18-40	42(51.22)	11(13.42)	53(64.63)
>40-60	11(13.42)	04(04.88)	15(18.29)
>60	06(07.32)	01(01.22)	07(08.54)
Total	64(78.05)	18(21.95)	82(100)

Table 2: Cases According to Seasonal Variation

Season	Male (%)	Female (%)	Total (%)
Winter(Nov-Feb)	21(25.61)	03(03.66)	24(29.27)
Summer(March-June)	27(32.93)	11(13.42)	38(46.34)
Monsoon(Jul-Oct)	16(19.52)	04(04.88)	20(24.39)
Total	64(78.05)	18(21.95)	82(100.0)

Table 3: Cases According to Days on which Autopsies were conducted

Day	No. of Autopsy		
	Male (%)	Female (%)	Total (%)
Monday	04(04.88)	02(02.44)	06(07.32)
Tuesdays	10(12.20)	04(04.88)	14(17.07)
Wednesday	08(09.76)	02(02.44)	10(12.20)
Thursday	14(17.07)	03(03.66)	17(20.73)
Friday	06(07.32)	03(03.66)	09(10.98)
Saturday	11(13.42)	02(02.44)	13(15.85)
Sunday	11(13.42)	02(02.44)	13(15.85)
Total	64(78.05)	18(21.95)	82(100.0)

Table 4: Cases According to Cause of Death

Cause	Male (%)	Female (%)	Total (%)
Asphyxia	09(10.98)	08(09.76)	17(20.73)
Hemorrhage & shock	33(40.24)	05(06.10)	38(46.34)
Cranio-cerebral Injury	13(15.85)	03(03.66)	16(19.51)
Miscellaneous	09(10.98)	02(02.44)	11(13.42)
Total	64(78.05)	18(21.95)	82(100.0)

Table 5: Cases According to Type of Weapon used

Weapon	Male (%)	Female (%)	Total (%)
Blunt	21(25.61)	05(06.10)	26(31.71)
Sharp	15(18.29)	03(03.66)	18(21.95)
Ligature	07(08.54)	04(04.88)	11(13.42)
Throttling	01(01.22)	02(02.44)	03(03.66)
Firearm	06(07.32)	00(00.00)	06(07.32)
*Miscellaneous	14(17.07)	04(04.88)	18(21.95)
Total	64(78.05)	18(21.95)	82(100.0)

*11 Unknown+ 02 Drowning+ 03 Burns+ 02 Aspirations

Original Research Paper

Profile of Organophosphorus Poisoning At Tertiary Care Hospital in Uttarakhand

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Abstract

Organophosphorus compound poisoning is a very common toxicological emergency encountered in the Kumaon region of Uttarakhand. It is particularly common among the rural agricultural workers which comprise a substantial group of the population of this region. A total 372 cases of Organophosphorus compound poisoning were analysed during the three year period from January, 2009 to December, 2011. The emphasis was given on age, sex, socioeconomic status, occupation, motive of poisoning, types of compound consumed its quantity, place, distance from referral place, and the ultimate outcome. Young male population of rural background, particularly agricultural workers was the commonest patients (54.07%). The most common motive of poisoning was with a suicidal intent, both in males (50.80%) and females (43.01%), and highest number of patients consumed Dichlorvos (40.86%). Financial crisis was one of the most common reasons analysed as the motive behind the poisoning (53.22%). Three hundred twenty two (86.56%) patients recovered and fifty (13.44%) expired. The major cause of death in these cases was respiratory failure followed by multi-organ failure.

Key Words: Organophosphorus compound poisoning, suicidal, Insecticide, Respiratory failure

Introduction:

Organophosphorus compound, a common pesticide used in agriculture for crop protection and pest control, is often implicated in accidental and suicidal poisoning in India. Its widespread use and easy availability has increased the chances of poisoning with these compounds. It is a highly toxic compound and acts by inhibiting the enzyme cholinesterase, results in accumulation of acetylcholine at synapses and myoneural junction leading to cholinergic over activity. [10]

WHO estimated that approximately 3 million pesticide poisoning occurs worldwide and cause more than 2,20,000 deaths per year. Developing countries like India and Sri Lanka report alarming rates of toxicity and death. [1] Suicidal poisoning with Organophosphorus compound is seen with increasing frequency and carries 4-30% mortality in Indian studies. [2]

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Respiratory failure is a common complication of Organophosphorus poisoning which responsible for a high mortality, so timely effective treatment is crucial for survival.

The demographic profile, the geographical terrain and the distribution of health care facilities is quite different in Uttarakhand as compared to other region of the country. Since there is a paucity of Literature regarding Organophosphorus compound poisoning in Uttarakhand, this particular observational study was undertaken.

Material and Methods:

This observational study was conducted between January, 2009 to December, 2011 in Dr. Susheela Tewari Government Hospital and Government Medical College, Haldwani, Uttarakhand, the only referral tertiary care centre for whole Kumaon region of Uttarakhand.

A total 372 cases of Organophosphorus compound poisoning were analysed during this period. The data was collected from all poisoning cases admitted through emergency or outpatient department, in a detailed proforma as per the history given by patient / attendant, with particular emphasis being given to age, sex, socio economic status, occupation, motive of poisoning, type of compound, its quantity, place from referral and final outcome. All data were analysed, documented and interpreted as per the laid down protocol.

Observations:

A total 372 cases of Organophosphorus compound poisoning were registered during the study period, January, 2009 to December, 2011. The age of Patients varied from 1- 70 years. The majority of patients, were male (43.81%) between the age group of 21-30 years. Male to Female ratio was 1.22:1. Persons of lower socio-economic status and lower middle class were the commonest patients (65.05%) and (31.98%) respectively. Most of the patients were either illiterate (60.21%) or educated up to high school (28.22%) and mainly belonging to rural areas (75.80%). (Table 1)

Occupation wise agricultural workers were on top of the list (51.07%) followed by house wives (27.68%) and labourers (12.90%). (Table 2)

It was observed in our study that highest number of patients consumed Dichlorvos (40.86%), followed by Methyl parathion (18.54%), the least consumed compound was Diazinon (9.67%). (Table 3)

The commonest motive of poisoning was suicidal in both males (50.80%) and females (43.01%), followed by accidental (4.83%). Homicidal poisoning was observed in 5 (1.33%) cases only. (Table 4)

Financial problem was one of the commonest reasons of poisoning (53.22%). (Table 5) The mortality rate in our study was 13.44%; it was fairly low because the majority of patients reached our hospital well within the fatal period. (Table 6) Respiratory failure was the leading cause of death in our study, followed by multi-organ failure.

Discussion:

Acute Organophosphorus compound poisoning is one of the commonest cause of acute poisoning in Uttarakhand with high mortality, particularly among the agricultural workers. The probable cause of high mortality are depending on the variety of factors such as easy availability of the poison, large group of agricultural population, socioeconomic status of the population and stressful life, particularly of youth. In our study majority of patients were male (55.16%) and they were in age group of 21 to 30 years (43.81%); similar observations were noted in other studies. [4-7]

In our study among the Organophosphorus compounds, Dichlorvos was the most commonly consumed Poison (40.86%), although Diazinon was the most commonly used compound in another study as reported by Singh et al. [8] In present study the commonest motive of poisoning was with a Suicidal intention and

the maximum number of victims were agricultural workers (51.07%), residing specifically in rural areas. This finding was similar to that of Gupta et al, [9] because use of the Organophosphorus compound as an insecticides, pesticides and fungicides was more in rural areas than urban.

Forget G [9] in his study showed that 75% of poisonings occur among economically weaker sections, which mainly reside in rural areas. Accidental poisoning in our study was mainly seen in children due to accidental ingestion and in adults due to accidental exposure. In our study the mortality rate was 13.44%, which was is quite low because the majority of the victims received treatment in the EMS 108 ambulance which provides primary care treatment to patient within half an hour, hence the survival rate was higher in our study.

It has been observed that incidence of death was found to be significantly more in those patients in whom a greater time interval had elapsed between consumption of the poison and hospitalization. [2]

Conclusion:

Organophosphorus poisoning is one of the most common poisonings in the rural areas of Uttarakhand, predominantly in the young population with a male predominance, belonging to low socioeconomic class. The commonest motive of poisoning was suicidal. Lack of education, poverty, cheap and readily easy availability of the Organophosphorus compounds, unemployment and stressful life were the common reasons behind the reason of poisoning.

Hence education amongst the agricultural workers and youth about the harmful and deleterious effects of Organophosphorus compounds and up gradation of the primary health centre facilities to render immediate management of Organophosphorus compound poisoning, which is an important step in management of such poisonings, could go a long way in helping to reduce both mortality and morbidity due to Organophosphorus compound poisoning.

Similarly strict implementation of the pesticide act and involving a new policy by the government to educate the public and youth in large about the dangerous, life threatening effects of Organophosphorus compounds could help ameliorating the harmful effects of such poisoning.

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Table 1: Socio-Demographic Profile of Patients (N=372)

Age (years)	Number	%
01-10	08	2.15
11-20	93	25.00
21-30	163	43.81
31-40	62	16.66
41-50	26	6.98
51-60	15	4.03
61 and above	05	1.34
Total	372	100
Sex	Number	%
Male	205	55.10
Female	167	44.89
Total	372	100
Male to female ratio	1.22 : 1	
Socio-economic Status	Number	%
Lower Class	242	65.05
Middle Class	119	31.98
Upper Class	11	2.95
Total	372	100%
Educational Status	Number	%
Illiterate	224	60.21
Up to high School	105	28.22
Up to Intermediate	32	8.60
Up to graduate / Post graduate	11	2.95
Total	372	100
Residence	Number	%
Rural	282	75.80
Urban	90	24.19
Total	372	100

Table 2: Occupation of Patients (N=372)

S.N.	Occupation	Cases (%)
1	Agricultural workers	190(51.07)
2	House Wives	103(27.68)
3	Labourers	48(12.90)
4	Students	17(4.56)
5	Drivers	6(1.61)
6	Clerical	2((0.53)
7	Businessmen	2((0.53)
8	Others	4(1.07)
	Total	372(100)

Table -3: Types of Poison Consumed (N=372)

S.N.	Type of Poison	Cases (%)
1	Dichlorvos	152(40.86)
2	Methyl Parathion	69(18.54)
3	Malathion	55(14.78)
4	Fenitrothin (Tic-20)	50(13.44)
5	Diazinon	36(9.67)
6	Unknown	10(2.68)
	Total	372(100)

Table 4: Motive of Poisoning (N = 372)

S.N.	Manner	Male (%)	Female (%)
1	Suicidal	182(50.80)	160(43.01)
2	Accidental	12(3.22)	06(1.61)
3	Homicidal	04(1.07)	01(0.26)
	Total	205(55.09)	167(44.88)

Table 5: Reason for Consuming Poison (n=372)

S.N.	Reasons	Cases (%)
1	Financial Problem	198(53.22)
2	Domestic Problem	142(38.17)
3	Unspecified	32(8.60)
	Total	372(100)

Table 6: Outcome of Poisoning Cases (n=372)

S.N.	Outcome	Patients (%)
1	Survived	322(86.56)
2	Expired	50(13.44)
	Total	372(100)

Original Research Paper

Patterns of Head Injuries in Road Traffic Accidents Involving Two wheelers: An Autopsy Study

*R. Ravikumar

Abstract

Road traffic accidents (RTA) have been the bane of the modern civilization accounting for considerable loss to the nation. Head injuries are leading causes of death from motorcycle crashes with many deaths occurring despite optimal use of the available treatment facilities. Hence the present study was conducted to know the patterns of head injuries in fatal accidents involving riders and pillion riders of two wheelers. This study was conducted from 1st April 2009 to 30th Sept 2010 at Victoria Hospital Mortuary, Bangalore. The present study entirely focuses on the patterns of head injuries in fatal accidents involving riders and pillion riders of two wheelers who were autopsied during this period.

A total of 245 cases of deaths due to two wheeler accidents were reported for the autopsy. Riders constituted (76.33%) and pillion riders (23.67%). Most victims were male (87.75%), skull fractures (67.75%) were observed in the two wheeler accidental death. Linear fracture (55.43%) was the commonest pattern of fracture observed in these accidents. Sub-dural haemorrhage was also the commonest intracranial haemorrhage and rib injuries were commonly associated with head injuries.

Key Words: Road traffic accidents, Riders, Pillion riders, Two wheelers, Skull fractures

Introduction:

Road Traffic accident is an unplanned event occurring suddenly, unexpectedly and inadvertently in an unforeseen circumstance. Incidences are more common among the two wheeler vehicles. Head was the most common site to be injured in RTAs.[1] As motorized two wheeler vehicles constitute a large portion of the vehicle fleet in India The exponentially increasing number of automobile vehicles, poor adherence to traffic rules and regulations such as maintaining lane discipline, driving in zigzag patterns by public, poorly maintained and congested roads, abuse of alcohol, and lack of awareness about helmets and new generation of high speed vehicles are altogether responsible for accidents.

The mechanical forces like shearing, strains and biophysical motion that occur during accidents to the head are responsible for patterns of injuries. Road traffic accident is the third major preventable cause of death.

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In this study a sincere effort has been made to study the patterns of head injuries in riders and pillion riders involving two wheelers road traffic accidents and to suggest measures to be taken to decrease the road traffic accidents involving two wheelers.

Materials & Methods:

A cross sectional study of total of 245 cases of deaths due to fatal road traffic accidents involving riders and pillion riders of two wheelers have been studied. All cases of deaths due to head injuries in fatal road traffic accidents involving riders and pillion riders of two wheelers of both sexes all age groups, treated and untreated, irrespective of duration of survival was included in the study.

Cases other than two wheeler road traffic accidents to Victoria Hospital Mortuary are not included in this study. Detailed autopsy examination was done on the request from the investigating officer in annexure 146(i) and (ii). Relevant information was collected from police, relatives and friends of deceased. Rokitsansky en-mass evisceration technique was followed in conducting the autopsy. [2] Then with all these findings, post-mortem conclusion as to the cause of death in each case was drawn and analyzed.

Observations and Results:

All cases of deaths due to two wheeler RTA involving riders and pillion riders were

autopsied in the Victoria Hospital Mortuary, Bangalore attached to Bangalore Medical College and Research Centre irrespective of Sex, Age groups treated and untreated and duration of survival for a period of 18 months from April 2009 to September 2010.

A total number of 245 cases of two wheeler Riders / Pillion riders' road traffic accidents were recorded. There were 187 (76.33%) two wheeler riders and 58 (23.67%) were pillion riders. The cases are seen more in the male victims (87.75%) as compared to females (12.25%). (Table 1)

Our study showed that the two wheeler RTAs are more in the third (115cases) & fourth decades (55cases) constituting 47.75% and 22.44% of total 245 victims. It was followed by 20 to 39 years constitutes 70.20% of total victims. (Table 2) The time was divided into 4 periods of 6 Hours interval. In this aspect of study most of the accidents have occurred during 6PM–12 midnight for Riders (43.52%) & Pillion riders (44.55%) and least during 12midnight– 6 AM for Riders (18.06%) & Pillion riders (16.83%). (Table 3)

Present study showed that the place of occurrence of RTA was more in the urban areas (74.29%) as compared to rural areas (25.71%). (Table 4) Among the total 187 RTA cases involving Riders, the evidence of Helmets used was recorded in 120 (64.17%) of the victims while 67 (35.83%) did not use it. None of the pillion riders were wearing helmets at the time of accidents. (Table 5)

In this study Basal plus Linear fracture of Vertex constituted 44 cases (23.53%), out of 187 riders and 11cases out of 58(18.97%) of pillion riders. Linear fracture of vertex only comprised 13.90% cases in riders, 18.97% cases in pillion riders followed by fractures of the base only in 11.23% in riders and 13.79% in pillion riders, Depressed fractures of vertex was found 5.60% in riders and 4.87% in Pillion riders.

Comminuted fractures were the least common in both riders and pillion riders. No fracture of skull was found in 62 cases, out of 187 riders and 17 cases out of 58 Pillion riders. (Table 6) We observed Sub dural haemorrhage (SDH) in 92.80% followed by sub arachnoid haemorrhage (SAH) in 76.80%, Intra cranial haemorrhage (ICH) in 17.60% and least is extra dural haemorrhage (EDH) in 4.83% in riders in this study while in pillion riders SDH in 87.80%, followed by SAH in 68.29%, ICH in 19.51% and least is EDH in 7.30% in cases where skull fracture occurred.

EDH, SDH & SAH in relation to skull without fracture were found as SDH in 82.75%

followed by SAH in 62.06%, ICH in 20.68% and least is EDH in 6.89% in riders, SDH in 100%, followed by SAH in 75.00%, and ICH in 25.00% in pillion riders. (Table 7)

Rib fractures were the most common injury seen other than the head injury in 54.40% in riders and 61.11% in pillion riders followed by long bone fractures in 16.00% in riders and 16.67% cases in pillion riders. (Table 8)

Discussion:

In the present study, motorcycle riders included 187(76.33%) and pillion riders comprised 58(23.67%) of 245 cases. Male preponderance was noted, as most of the motorcyclists were Male accounting for 215(87.75%) and Females accounting for 30(12.25%) similar to the findings of studies of Kumar et al [4] were males belonging to 88.22% and females 11.77% and in the study of Singh YN et al [14] males belong to 86.96% and females belong to 13.04%.

Most Vulnerable age groups is the active population of the study resulting were those persons of third decade 48.13% followed by fourth decades 24.06% showing 72.20% of riders and 63.80% of pillion riders. Findings found in the studies by Kumar A et al [4] results show that the younger economical active groups 21-30years followed by 31-40 years, highest number of fatalities (54.24%) was in the 21-40years were predominantly involved as these age groups are found using the roads frequently and are generally rash drivers.

Peak timing of occurrence of RTA was 06.00 PM to 12.00 midnight followed by 12.00noon to 06.00PM which is probably due to heavy and unequal distribution of the traffic at these closing hours of the people and the rider is generally exhausted after day's work.

Sirathanont [5] demonstrated most of motorcycle crashes were between 06.00 PM – 09.00 PM. Ding et al [6] reported most of the head injuries occurred between 04.00 PM – 11.00 PM peaking at 9.00 PM.

It is observed that incident were more in the Urban areas this reveals the common outdoor working time of the urban regions. Findings observed in Singh Y N et al [14] found 16.98% of victims from rural areas.

Helmet use was infrequent among Motor cyclists in our study. 67(35.82%) Riders, among 187 riders have not been wearing a helmet at the time of accident. None of the pillion riders have been wearing Helmet. Failure to wear a helmet resulted in a significantly higher incidence of head injury and death among both riders and pillion rider motorcycle

crashes as found in Nupur pruthi et al and Sharma BR et al. [15, 17] Study in Mumtaz B et al [9] where frequency of helmet use is 56.6% and that of non users in 43.3%.

Most of the riders had worn substandard helmets which resulted in severity of the head injury. Use of an approved helmet at the time of collision significantly reduces the likely hood of sustaining head injuries, severe traumatic brain injuries, intracranial lesions and serious neuro-motor disability as suggested by Cawich SO et al. [13]

None of the pillion riders wore the helmets; lack of wearing the helmet resulted in increased incidence of head injuries in pillion riders also. To reduce the incidence of head injury in pillion riders they should wear crash helmet as suggested by Modi. [7]

It may be observed that head injuries constituted as a major pathology behind the death of the deceased, similarly studies by Bairagi KK et al. [16] the most of the head injuries are associated with skull fractures which increases the fatality of victims. [21]

Skull fractures are not a dictum to be present in all fatal head injury cases. In this study skull fractures were present in 166 (67.75%) cases. Compared to 69.63% of cases in the study by Kumar A et al and Singh B et al. [4, 20] The dominant type of skull fractures found was the linear (fissured) fracture in 55.43% cases followed by basilar fracture in 17.47%, Crushes fracture in 18.07%, Communated fracture in 5.42% and depressed fracture in 3.62%. Fissured fracture was the most commonly observed fracture (57%) in study of Menon A et al and Shivakumar BC et al. [11, 18]

The commonest variety of Intra Cranial Hemorrhage found was subdural haemorrhage 90.83%, followed by sub arachnoid haemorrhage 70.53%, Intra cerebral hemorrhage 20.64% and least is extra dural hemorrhage found in 4.75% of cases as studied by others. [5, 19] The most common cause of death which was Intra Cranial Haemorrhage from head injury in study by Nzegwu et al. [12]

A fracture of the skull with associated brain injury is the most common cause of death in our study. We found multiple injuries in most of cases involving other systems a typical feature of fatal motor cycle accidents as mentioned by Parikh CK. [8] Apart from the head injuries, other system injuries were also noted. Rib fractures were commonest other system injury found in 44.44% of cases. Similar to the findings of the study by Sauter C et al and Kumar A et al [10, 5]

Conclusion:

In this study it has been observed that the human error is mainly responsible for fatal RTA. Though it is a most difficult task to control human errors involved, sincere efforts made in this direction can reduce the mortality and morbidity. Preventive measures of all epidemic diseases are based on the cause. Similarly for reducing fatalities among victims of two wheeler road traffic accidents, it is essential to study the cause of RTAs, which revolve around factors responsible as Human errors, Machine (Vehicle) errors, and environment. [3]

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Table 1: Total Deaths due to Fatal RTA involving Riders/Pillion Riders of Two Wheelers

	Male (%)	Female (%)	Total (%)
Riders	177(94.7)	10(5.3)	187(76.3)
Pillion Riders	38(65.5)	20(34.5)	58(23.7)
Total	215	30	245

Table 2: According to the Age Group

Age (yrs)	Riders (%)	Pillion Riders (%)
0 – 9	0(0.00)	0 (0.0)
10 – 19	10(5.4)	6(10.3)
20 – 29	90(48.1)	27(46.6)
30 – 39	45(24.0)	10(17.2)
40 – 49	15(8.0)	4(7.0)
50 – 59	18 (9.6)	8(13.8)
60 – 69	5 (2.7)	3(5.2)
≥70	4(2.1)	0(0.0)
Total (n=245)	187	58

Table 3: Time of Accident

Time Interval	Riders (%)	Pillion Riders (%)
6 AM – 12Noon	39(18.0)	5(16.8)
12 Noon– 6PM	60(27.8)	11(27.2)
6PM – 12Mid Night	94(43.5)	10(44.6)
12Mid Night – 6AM	23(10.6)	03(11.4)
Total	216	29

Table 4: Place of Accident

Rural/Urban	Rural (%)	Urban (%)
0 – 9	0 (0.0)	0(0.0)
10 – 19	3(4.8)	13(7.1)
20 – 29	26(41.3)	91(50.0)
30 – 39	19(30.1)	36(19.8)
40 – 49	5(7.9)	14(7.7)
50 – 59	8(12.7)	18(9.9)
60 – 69	2(3.2)	6(3.3)
≥70	0(0.0)	4(2.2)
Total (n=245)	63	182

Table 5: According to Evidence of Using Helmets among Riders

Helmets Used	Used (%)	Not Used (%)
0 – 9	0(0.0)	0(0.0)
10 – 19	7(5.8)	3(2.5)
20 – 29	59(49.1)	31(25.8)
30 – 39	31(25.8)	14(11.7)
40 – 49	10(8.3)	5(4.1)
50 – 59	8(6.7)	10(8.3)
60 – 69	3(2.5)	2(1.7)
≥70	2(1.7)	2(1.7)
Total (n=187)	120 (64.1)	67(35.9)

Table 6: Types of Skull fractures in RTA Involving Riders & Pillion Riders

Types of Skull Fracture	Riders (%)	Pillion Riders (%)
Linear Fracture of vertex	26(13.9)	11 (18.9)
Communated Fracture of vertex	4(3.2)	2(4.9)
Depressed fracture of vertex	7(5.6)	2(4.9)
Basal Fracture	21(11.2)	8(13.8)
Basal Fracture +linear fracture of vertex	44(23.5)	11(19.0)
Crush fracture of skull	23(12.3)	7(12.0)
No Fracture	62(33.1)	17(29.3)
Total	187(76.3)	58(23.7)

Table 7: Intra Cranial Hemorrhages in Riders & Pillion Riders

Riders	EDH (%)	SDH (%)	SAH (%)	ICH (%)
Skull With Fracture	6(4.8)	116 (92.8)	96 (76.8)	22 (17.6)
Skull Without Fracture	2(6.9)	24(82.8)	18(62.1)	6(20.7)
Pillion Riders				
Skull With Fracture	3(7.3)	36(87.8)	28(68.3)	8(19.5)
Skull Without Fracture	0(0.0)	8(100)	6(75.0)	29(25.0)

Table 8: Injuries in Vital Organs other than Head Injuries in Riders & Pillion Riders

	Riders (%)	Pillion Riders (%)
Ribs Fractures	68(54.4)	22(61.1)
Long Bones Fractures	20(16.0)	6(16.7)
Pelvis Fracture	2(1.6)	2(5.6)
Vertebral Fracture	10(8.0)	3(8.3)
Visceral Lacerations	25(20.0)	3(8.3)
Total	125(77.6)	36(22.4)

Original Research Paper

Estimation of Stature from Index and Ring Finger Length

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Abstract

Establishing the identity of person is one of the significant aspects of Forensic investigation. Recently studies were conducted to estimate stature from hand and phalange lengths; however, few studies were conducted using finger lengths. The purpose of present study was to evaluate utility of index and ring finger lengths in estimation of stature and to predict the accuracy of regression models derived from such parameters. The study was carried out on a cross sectional sample of 195 adult students out of which 100 were males and 95 were females. There was significant difference ($P < 0.001$) between stature of male and female subjects. Similarly significant difference ($P < 0.001$) exists between male and female index and ring finger length. A significant correlation was observed between finger length and stature. Pearson correlation between finger length and stature was higher among females than males. The findings of present study indicate that index finger and ring finger lengths can be used successfully to predict living stature of an individual.

Key Words: Forensic, Identification, Stature, Finger Length, Index and ring finger

Introduction:

Establishing the identity of person is very essential for the Forensic investigation. Moreover, the work gains importance while dealing with mass disaster or examining mutilated and commingled body parts or dismembered body parts. Albeit partial, estimation of stature is one of the important characteristics to establish identity of a person.

Estimation of stature is based on a principle that every body part bears a more or less constant relationship with height of an individual. Various studies in past have utilized various body parts such as upper and lower extremities including hand and foot dimensions for estimation of stature. [1-6]

Recently studies were conducted to estimate stature from hand and phalange lengths [7-8] however; few studies were conducted using finger lengths. [9-14]

Considering the paucity of studies on such parameters and in view of importance of estimation of stature from the different body parts, the present study was undertaken.

Aim of this study was to evaluate utility of index and ring finger lengths in estimation of stature and to predict the accuracy of regression models derived from such parameters.

Material and Methods:

The present prospective study consists of adult students of Government Medical College, Miraj, District Sangli, Maharashtra, who were randomly selected from the 5 year MBBS batches. The study was carried out on a cross sectional sample of 195 adult students out of which 100 were males and 95 were females.

Data on age, sex, height and weight were collected and the anthropometric measurements were taken. The length of the index finger (IFL) and ring finger (RFL) of the left and right hand of each subject were measured with the aid of manual vernier calipers, from the tip of the digit to the ventral proximal crease, where there was a band of crease at the base of the digit, the most proximal crease was used.

Stature was estimated from vertex to the floor with feet axis parallel and head in Frankfort plane. Subjects with injuries or deformities in any of the hands or spine were excluded from the study. All measurements were made in centimeters to the nearest millimeter with digits fully extended. Three parameters were investigated which includes height, weight and the length of index and ring fingers of both hands. Data was analyzed using SPSS (version 16) software. The stature, index and ring finger length data is expressed as mean \pm Standard deviation (\pm SD).

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Descriptive statistics and Students't-test were used to analyze and determine the parameters studied in both males and females. The relationship between the parameters studied was established using Pearson correlation to establish the strength of the relationship between the lengths of index and ring finger and stature.

Linear regression equation were derived for stature estimation from index and ring finger length in male and females with stature acting as the dependent variable and finger length as independent variable. Statistical significance was accepted at P value less than or equal to <0.05 ($P < 0.05$). Similarly multiplication factors were derived for stature estimation.

A multiplication factor was calculated by dividing the stature with index and ring finger in every individual. The mean value of multiplication factor was taken as multiplication factor for estimation of stature from index and ring fingers.

Results:

The mean age of male population was 21.52 years while the mean age of female population was 20.08 years. (Table 1) The mean height (171.6 cm) of men exceeds the mean height (157.3 cm) of women.

The descriptive statistics of stature and lengths of right index finger (RIFL), right ring finger (RRFL), left index finger (LIFL) and left ring finger (LRFL) in both sexes showed significant difference ($P < 0.001$) between stature of male and female subjects.

Similarly significant difference ($P < 0.001$) exists between male and female index and ring finger length. (Table 2) A significant correlation was observed between length and stature. (Table 3) Pearson correlation between finger length and stature was higher among females than males.

Amongst males, correlation was higher between the ring finger length and stature (right hand $r = 0.546$ and left hand $r = 0.572$). In females, correlation was higher between index finger and stature (right hand $r = 0.618$ and left hand $r = 0.612$). Linear regression equations were derived for reconstruction of stature in males and females. (Table 4)

The predictive accuracy for regression models for stature reconstruction was derived.

The standard error of estimate (S.E.E) was smaller in females (S.E.E. ranged from 4.16 cm to 4.26) in comparison of males (S.E.E. ranged from 5.84 cm to 6.10). (Table 5)

Multiplication factors for ease of calculation and stature reconstruction were

derived. The mean multiplication factors for reconstruction of stature from finger length ranged from 22.37 to 23.38 in males and 22.71 to 23.27 in females. (Table 6) The relationship between stature and finger lengths among males and females are shown in scatter diagram. (Fig. 1 and 2)

Discussion:

Estimation of stature from bones especially longer ones is preferable practice because of higher correlation coefficient and small error of estimate. However, practical difficulty arises in a situation where only dismembered body part is available for medical examination. Therefore in search of new parameters, the Forensic investigators are exploring different body parts to estimate stature such as head, face, hand, foot, phalanges, finger length etc. [1-16]

With establishment of DNA profiling technique as a reliable tool in identification, the utility of such traditional methods are now questioned. However, the usefulness of such methods cannot be discarded especially in circumstances where sophisticated techniques are not available or where such techniques have limitations. Few studies have demonstrated the utility of fingers in estimation the stature.

Tyagi et al studied the subjects from Delhi and found positive correlation between stature and finger lengths and have suggested that index finger was best for the prediction of stature in both males and females. [9] Jasuja et al had studied the hand and four phalange lengths in 60 subjects belonging to Jat Sikhs community. The researchers had observed correlation coefficient that ranged from 0.215 to 0.681 and concluded that stature could be estimated from studied parameters. [7]

Rastogi et al estimated stature from middle finger and noted a positive correlation that ranged from 0.504 to 0.696 between middle finger length and stature while studying the north and south Indian population. [10] Varghese et al studied in Mysore, India and found that best finger to predict the height in case of males was left thumb and in females it was right thumb. [11]

Habib et al studied 159 Egyptians subject aged between 18 to 25 years and concluded that hand length gave better prediction of stature than the length of phalanges. Amongst phalanges, little fingers in male and distal phalanges of female fingers were not correlated with stature. [8] Shivakumar et al while studying female students found correlation coefficient of 0.53 between middle finger length and stature. [12]

Kumar et al had studied 200 subjects from Uttarakhand, India aged between 21 years to 30 years for correlation between length of thumb and stature and noted positive correlation. The correlation coefficient ranged from 0.240 to 0.256. [13] Krishan et al estimated stature from index and ring finger length in a North Indian population and observed that stature can be estimated from these finger lengths with a reasonably accuracy.

The correlation coefficient ranged from 0.671 to 0.748 in males and from 0.367 to 0.531 in females. [14] However, this study was conducted on adolescent population with their age ranged from 14 years to 18 years (mean age 16 ± 1.3 years).

Thus the result obtained from the study is applicable to adolescent population only. Hence there is need for a study whereby the results could be pertinent to adult population.

The results of our study are encouraging. Statistically significant correlation was noted between index and ring finger and stature. In male the correlation was higher between ring finger and stature ($r=0.54$) while in females the correlation was higher between index finger and stature ($r=0.618$).

While comparing the parameters amongst sexes, it was found that female have higher correlation than males. From the regression models derived in the present study the standard error of estimate in the predicted stature was more in males than the females. In other words the accuracy of stature estimation in females is more than males.

The present study has also calculated multiplication factor for the ease of stature reconstruction. The mean value of multiplication factor in male ranged from 22.37 to 23.38 in males and 22.71 to 23.27 in females. The standard deviation varied from 1.13 to 1.17 in males and 0.91 to 1.13 in females.

The multiplication factor is a handy tool and proves vital in situation where the forensic investigator is not well versed with complex mathematical equations or where the investigator is dealing with number of cases like mass disaster or people affected in terrorist attacks etc. The findings of this study are comparable with findings of Krishan et al. [14]

However Krishan et al [14] had noted higher correlation coefficient for males than females whereas in present study we have noted higher correlation coefficient for females than males. This difference could be attributed to population difference as Krishan et al [14] had utilized adolescent north Indian population whereas we have utilized Maharashtrian

population. While studying middle finger length to estimate stature, Rastogi et al [10] had noted that statistically no significant difference existed between the mean stature and middle finger length of south Indian and north Indian populations. Therefore these researchers were of view that if study results are applied to same race then geographical variations did not influence on body proportions. However, caution should be exercised because the results are from a single study and between two populations only.

It would be interesting and fruitful to have similar studies in other geographical areas and with different populations so as to evaluate whether population and geographical difference exists or not?

Conclusion:

Estimation of stature is an important tool to establish partial identity of a person. The importance of estimation of stature from the different body parts cannot be overlooked. The findings of present study indicate that index finger and ring finger lengths can be used successfully to predict living stature of an individual. Depending on the choice of investigator, either formula derived from regression models or multiplication factors can be used to reconstruct the stature.

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Table 3: Pearson Correlation (r) between Finger Length and Stature (in cm)

Stature	Male	Significance	Female	Significance
RIFL	0.515	P < 0.001	0.618	P < 0.001
RRFL	0.546	P < 0.001	0.594	P < 0.001
LIFL	0.556	P < 0.001	0.612	P < 0.001
LRFL	0.572	P < 0.001	0.594	P < 0.001

Table 4: Linear Regression Models Calculated to Reconstruct the Stature from Index and Ring Finger (In Cm)

Parameter	Male	Female
RIFL	$106.68 + 8.80 \times \text{RIFL}$	$95.45 + 9.09 \times \text{RIFL}$
RRFL	$107.36 + 8.36 \times \text{RRFL}$	$96.59 + 8.75 \times \text{RRFL}$
LIFL	$103.17 + 9.29 \times \text{LIFL}$	$91.96 + 9.65 \times \text{LIFL}$
LRFL	$104.89 + 8.66 \times \text{LRFL}$	$97.99 + 8.56 \times \text{LRFL}$

Table 5: Predictive Accuracy for the Regression Equation Derived

Sex	Parameters	R-square	Adjusted R-square	S.E.E (cm)
Male	RIFL	0.265	0.258	6.10
	RRFL	0.298	0.291	5.97
	LIFL	0.309	0.302	5.92
	LRFL	0.327	0.320	5.84
Female	RIFL	0.382	0.375	4.16
	RRFL	0.353	0.346	4.25
	LIFL	0.375	0.368	4.18
	LRFL	0.353	0.346	4.26

Fig. 1A-1D: Relationship between Index and Ring Finger Length (Cm) & Stature (Cm) in Male

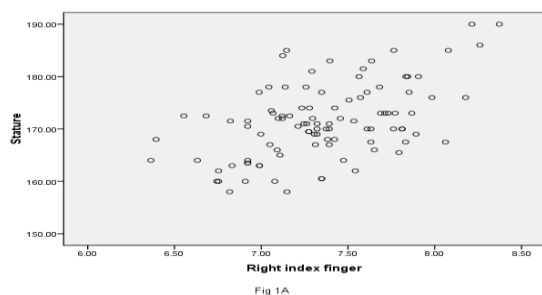


Fig. 1B:

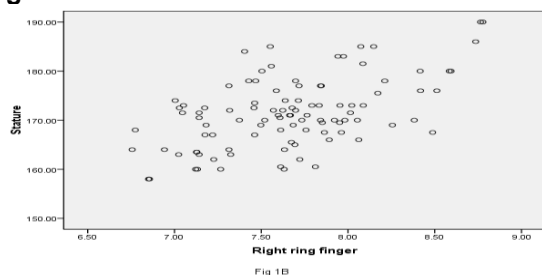


Fig. 1C:

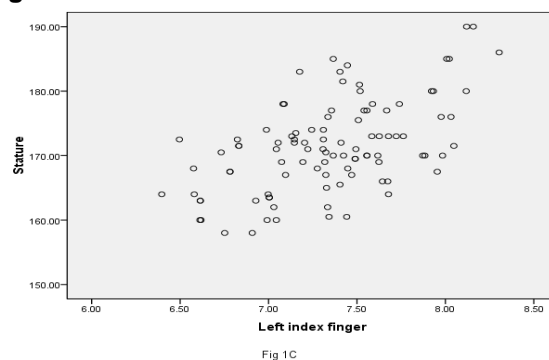


Fig. 1D:

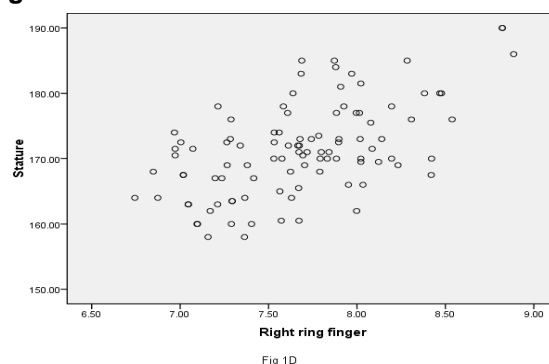


Fig. 2A-D: Relationship between Index and Ring Finger Length (cm) & Stature (cm) in Female

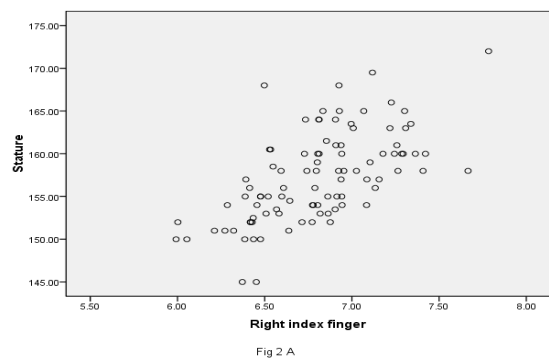


Fig. 2B:

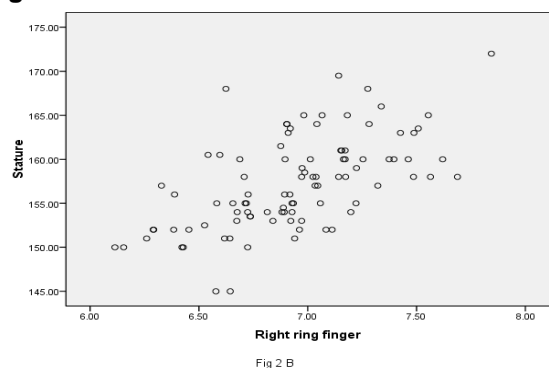


Fig. 2C:

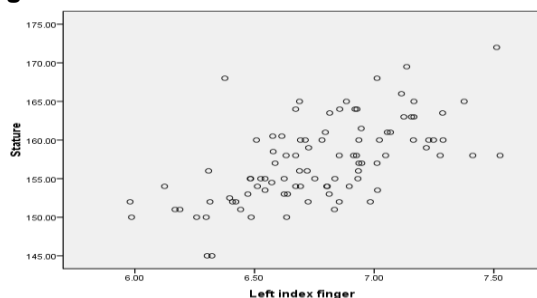


Fig 2 C

FIG. 2D:

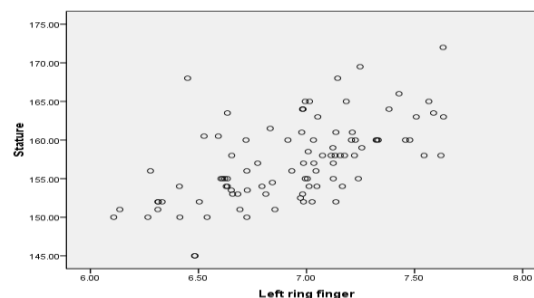


Fig 2 D

Table 1
Age Related Descriptive Data

Parameters	Male (n = 100)				Female (n = 95)			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Age	19	26	21.52	1.41	18	23	20.81	0.97

Table 2
Descriptive Statistics of Stature and Finger Length (in cm)

Sex	Parameter	Minimum	Maximum	Mean	S.E. of mean	SD
Male	Stature	158	190	171.46	0.708	7.08
	RIFL	6.36	8.37	7.35	0.041	0.41
	RRFL	6.76	8.78	7.66	0.046	0.46
	LIFL	6.40	8.30	7.34	0.042	0.42
	LRFL	6.74	8.89	7.67	0.046	0.46
Female	Stature	145	172	157.3	0.540	5.26
	RIFL	5.99	7.78	6.80	0.036	0.35
	RRFL	6.11	7.84	6.93	0.036	0.35
	LIFL	5.98	7.53	6.76	0.034	0.33
	LRFL	6.11	7.63	6.92	0.037	0.36

Table 6
Multiplication Factor for Male & Female for Stature Estimation from Ring & Index Finger Length (Cm)

Sex	Parameter	Minimum	Maximum	Mean	Median	SD	CD*	CV**
Male	RIFL	20.77	26.32	23.35	23.28	1.17	0.039	5.1%
	RRFL	19.73	24.85	22.41	22.42	1.15	0.041	5.1%
	LIFL	21.05	26.55	23.38	23.34	1.15	0.040	4.9%
	LRFL	19.89	24.97	22.37	22.33	1.13	0.041	5.1%
Female	RIFL	20.61	25.85	23.16	23.25	0.95	0.034	4.1%
	RRFL	20.55	25.36	22.71	22.60	0.94	0.033	4.2%
	LIFL	20.99	26.34	23.27	23.21	0.91	0.032	3.9%
	LRFL	20.72	26.04	22.74	22.56	0.98	0.035	4.4%

*CD = coefficient of dispersion, **CV% = coefficient of variation

Original Research Paper

Attitudes of Medical Students towards Medico-legal/Clinical Autopsy

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Abstract

Autopsy is a research tool which has been used for centuries. It is divided into medico legal and clinical or academic autopsies. The use of autopsy in medical education has been declining. Present study is carried out to determine the attitudes of medical students toward autopsy. Three hundred medical students of 2nd, 3rd and 4th year MBBS were randomly selected for the study. The students were asked to respond anonymously to a set of questions. Most of the students (80.7%) agreed on the importance of autopsy in medical education. 166 (55.3%), respondents suggested that medical students should actively participate in performing autopsies. The majority of the students (282, 94%) felt that autopsy should not be scrapped from the medical curriculum. 51% of students did not want autopsies to be performed on them or their relatives after death. Most of the students were of the view that use of primitive instruments such as chisel and hammer should be replaced with more modern equipment like oscillating saw and care should be taken to keep the autopsy room clean and odour free.

Key Words: Medico legal autopsy, Clinical autopsy, Medical education, Forensic Medicine, Consent

Introduction:

Autopsy is a research tool which has been used for centuries. The word autopsy is derived from the Greek word autopsia- "to see with one's own eyes". Autopsy can be divided into medico legal and clinical or academic autopsies. A clinical autopsy is the final step in the identification of a person's illness or cause of death. The medico-legal autopsy plays an important role in the administration of justice.

The use of autopsy in medical education has been declining, just as autopsy rate has been falling worldwide [1, 2] this is further worsened by authorities deterring medical students from attending autopsy sections in some areas. [3] In India, according to the curriculum of the Medical Council of India, a medical student should witness a minimum number of medico legal autopsies in the second year so that they can observe and interpret various findings.

Compulsorily witnessing a minimum number of medico-legal autopsies by a medical student is implemented to acquaint a medical student with conducting a medico-legal autopsy after registering as a medical practitioner. Due to lack of Forensic Medicine experts in India, a general practitioner many a time is required to perform a medico legal autopsy.

It is only when students attend an autopsy section that they can appreciate the large number of pathological conditions in different patients. The value of autopsy (Clinical/Medico legal) has been proven in its elucidation of the cause of death, clinical quality control, medical auditing and in medical education. [4, 5]

Various reasons given for the decline in autopsy-based teaching include insufficient hospital autopsies, competing departmental duties and limited curriculum time. [6] The need to expose the students to autopsy cannot be over emphasized because eventually these students will become clinicians and as clinicians they are not likely to advocate autopsies if they have not been properly exposed to the same.

It is obvious that knowledge of autopsy will broaden the students' mind and enhance a more accurate diagnosis during the subsequent years of their clinical practice as doctors.

Many medical students graduate without seeing an autopsy [7], but in some countries they may be the only medically qualified person

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to undertake the task. In India, for example, according to the curriculum of the Medical Council of India, a medical student should witness medico legal autopsies in the second and third year of MBBS so that they can observe and interpret the various changes in organs and tissues. An intern is supposed to acquire the skill of doing a medico-legal autopsy. Thus, every medical graduate is presumed to be capable of doing a medico-legal autopsy. [8]

In Australia, medical students used to be expected to attend routine hospital autopsies. But anecdotal evidence shows a decline in human dissection and autopsies for teaching in Australian medical schools. The key reason for the decreasing use of autopsies by university pathology departments is the decrease in the rate of hospital autopsies and the growing field of non-autopsy pathology, including molecular and cellular pathology [9] Students attendance at autopsies is compulsory in five medical schools in Australia.

The United States does postmortem examinations in less than 5% of deaths in hospital, and the procedure is alien to almost every doctor trained in the past 30 years. Less than half of US medical schools require attendance at autopsy, and most students graduate without attending a single session. [3]

In general, throughout Turkey, a general practitioner often does Forensic autopsies and examines legal cases because there are insufficient forensic medicine specialists. Undergraduate forensic medicine education is a must for every medical student in Turkey. [10-12] In Brazil, students are encouraged, but not obliged, to attend necropsies. They are most likely to attend necropsies during the final two academic years. [13]

Very few studies have been conducted on the attitudes of medical students to clinical autopsy /medico legal autopsy. The aim of this study is to investigate the general attitude of medical students of 2nd, 3rd and 4th years towards medico-legal autopsy/Clinical autopsy.

Aims and Objectives:

- To study the attitude of medical students towards autopsy, specifically, medico-legal autopsy.

Materials and Methods:

This study was conducted among medical students of a premier medical college of India at Pune. Comments of the students of 2nd, 3rd and 4th year were obtained by asking them to answer a questionnaire on the subject. Questionnaires were prepared, after consulting other faculty members of the dept, going through

literature and day today interactions with students during autopsy.

The questionnaires were distributed to the aforementioned students and participation in the study was voluntary. The students were asked not to disclose their identity.

The questionnaires were received in a box, kept specifically for the purpose. Their comments were analyzed in detail on the following aspects: usefulness and necessity of autopsy in medical practice and education; their personal distaste for the procedure, whether attendance at an autopsy should remain a compulsory part of medical education, staff attitudes, observance of relative's wishes; and feelings about autopsies carried out on self or relatives. A total of 300 students participated in the study.

Observations:

Out of the 340 questionnaires distributed, 300 were returned duly filled. The age range was 18-24yrs because the commonest age of admission into the Medical College in India is between 17-20 yrs. 244 (81.3%) of them were male while 56 (18.7%) were females. All these students witnessed 10 medico-legal autopsies each during 2nd and 3rd year of medical graduation in the subject of Forensic Medicine and Toxicology, which is a mandatory requirement as per the syllabus prescribed by Medical Council of India.

In the evaluation of response, 217 (72.3%) of the students stated that the number of autopsies they witnessed was enough, while 83 (27.7%) said that the number was not enough. However, a total of 143 (47.7%) students would recommend medical students to watch more autopsies. Most of the students 242 (80.7%) were of the view that autopsy is necessary, not only from the medico-legal point of view, but it also helps them to understand various anatomical relations and pathology of the organs. The majority, 166 (55.3%), suggested that medical students should actively participate in performing autopsies.

In spite of the fact that the students view autopsy whether medico-legal or clinical, as being necessary, 51% of them would not want autopsies to be performed on them or their relatives after death.

Most of the students (282, 94%) felt that autopsy should not be scrapped from the medical curriculum. (Table 1) Majority of the students (78%) were not interested in specializing in Forensic Medicine because it deals with death, while 63% of them had made up their mind to specialize in other specialties,

6.4% of them felt that forensic medicine as a profession is not lucrative, because there is very little scope at present in India for this specialty. (Table 2) Most of the students were of the view that use of primitive instruments such as chisel, hammer should be replaced with the more modern equipment like oscillating saw and care should be taken to keep the autopsy room clean and odour free. (Table 3)

About a third of the respondents felt that inadequate respect had been shown to the dead. They were of the view that the autopsy was done very quickly, viscera were thrown about and the organs stuffed in a bag. They also pointed to the unnecessary chats and remarks by the staff during the procedure.

Some students commented about the removal of tissues and organs during autopsy by the autopsy surgeon. They were of the view that detailed consent should be obtained from relatives for retaining any organ for research or investigation purpose. However, few of them are aware that in medico-legal autopsy, as compared to clinical autopsy, such consent is usually not mandatory in certain circumstances. 34% students suggested that relatives' objections to autopsy should be respected and their views and wishes should be adhered to.

Discussion:

The age range of the students was 18-24yrs in this study. This is because the common age of admission into the Medical College in India falls between 17-20 yrs. This compares favorably with the findings of Brieger WR [14] in 1980 and Ekanem and Akhibe [15] in 2006.

In the present study, all the students witnessed a minimum of ten autopsies each. Although 72.3% of the students said that the number of autopsies they witnessed were enough, 143 (47.7%) students recommended that medical students should watch more autopsies. This is in contrast to the study by Ekanem and Akhibe [15], where the figure was 57% and 74% respectively. Most of the students, 242 (80.7%), agreed that autopsy is necessary and they learnt something from watching and participating in an autopsy.

This compares favourably with the studies of other authors. [13, 15-17] In Nigeria several students commented that attendance at autopsy may have fundamental psychological benefits, "---- aiding students to come to terms with the death of a patient," and "attending one or more autopsies is good for medical students in that it is one way in which we can come to terms with mortality." [18]

In our study only 51% agreed to an autopsy being performed on them. Which is similar to the study by Ekanem and Akhibe [15], where only 34% agreed to autopsy being performed on themselves, and is in contrast to the studies by Sanner [19] in Sweden, and Jadav CJ et al [17] in which 90% and 82.5% of the students respectively agreed for autopsy to be performed on themselves, though most of them felt uncomfortable at the thought of it.

The majority, (166, 55.3%), suggested that students should actively participate in performing autopsies rather standing and watching as mute spectators. The same view was expressed by the students (76%) in a study conducted by Ekanem and Akhibe. [15] 36.3% respondents felt that inadequate respect had been shown to the dead. They were of the view that the autopsy was done very quickly; chisels and hammers were indiscriminately used to open the body cavities.

Viscera were thrown about and unnecessary remarks and chats were made during the procedure. Similar feelings were also expressed by students in a study conducted by E W Benbow. [18] However, none of the respondents had suggested how the procedure might be modified to afford proper respect. 74% students suggested that primitive instruments such as chisel, hammer and saw should be replaced with modern oscillatory electric saw in the autopsy room.

Though few big institutions in India have got modern autopsy rooms with state-of-the-art facilities, quite a large number of mortuaries are still using primitive facilities. 89.3% of the respondents were aware that medico-legal autopsy is required in all cases of suspected death such as legal reasons/suspicious circumstances of death/poisoning/drowning/child death etc. However, several students have raised objections to autopsies on the victims of road traffic/rail traffic accident, on the grounds that the cause of death was already known in these cases. This compares favourably with the study of E W Benbow. [18]

The majority of the students (78%) were not interested in specializing in Forensic Medicine because it deals with death, while 63% of them had made up their mind to specialize in other specialties. 6.4% of them felt that forensic medicine as a profession is not lucrative, because there is very little scope at present in India for this specialty. Though no other study has been exclusively done on this subject i.e. medico legal autopsy, a similar study by Ekanem and Akhibe [15] on the clinical autopsy compares favourably with the present study,

where students have shown the same response for the subject of pathology.

Conclusion:

The need to expose medical students to autopsy (Medico-legal and Clinical) cannot be over emphasized because eventually these very students will become clinicians or forensic experts. The knowledge of medico-legal/clinical autopsy will broaden the student's perceptive and will help the legal system in delivering quick justice in criminal cases. However, most of the mortuaries in India are in a primitive state and do not encourage the student to become more interested in observing autopsies.

Moreover, the apathetic attitude of the mortuary staff, including autopsy surgeons, the archaic methodology, equipment and procedure involved act as a deterrent to the involvement of students in the subject. Unpleasant aspects of an autopsy demonstration should be kept to a minimum to encourage attendance and promote a sense of its value, and that it might be useful to influence and modify students' opinions before they become entrenched in discussing dying and death in the medical curricula.

Even though the potential value of the necropsy (Medico-legal and clinical) in undergraduate teaching is very large, its prominence has diminished in recent decades, and medical students in some schools may qualify without ever entering a mortuary. Necropsy should be carefully and sensitively incorporated into programmes designed to teach students about death and dying. This might reduce both, their reluctance to seek permission for necropsy and their difficulty in looking after the dying patient.

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Table 2: Reasons for Not Specializing in Forensic Medicine

	Reasons	%
1	Not interested in Forensic Medicine	29%
2	Interested in other specialties	53%
3	Not lucrative, Scope in India is minimal	6.4%
4	No reasons	11.6%

Table 3: Suggestions for Improvement in Autopsy Procedure

Suggestions	%
Improvement in hygiene and sanitation in autopsy room	50
More involvement of autopsy surgeon during autopsy	21.7
Replacement of primitive instruments with modern ones in the autopsy room	74
Active participation of students during autopsy	10.3
Show more respect towards dead body	36.3

**Table 1
Response to Questions in Relation to Gender**

Questions	Male		Female		Total	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Do you think the number of autopsies you watched were enough?	172 (70.5)	72(29.5)	45(80.4)	11(19.6)	217(72.3)	83(27.7)
Would you recommend that medical students should watch more autopsies?	116 (47.5)	128(52.5)	27(48.2)	29(51.8)	143(47.7)	157(52.3)
Should medical students actively participate in performing autopsies?	139(57)	105(43)	27(48.2)	29(51.8)	166(55.3)	134(44.7)
Did you learn anything from the autopsies you watched?	196(80.3)	48(19.7)	46(82.1)	10(17.9)	242(80.7)	58(19.3)
Should witnessing autopsy be scrapped from the UG curriculum	18(7.4)	226(92.6)	Nil	56(100)	18(6)	282(94)
At death would you like autopsy to be performed on you or any of your near relatives.	128(52.5)	116(47.5)	19(33.9)	37(66.1)	147(49)	153(51)
Would you like to specialize in Forensic Medicine?	47(19.3)	197(80.7)	19(33.9)	37(66.1)	66(22)	234(78)

Original Research Paper

Most Predominating Pattern of Lip Prints In North Indian Population

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Abstract

The concept of identity is a set of physical characteristics, functional or psychic, normal or pathological-that define an individual. "Cheiloscopy" is a method of identification of a person based on the characteristic arrangement of lines on the lips. This study was conducted on 300 individuals of either sex (M: F: 100:200) to study the predominating pattern of lip prints in the North Indian Population. Materials used were dark colored lipstick, cellophane tape and white bond paper. The lips of the subject were thoroughly cleaned and lipstick was applied uniformly. Lip prints were taken on the glued portion of cellophane tape and then stuck on to a white bond paper. Then each of these lip prints were scanned using an image scanner set at a resolution of 300ppi. Type I, I' & II lip prints, when taken together found to be most predominant almost all the regions in both the sexes except in LUM region where type III replaced type II. In our study no two individuals or more than two individuals had similar types of lip prints patterns.

Key Words: Lip prints, Males, Females, North Indian Population, Lip Regions

Introduction:

One of the challenges faced by man in earlier days was to establish the identity of an individual. The concept of identity is a set of physical characteristics, functional or psychic, normal or pathological-that define an individual. Identification of humans is prerequisite for personal, social and legal reasons. [1] It is required for unknown deceased person in homicide, suicide, accident, mass disaster etc and for living individuals who are missing or culprits hiding their identity. [2] Traditional methods of personal identification include anthropometry, sex determination, post-mortem reports, Differentiation by blood groups, dactyloscopy and DNA finger typing.

These methods have been proved to be successful in many cases. [3, 4] Theory of uniqueness is a strong point used in the analysis of fingerprint & bite marks, to convince the court of law. [5] The positive identification of living or deceased persons using the unique traits and characteristics of teeth and jaws is a corner stone of Forensic science. [6]

A series of Forensic Odontological studies on the morphology of lips and the patterns produced when they are impressed onto a variety of surfaces form a worthy additional weapon for personal identification. [3]

"Cheiloscopy" derived from Greek word *cheli*-lips and *skopein*-see is the name given to the study of lip prints. [7] It was thought of as a method of identification of a person based on the characteristic arrangement of lines appearing on the red part of the lips.

In the present stage of development, cheiloscopy has surpassed the limits of a method and has become a means of criminalistic identification with lip prints.

Evidence such as photographs, cigarette, drinking glasses, cups, letters, window panes and other items that could bear lip prints should be closely examined. A trace of this kind carries a huge amount of information which can be used in the reconstruction of the events establishing versions checking them and identifying suspects. [8, 9]

Lip prints are similar to fingerprints, palm prints and foot prints, in that the individual

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characteristics are used for identification. The creases on the vermillion border of the lip, which appear as white areas in lip prints and the raised reddish areas outlined by creases, which appear as dark areas, are analogous to the furrows and ridges of friction ridge skin. The creases on the vermillion border are also referred to as grooves, furrows, wrinkles or valleys. [9]

According to Coward the lip print patterns appear to be genetically determined and unchanged from birth. These remain stable over passage of time, so they are useful as Forensic investigation tool that deals with identification of humans. [10] The foundations of cheiloscopy are thus the same as that of dactyloscopy that is to say, lip prints are invariable, permanent and allow establishing a classification. [12]

It has been verified that lip prints recover after undergoing alterations like minor trauma, inflammation and diseases like herpes. [3] The form of furrows does not vary with environmental factors. However, major trauma to the lips may lead to scarring, pathosis and the surgical treatment rendered to correct the pathosis may affect the size and shape of the lip, thereby altering the pattern and morphology of grooves. [11] It has also been suggested that variations in patterns among males and females could help in sex determination. [5]

Since the study in this field is still at the level of infancy, so the present study was designed to gain detailed knowledge of the lip print patterns of various individuals of North India.

Material and Methods:

Present study was conducted on 300 students (M: F 100:200) belonging to MBBS, BDS and B.Sc streams. Subjects with malformation, deformity, inflammation, trauma, surgical scars or any other abnormalities of the lips were excluded because of their unsuitability for this study. The subjects having full dentition were included. However eruption of last molar was ignored in classifying person with full dentition as its eruption was variable.

A written consent for wilful participation in the study was taken from all the subjects. Name, age, sex, caste and permanent address of the participants were noted on the same sheet on which cellophane tape with his/her lip prints was stuck. A dark coloured lipstick Colorbar 01R, cellophane tape and white bond paper comprised the materials for the study.

Method:

Lips of the subject were cleaned thoroughly with soap and water. Lipstick was

applied uniformly on the lips, starting at the midline and then moving laterally. Lip prints of both lips together were taken using strip of cellophane tape on its glued portion. Then these prints were stuck on to a white bond paper.

Lip prints of each individual were scanned using an image (hp) scanner set at a resolution of 300ppi. A horizontal line was drawn to distinguish the upper lip from the lower lip and another vertical line to divide each lip into left and right side.

As a result four quadrants were obtained, viz. Right half of upper lip, left half of upper lip, left half of lower lip and right half of lower lip. Each quadrant was further divided into medial and lateral halves. So all lip prints were studied in eight parts as follows:

Upper Lip	L	M		M	L
Lower Lip	L	M		M	L

Mid line

The lip prints collected were classified using the classification proposed by Suzuki and Tsuchihashi [13] as follows:

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

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

Type II: A branched groove.

Type III: An intersected groove.

Type IV: A reticular pattern.

Type V: Other patterns.

Data thus obtained was compiled, scrutinised and analysed to find different patterns in the region. It was compared with accessible literature. An attempt was made to find out if any pattern was more relevant in either sex.

Observations and Discussion:

1. Right Upper Lateral (RUL) & Right Upper Medial (RUM) Regions:

Present study showed that in RUL region Type I, I' & II taken together were found in 75% of males and 64.5% of females. (Table 1) Earlier Augustine et al [12] found it in 37.75% of males and 35.93% of females.

Thus these patterns were more prevalent in North Indian population. It is more so in type I' which was seen in 31% of our males and 26% of our females as compared with corresponding figures of 0.35% and 2.81% in Augustine et al [12] study. Later found type III to be more prevalent in both sexes (55% in males and 54.3% in females).

However in the present study type III was seen in only 10% of males and 17% of females. Though not many differences were observed in type IV, the type V was also more prevalent in our sample (12% in males' and 14%

in females) as compared with Augustine et al. [12] In the RUM region it was seen that Type I, I' and II taken together were found in 42% of males and 39% of females. Augustine et al [12] found it in 35.7% of males and 31.25% of females. Thus these patterns were more prevalent in North Indian population.

It was more so in type I' which was seen in 11% of our males 11.5% of our females as compared with corresponding figures of 3.21% and 3.75% in Augustine et al. [12] As far as type III is concerned it was found to be more prevalent in males of Augustine et al [12] sample (35.35%) as compared with our sample (29%) but not much difference was seen in the case of females. Similarly, type IV was also more prevalent in their sample, seen in 24.28% of males and 32.18% of females as compared with corresponding figures of 18% and 11% in the present study.

On the other hand, type V was more prevalent in our sample (11% in males and 15% in females) as compared with Augustine et al [12] (4.64% in males and 2.18% in females). When compared between the two sexes, type I and type IV were more prevalent in males (10% and 18% respectively) as compared with females (5.5% and 11% respectively), while type III and type V were more prevalent in females (35% and 15% respectively) as compared with males (29% and 11% respectively).

2. Left Upper Medial (LUM) & Left Upper Lateral (LUL) Regions:

In our study in LUM region it was seen that type I, I' and V taken together were found in 35% of males and 34.5% of females. (Table 2) Augustine et al [12] found it in 10% of males and 8.73% of females. Thus these patterns were more prevalent in North Indian population.

On the other hand, the other three patterns i.e. type II, III and IV was more prevalent in Augustine et al study [12] as compared with the present one.

When compared between the two sexes, while type I was more prevalent in males (males 12%; females 7%), the type III was more prevalent in females (30%) as compared with males (22%). However not many differences were seen in rest of types between the two sexes.

In the LUL region it was seen that type I, I' and II taken together were found in 81% of males and 67.04% of females. Earlier Augustine et al [12] found it in 41.05% of males and 35.62% of females. Thus these patterns were common in North Indian population. Such a high difference was primarily because of type I' which

was seen in 31% of our males and 29.5% of our females as compared with 0.35% of males and 1.25% of females in their study.

Similarly type V was more prevalent in our sample (males-9%; females-11%) as compared with Augustine et al, 2008 sample (males-0.35%; females-0%). On the contrary, type III was found to be more prevalent in earlier study by Augustine et al which was seen in 53.92% their males and 55% of females as compared with corresponding figures of 5% and 16% in present study.

Not many differences were observed in type IV. When compared between the two sexes, while type I was found to be more prevalent in males (13%) as compared with females (5.5%), type III was found to be more prevalent in females (16%) as compared with males (5%). Other types were almost equally distributed in the two sexes.

3. Left Lower Lateral (LLL) & Left Lower Medial (LLM) Regions:

In the LLL region it was seen that type I, I' and II taken together were found in 85% of males and 84.5% of females. (Table 3) It was 18.56% of males and 20.3% of females in Augustine et al study. [12] These patterns were more common in North Indian population.

Again, this huge difference between the two studies was primarily in type I' and II which were more prevalent in our sample, while type III was more prevalent in both sexes (78.57% in males and 77.81% in females) in other study. [12] When compared between the two sexes, type I was found to be more prevalent in males (15%) as compared with females (7.5%), while on the other hand type II was found to be more prevalent in females (57%) as compared with males (48%).

In the LLM region it was seen that type I, I' and II taken together were seen in 62% of our males and 77% of our females while Augustine et al [12] found 38.91% of males and 39.05% of females. Thus these patterns were more prevalent in North Indian population.

Type I and I' were found to be more prevalent in females of our study (40% and 26.5% respectively) as compared with Augustine et al [12] study (21.56% and 6.56% respectively) while not much differences were seen in the case of males. On the contrary, type III and IV taken together were more prevalent in Augustine et al [12] sample (58.20% in males and 59.06% in females) as compared with our study (28% in males and 16% in females).

When compared between the two sexes type I and type I' were found to be more

prevalent in females (66.5%) as compared with males (41%), while on the other hand type II and III were found to be more prevalent in males (41%) as compared with females (19.5%).

4. Right Lower Medial (RLM) & Right Lower Lateral (RLL) Regions:

Present study showed that in the RLM region type I, I' and V taken together were found in 58% of males and 67% of females. Augustine et al [12] found it in 36.34% of males and 32.8% of females. Thus these patterns were more prevalent in North Indian population.

On the contrary, type IV was more prevalent in Augustine et al [12] sample (30% in males and 35.62% in females) as compared with our sample (7% in males and 7.5% in females).

Similarly type III was also more prevalent in their study. When compared between the two sexes, type I' was found to be more prevalent in females (22%) as compared with males (15%), while on the other hand type III was found to be more prevalent in males (21%) as compared with females (9.5%).

In the RLL region it was seen that type I, I' and II taken together were found in 86% of our males and 81.5% of our females. Earlier Augustine et al [12] found it in 17.12% of males and 18.43% of females. Thus these patterns were more prevalent in North Indian population.

Such a huge difference was primarily because of type II which was seen in 53% of our males and 49.5% of our females as compared with 13.92% of males and 15.62% of females of Augustine et al. [12]

Similarly type V was more prevalent in our sample (9% of males and 6.5% of females) as compared with Augustine et al [12] sample (0% of males and 0.31% of females).

On the contrary type III was found to be more prevalent in Augustine et al [12] study (81.78% of males and 79.37% of females) as compared with our study (5% of males and 12% of females). Not many differences were seen when the data was compared between the two sexes.

Conclusion:

All the lip prints were different from one another in one aspect or the other. Hence it can be safely concluded that lip prints like the finger prints are unique to an individual and may form a reliable method for personal identification. Also lip prints vary in different parts of the lip.

These observations establish that every individual has got its own unique lip prints and if ante-mortem record is prepared, it can be compared with post-mortem record as lip print is unique for every individual and so can be used as Forensic tool for personal identification.

It is safe to assume that cheiloscopy, in its present stage of development, has become a means of criminalistic identification dealing with lip prints. Also, the present study provides a baseline data for future studies in cheiloscopy.

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Table 1
Comparison of Lip Print Pattern in Right Upper Lateral (RUL) and Right Upper Medial (RUM) Region

Type	RUL				RUM			
	Males		Females		Males		Females	
	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al	Present Study	Augustine et al
Type I	17%	13.5%	8%	9.06%	10%	6.42%	5.5%	3.75%
Type I'	31%	35%	26%	2.81%	11%	3.21%	11.5%	3.75%
Type II	27%	23.9%	30.5%	24.06%	21%	26.07%	22%	23.75%
Type III	10%	55%	17%	54.3%	29%	35.35%	35%	34.37%
Type IV	3%	6.07%	4%	9.06%	18%	24.28%	11%	32.18%
Type V	12%	35%	14.5%	62%	11%	4.64%	15%	2.18%

Table 2
Comparison of Lip Print Pattern in Left Upper Medial (LUM) and Left Upper Lateral (LUL) Region

Type	LUM				LUL			
	Males		Females		Males		Females	
	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]
Type I	12%	5.71%	7%	4.68%	13%	16.42%	5.5%	11.56%
Type I'	10%	1.78%	13%	2.18%	31%	.35%	29.54%	1.25%
Type II	26%	28.21%	21.5%	27.18%	37%	24.28%	32%	22.81%
Type III	22%	37.5%	30%	35.31%	5%	53.92%	16%	55%
Type IV	17%	24.28%	14%	28.75%	5%	4.64%	6%	9.37%
Type V	13%	2.5%	14.5%	1.87%	9%	.35%	11%	0%

Table 3
Comparison of Lip Print Pattern in Left Lower Lateral (LLL) and Left Lower Medial (LLM) Regions

Type	LLL				LLM			
	Males		Females		Males		Females	
	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]
Type I	15%	2.85%	7.5%	2.18%	29%	25.71%	40%	21.56%
Type I'	22%	0%	20%	.62%	12%	5.35%	26.5%	6.56%
Type II	48%	15.71%	57%	17.5%	21%	7.85%	10.5%	10.93%
Type III	7%	78.57%	9.5%	77.81%	20%	27.85%	9%	24.06%
Type IV	1%	2.85%	0%	1.56%	8%	30.35%	7%	35%
Type V	7%	0%	6%	.31%	10%	2.85%	7%	1.87%

Table 4
Comparison of Lip Prints Right Lower Medial (RLM) and Right Lower Lateral (RLL) Regions

Type	RLM				RLL			
	Males		Females		Males		Females	
	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]	Present Study	Augustine et al [12]
Type I	34%	26.7%	36.5%	23.43%	19%	2.85%	15%	2.5%
Type I'	15%	4.64%	22%	6.56%	14%	.35%	17%	.31%
Type II	14%	11.07%	16%	9.68%	53%	13.92%	49.5%	15.62%
Type III	21%	22.5%	9.5%	21.87%	5%	81.78%	12%	79.37%
Type IV	7%	30%	7.5%	35.62%	0%	1.07%	0%	1.87%
Type V	9%	5%	8.5%	2.81%	9%	0%	6.5%	.31%

Original Research Paper

Profile of Medico-legal Cases in Casualty of a Rural Medical College of Haryana

*Yogender Malik, **Rahul Chawla, ***Gaurav Sharma, ****Pushpendra Malik, *****Rajendra Singh, *****Achal Tripathi

Abstract

Apex court of our country has made saving life of patient in emergency supreme duty of doctor. However, medico-legal cases mandates exhaustive documentation mandatory after the treatment is over. Medico legal cases are handled in casualty by first Contact doctor. Contact doctor is generally a MBBS doctor and he seeks many expert opinions in a single report. So, the case then has to go to different departments for expert opinion. Present study was conducted in Bhagat Phool Singh Govt. Medical College for Women (BPS GMC), Khanpur Kalan, Sonapat from 1st September 2011 to 1st November 2012. In this study predominant sex was male and age group was 20-40 years. Bulk of the cases in the study was road side accidents and poisoning. In all the cases the contact doctors sought expert. Profiling helps in knowing the burden of medico-legal cases on different departments.

Key Words: Casualty, Profile, Opinion, Medico-legal Cases

Introduction:

The casualty also deals with medico-legal cases and these were expected to constitute a substantial proportion of the workload. Such patients not only merit treatment, but exhaustive documentation of such cases is mandatory. [1]

Profiling of medico-legal cases is an important aspect for the prevention of preventable casualties in future and to study the genuine crime in the area. [2] Profiling helps in knowing the burden of medico legal cases on different departments. Ours is a new Medical College in rural area exclusively for girl students with OPD of 1400 and 200 admissions daily.

Material and Methods:

The present study was conducted on 202 patients admitted to the casualty department of BPSGMC for women from 1st September 2011 to 1st November 2012.

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Objectives:

1. Profiling of medico-legal cases coming to the Casualty department of BPS GMC for Women, Khanpur Kalan, Sonapat.
2. Suggestions for improving medico-legal work in Casualty.

Observations:

In our study out of 202 cases, maximum numbers of cases 61 were reported in the age group of 21-30years followed by 31-40years, which showed 39 cases. (Table 1)

In respect to gender distribution, 148 were male as compared to 54 female and male to female ratio was 2.74:1 in this study. (Table 2) The hospital caters for more than 5 districts surrounding it. Most of the medico-legal cases came from Sonapat district (180) as compared to others. (Table 3)

Casualty department gets different types of Medico-legal cases and maximum cases reported were of poisoning (84) followed by road traffic accident (74). (Table 4)

The contact doctor seeks opinion from subject experts for the injuries which he found on first examination. In the present study we found that the opinion from expert was sought in all cases. In 147 cases opinion was taken from single department and in 20 cases from more than two departments. (Table 5) In present study most commonly opinions were sought from Medicine department (85) followed by surgery opinion (82). (Table 6)

Discussion:

Most common age group involved in Medico-legal cases was 21-30 years as this age group is economically most productive age group and also involved in outdoor household activities. This finding is similar to findings of other studies. [3-9] Male to female ratio was 2.74:1 which is consistent with finding of others. [3] Our Medical College is situated in Sonapat district. So, most of the medico-legal cases to our casualty are coming from Sonapat District.

Most common cases were poisoning followed by RTA. This finding is in variance to other studies. [1, 3] This could be due to the fact that our Medical College is in rural belt with most of the people involved in agriculture related activities with more accessibility to pesticides.

Opinion from expert was sought in most of the cases. Single department opinions were most common but more than one department opinions were also not uncommon. Maximum opinions were sought from Medicine, Surgery and Orthopedics department which is consistent with workload of these departments in other studies. [1]

Conclusion:

The contact doctor is mostly MBBS and he seeks opinion from experts regarding injuries. This leads to increased workload of different departments. This can be practice of defensive Forensic Medicine by contact doctors.

This new aspect in this study forces us to think whether the current time allotted to the subject for practical training of students during MBBS is sufficient or we should demand increase in time in the curriculum? The 15 days posting under Forensic Medicine department during internship should be mandatory for better exposure to medico-legal cases.

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Table 1: Age wise Distribution of Cases

Age (years)	Cases
0-10	5
11-20	29
21-30	61
31-40	39
41-50	28
51-60	6
>60	3
Not mentioned	13
Total	202

Table 2: Sex Wise Distribution

Sex	Cases
Male	148
Female	54
Total	202

Table 3: Area Wise Distribution

Area Catered	Cases
Sonapat District	180
Others	22
Total	202

Table 4: Mode of Injury

Type of Injury	Cases
Assault	20
Burns	14
Electrocution	1
Fall from height	1
Firearm injury	1
Hanging	3
RTA	74
Snake bite	1
Poisoning	84
Not mentioned	3
Total	202

Table 5: Opinions Sought Per MLR

No. of opinions in one MLC	Cases
Single department opinion	147
Two department opinion	35
More than two department opinion	20
Total	202

Table 6: Opinions Sought From Departments

Name of Department	Cases
Surgery	82
Orthopaedics	63
Medicine	85
ENT	20
Dental	13
Ophthalmic	23
Forensic Medicine	1

Review Research Paper

Can A Hospital Commit Criminal Negligence?

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Abstract

Criminal complaints are being filed against doctors alleging commission of offences punishable under Section 304A or Sections 336 / 337 / 338 of the IPC alleging rashness or negligence on the part of the doctors resulting in loss of life or injury (of varying degree) to the patient. The offence of criminal negligence requires a specific state of mind in respect of the person committing the offence. The offence of medical criminal negligence cannot be fastened on the Hospital /Company since the Company can neither treat nor operate a patient of its own. It is the Doctor working in the Hospital/Company who examines, treats prescribes medicines & performs operations. If there is a deliberate or negligent act of the Doctor working in the Corporation/Hospital, it is the liability of the Doctor and not of the Corporation for criminal negligence despite the fact that due to the act of the Doctor of treating patients the Corporation was getting some revenue.

This paper deals with critical review of recent judgment of the Delhi High Court pronounced on August 2, 2010 on the issue of criminal negligence by the Company or doctor.

Key Words: Company; Hospital; Corporate Hospital; Criminal Negligence; Doctor

Introduction:

Criminal responsibility carries substantial moral overtones. Some of life's misfortunes are accidents for which no body is morally responsible, others are wrong for which responsibility is diffuse, yet others are instances of culpable conduct & constitutes grounds for compensation and at times for punishment.

To distinguish between these categories requires careful, morally sensitive and scientifically informed analysis. [1] No sensible professional would intentionally commit an act or omission which would result in loss or injury to the patient as the professional reputation of the person is at stake.

A surgeon with shaky hands under fear of legal action cannot perform a successful operation and a quivering physician cannot administer the end-dose of medicine to his patient. To draw a distinction between the blameworthy and the blameless, the notion of *mens rea* has to be elaborately understood. [9]

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Brief Facts of the Case:

Indraprastha Medical Corporation Limited has claimed that a company incorporated under Companies Act and the company being only a juristic person was incapable of committing a crime of medical negligence, because it involved personal negligent act. [Page 2] [Para 1]

A writ petition was filed by the petitioner for quashing of order dated 19th December, 2007, passed by learned Metropolitan Magistrate in a complaint case under section 336/337/471 read with section 34 IPC qua the petitioner.

Grounds:

A complaint was filed before the learned M.M. against the petitioner company and the Doctors involved in the treatment of deceased wherein it was alleged that deceased died due to gross medical negligence of the Doctors. It is also submitted that Doctors involved in treatment advised wrong/superfluous treatments in order to extract extra money. [Para 2][1]

The petitioner's alleged that petitioner is not assailing the order as against Doctors but is assailing it so far as company was concerned on the ground that the company running the hospital, could not have acted in the manner in which it is assailed by the complainant. [Para 3]

Liability of Doctors under Criminal Law:

A medical professional may be held

liable for negligence on one of the two findings:

1. Either he was not possessed of the requisite skill which he professed to have possessed, or,
2. He did not exercise, with reasonable competence in the given case, the skill which he did possess.

Section 88 IPC provides exemption for acts not intended to cause death, done by consent in good faith for persons' benefit.

Section 92 IPC provides for exemption for acts done in good faith for the benefit of a person without his consent though the acts cause harm to a person and that person has not consented to suffer such harm.

Section 93 IPC saves from criminality certain communications made in good faith.

Illustration; under Section 88 IPC is as under:

1. A, a surgeon, knowing that a particular operation is likely to cause the death of Z, who suffers under a painful complaint, but not intending to cause Z's death and intending in good faith, Z's benefit, performs that operation on Z, with Z's consent. A has committed no offence. [Para34][R]

Essential Ingredients of Criminal Negligence:

- Amount of Damage,
- Degree of Negligence
- Mens Rea

There is distinction between negligence under Civil law and negligence under Criminal law. It is the **amount of damages** incurred which is **determinative of the extent of liability in tort**; but in criminal law it is not the amount of damages but the **amount and degree of negligence that is determinative of liability**.

To fasten liability in Criminal Law, the degree of negligence has to be higher than that of negligence enough to fasten liability for damages in Civil Law. The essential ingredient of *mens rea* cannot be excluded from consideration when the charge in a criminal court consists of criminal negligence.

Degree of Negligence in Criminal Law:

To prosecute a medical professional for negligence under criminal law, it must be shown that the accused did something or failed to do something which in the given facts and circumstances **no medical professional in his ordinary senses and prudence would have done or failed to do**.

In order to hold the existence of criminal rashness or criminal negligence it shall have to be found out that the rashness was of such a degree as to amount to taking a hazard knowing

that the hazard was of such a degree that injury was most likely imminent.

Medical Professionals on different footing in case of Criminal Negligence:

Hon'ble SC [7, 8] has held that "negligence in the context of medical profession necessarily called for a treatment with a difference, the negligence attributed to the doctor must be gross in nature to make him liable for criminal prosecution".

"To prosecute a medical professional for negligence under criminal law, it must be shown that the accused did something or failed to do something which in the given facts and circumstances no medical professional in his ordinary senses and prudence would have done or failed to do" –**CJI, R.C. Lahoti**

Protection from Frivolous Criminal Prosecution:

Noticing a sudden increase in the cases of doctors being subjected to criminal prosecution, the Apex Court laid down elaborate guidelines so as to shield the doctors from frivolous criminal prosecution. Many a complainant prefers recourse to criminal process as a tool for pressurizing the medical professional for extracting uncalled for or unjust compensation. Such malicious proceedings have to be guarded against. [6]

Doctors Not Always at Fault:

The subject of "criminal negligence by doctors" is always a complex matter for medical fraternity and a great challenge before judiciary. In recent years, sudden spurt of cases of "negligence" (about 20000 a year as estimated by the IMA) and decision of SC in Dr. Suresh Gupta vs. Govt. of NCT of Delhi, on 4th August 2004 [7], and another decision, exactly after one year i.e. on August 5, 2005 filed by Mr. Jacob Mathew against two doctors of CMC Ludhiana, Punjab [8], raises a fresh debate and given an opportunity to medical fraternity for introspection about implementation of medical ethics, update of knowledge and enhancement of skill, but not an immunity against filing of 'criminal negligence suits' against them.

Supreme Court Views on the Issues:

In *Standard Chartered Bank vs. Directorate of Enforcement*, [3] made following observations regarding criminal liability of the Corporation:

"There is no dispute that a company is liable to be prosecuted and punished for criminal offences. Although there are earlier authorities to the effect that corporations cannot commit a crime, the generally accepted modern rule is

that except for such crimes as a corporation is held incapable of committing by reason of the fact that they involve personal malicious intent, a corporation may be subject to indictment or other criminal process, although the criminal act is committed through its agents.

XXX 8. In as much as all criminal and quasi-criminal offences are creatures of statute, the amenability of the corporation to prosecution necessarily depends upon the terminology employed in the statute. In the case of strict liability, the terminology employed by the legislature is such as to reveal an intent that guilt shall not be predicated upon the automatic breach of the statute but on the establishment of the actus reus, subject to the defence of due diligence.

The law is primarily based on the terms of the statutes. In the case of absolute liability where the legislature by the clearest intendment establishes an offence where liability arises instantly upon the breach of the statutory prohibition, no particular state of mind is a prerequisite to guilt. Corporations and individual persons stand on the same footing in the face of such a statutory offence.

It is a case of automatic primary responsibility. It is only in a case requiring mens rea, a question arises whether a corporation could be attributed with requisite mens rea to prove the guilt. But as we are not concerned with this question in these proceedings, we do not express any opinion on that issue."

In *Kalpnaath Rai vs. State*, [2] made following observations:

"The company is not a natural person. We are aware that in many recent penal statutes, companies or corporations are deemed to be offenders on the strength of the acts committed by persons responsible for the management of affairs of such company or corporations e.g. Essential Commodities Act, Prevention of Food Adulteration Act etc. But there is no such provision in TADA which makes the company liable for the acts of its officers. Hence, there is no scope whatsoever to prosecute a company for the offence under Section 3(4) of TADA. The corollary is that the conviction passed against A-12 is liable to be set aside." In *Standard Chartered Bank vs. Vinay Kumar Sood & Ors*, [5], this court had observed as under:

"Undisputedly, the petitioner is a bank incorporated in England with limited liability by Royal Charter, 1853 and, therefore, is a corporation/company. A company cannot be in any case held to have committed an offence under Section 500 IPC because; most essential

ingredient of the said offence i.e. 'mens rea' would be missing as a company is a juristic entity or an artificial person, whereas a Director is not a company. The company may be made liable for offences; however, if there is anything in the definition or context of a particular Section or a particular statute which would prevent the application of the said section to a limited company, the limited company cannot be proceeded against. [Para 4][1][5]

Reasons for Hospital not Liable for Criminal Negligence:

Court observed that "there are number of provisions of law in which it would be physically impossible by a limited company to commit the offence. A limited company, therefore, cannot generally be tried for offences where mens rea is essential." Court further added that "Similarly, a company cannot face the punishment of imprisonment for obvious reasons that company cannot be sent to prison by way of a sentence." [Para 4] [1]

When Hospital is held Liable:

Delhi High Court observed that "however, if there is an administrative negligence, or a negligence of not providing basic infrastructure, which results into some harm to an aggrieved person or such negligence which is impersonal, the hospital can be held liable." Court further added that "but, in the case of medical negligence, which is personal to the Doctor who gave treatment, the Corporation (Hospital) would not be liable and it is the Doctor who can be indicted for medial criminal negligence." [Para 5] [1]

Prosecution of Medical Practitioners' u/s 304A IPC:

- Doctors can be prosecuted for an offence of which rashness or negligence is an essential ingredient, but they are to be protected from frivolous and unjust prosecutions.
- Many a complainant prefers recourse to criminal process as a tool for pressurizing the medical professional for extracting uncalled for or unjust compensation. Such malicious proceedings have to be guarded against.
- A private complaint may not be entertained unless the complainant has produced *prima facie* evidence before the Court in the form of a credible opinion given by another competent doctor to support the charge of rashness or negligence on the part of the accused doctor.
- The Investigating Officer, before proceeding against the doctor should obtain an

independent and competent medical opinion preferably from a Doctor in Govt. service.

- A doctor may not be arrested in routine, unless his arrest is **necessary for furthering the investigation or for collecting evidence** or the **Doctor would not make himself available to face prosecution unless arrested.** [Para 54, 55] [6, 7, 8]

Summary and Conclusion:

Delhi High Court observed that “these days, **all Doctors with big hospitals, are on panels where they have fixed fee for examination of patients and for conducting operations.** Out of this fee, **a percentage is paid to the hospital.** Court held that “**the hospital/company cannot be held liable for the personal negligence of the Doctor in giving wrong treatment.**” [1]

There is intense need to create awareness, as well as education to public about accepting bad consequences of treatment, informed consent, accidental and unexpected results of the treatment.

Doctors are advised to learn from mistakes and follow all the ethical guidelines recommended by the MCI in 2002. [10] It is claimed that the judgment will go a long way in improving doctor-patient relationship, patient care and confidence of medical professionals due to enhanced liability after this judgment.

It is hoped that the law cannot be misused against the doctors by the hospital administrators or management. It had become a sad trend that doctors were unduly made targets without knowing the real cause. Before holding

any person responsible for an incident, the expert opinion is necessary.

The SC decision [8] was a step in the right direction. It would stop the exploitation of doctors by the vested interest groups. The judiciary has proved that law of the land prevails and this defends doctors dealing with safety of human life. However, Court does not ruled out possibility of hospital's liability for civil negligence and under the doctrine of vicarious liability. Now the onus is on every member of medical fraternity, various medical associations including Indian Medical Association and the State Medical Councils, and the MCI to come forward and play their much needed role in implementation of ethical guidelines of 2002 in later and sprit.

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Review Research Paper

Critics and Sceptics of Medico-legal Autopsy Guidelines In Indian Context

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Abstract

Medicine is governed by set code of principles which are followed by every Medical professional during his medical practice. Doctors dealing with medico-legal work, bear a further burden of not only abiding by these rules but also by being vested with deciding authority in such matters. World over, medico-legal authorities issue guidelines and rules, which vary in procedural content from nation to nation. In India, the basic guidelines are almost the same, though differences in their applications differ from state to state. Comparison of both Indian and Western scenarios on this issue lay bare a basic difference. Uniform medico-legal guidelines and standard protocols make medico-legal work less complicated in practice. In India, however, stark differences exist even amongst states as far as application of medico-legal guidelines is concerned. Consequently, no comprehensive unanimity exists in medico-legal work in India. This paper attempts to make a critical and sceptical analysis of this problem with a few suggestions for the streamlining of medico-legal work in India.

Key Words: Medico-legal guidelines; Differences; Manual, Medical Professional

Introduction:

Whenever a patient comes to a general practitioner, he should abide by some guidelines, both in the interest of the patient as well as himself. These become more important particularly in medico-legal subjects. All states in India have different formats for medico-legal and postmortem examination with almost identical content, but different autopsy guidelines are being followed in different ways in each state whose critical and skeptical analysis has been attempted in this article.

Legal Concept:

The concept of a medico-legal autopsy has been mentioned in the sections 174 and 176 Code of Criminal Procedure (Cr.P.C.) during investigations of a suspected death. [1]

Objects of a Medico-Legal Autopsy:

The objective of the post-mortem examination is to establish the identity of a body, when not known, to ascertain the time since death and the cause of death; and whether the death was natural or unnatural and if unnatural, whether it was homicidal, suicidal or accidental.

In case of newly born infants, the question of live birth and viability assume importance and should be determined. [2]

The term "postmortem examination" is often used as a simile for "autopsy." Basically, it is not.[3] A postmortem examination means only what it says that the body was examined after death. It can mean and often does mean that the physician merely looked at the body, fully clothed, or that he "viewed" the body at a funeral home or in a morgue.

A complete autopsy involves opening all body cavities and all organs of the trunk, chest, and head. [3] In all cases, a complete and not a partial examination are more necessary in this country on account of the imperfectness of the preliminary evidence as to the possible cause of death. [4] However, legal authorities have often made exceptions to this rule by commenting that it is not at all necessary for the autopsy surgeon to open all the cavities in the body of the deceased, where the cause of death is otherwise ascertainable.

The postmortem report is still reliable even if no x-ray was done. This is exemplified in the celebrated murder case of Smt. Indira Gandhi late Prime Minister of India, The Apex court stated in its judgment that undisputedly Smt. Indira Gandhi died as a result of the gun shot injuries inflicted by Beant Singh and Satwant Singh with their service revolver and carbine respectively. In view of such clear evidence about the cause of the death, the post-

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mortem or a fuller postmortem examination loses all its significance. It becomes important only in cases where the cause of death is to be established and is a matter of controversy. [5]

General Guidelines for Conducting the Post-mortem Examination:

- **Consent for Post-mortem Examination:**

No consent is required for post-mortem examination of medico-legal deaths. However, whenever a pathological / hospital autopsy is required for knowing the nature of the disease resulting into the death of a non- medico-legal subject; then the consent of relatives is a must.

- **Authority to conduct a Post-mortem:**

A medico-legal post-mortem can be conducted only after a written request has been made by the police or by the order of the Court. It can be conducted only by a medical officer who has been authorized to do so. [6, 7]

- **Time of Conduction of a Post-mortem: [6]**

It may however, be noted that no medico-legal post-mortem examination is permitted to be conducted after 5.00 P.M. unless there is serious threat to the law & order machinery and in such situation instructions for conducting the medico-legal post-mortem is invariably issued by the District Magistrate by stating the reason.

- **Other Salient Requisites:**

1. Post-mortem examination is not an emergency requiring pressing necessity or urgency, which is a common misconception in the eyes of the lay public, authorities and investigating agencies. Such pressure on the autopsy surgeons usually leads to improper and unscientific actions which will negatively affect the outcome of the post-mortem examination and ultimately leading to denial of justice in the Courts of Law.
2. Written request /requisition on a prescribed form (25.35 A, B, C) [7] i.e. Inquest report from competent authority like police or magistrate is a must. [6,7] Sometimes, it has been observed that the authorities ask for post-mortem examination without complete inquest reports by stating that the inquest is being prepared and will be submitted soon by the time that the autopsy is over.

Such requests preferably should not be entertained. In order to render this part of the evidence more definite and more valuable, it is necessary that the police, in handing over the body for examination, should at the same time hand over an account of all that is known as to the suspicious circumstances of death and it should be noted by the medical officer

whether he was in possession of this information or not when making the post-mortem examination. [4] It looks odd that as per these instructions, post-mortem examination may be conducted without knowing the account regarding the suspicious circumstances of death and will put the doctor in adverse situation. However, most of the recognized authors mention that the police report should be thoroughly gone through before commencement of the post-mortem examination.

3. Post-mortem examination is permitted from 6.00 Hrs to 18.00 Hrs on all days and the requisition for autopsy can only be received up to 16.00 Hrs. [2] In India, whenever, a death occurs around sunset, the relatives cremate/bury the body the next morning. Therefore, apart from the scientific reasons of not performing night autopsies, there is a religious and cultural basis for this too.
4. The authors feel that a receipt should be issued to the police official indicating the date and exact time of bringing the body in the mortuary. Prior to receipt of the police papers it should be ensured that a tag indicating the name of police post with FIR/DD number has been put on the dead body by the police for the purposes of identification, and a completely filled request form must be submitted along with the inquest papers by the police officials;
5. An autopsy should be conducted in broad daylight and not in artificial light between 7 a.m. to 5 p.m. [8] Always avoid delaying in performing PME.
6. The identification of the dead body must be confirmed by the relatives /police before the start of the PME; always take signature of at least two relatives of the deceased persons on the PM report in case of known bodies, and police official in case when the body is unknown. This issue assumes greater significance in cases of burnt/mutilated/decomposed dead bodies. There have been reports in the media that such bodies got exchanged.
7. Medical officer should always try to study all the available facts of the case prior to PME from inquest report, hospital records, the bed head ticket /summary of the death etc. The condition of the deceased before death must be perused to know his clinical condition, treatment and terminal events for taking precaution for self as well as staff of the mortuary in case of high risk infectious diseases like AIDS, rabies, etc; in hospital deaths.

8. Don't allow any unauthorized person into the mortuary while PME is going on. Being laymen, certain scientific facts/findings could be distorted after being leaked out by interested parties to the press that may lead to avoidable rumour mongering regarding the case. Such situations can show the forensic personnel in bad light. However, some exceptions can be made to this general rule- the Investigating Officer can be shown certain findings found on autopsy contrary to the inquest report. Allegations of the relatives could be scientifically countered by showing them the findings on the dead body.
9. The Medical Officer should not accede with the version of the relatives or the police while giving opinions which must be based honestly on the scientific facts.
10. Prepare the PM Report simultaneously and at the earliest and the original copy the PMR should preferably be handed over to the police. However, there is a recent Punjab & Haryana High Court Order on preparation of medico-legal reports generated by computer and uploading the same on the web.
11. Considering the inadequate infrastructure and manpower, the authors have evolved an alternative that in the first instance, hand-written report is handed over to the police and later on a computerized report may be obtained after about a week. This will significantly lead to a decrease in paperwork and workload as only those cases in which the police file a charge sheet in the Hon'ble Courts may request for the same. Many times the police do not report to collect the computer generated reports.
12. Hand over the PM report and other articles only to an authorized police official;

As per settled principles of law, PM Report is not a public document. [9] In fact, the opinion of Medical officer contained in the post-mortem report is only to aid the investigating officer in the investigation and this report is not a record of Medical Officer of his official "act" for use of the public and, thus not a public document covered under sections 74 and 76 of Indian Evidence Act. [10]

Therefore, post-mortem report being an expert opinion can be given only on specific orders of the court, on clear direction regarding issuing of the same, whether the post-mortem report is to be supplied to the applicant or not. Postmortem examination - when and whom held- the legal requirement in respect of postmortem examination by a qualified surgeon

are contained in section 174(3), code of criminal procedure. [1]

In every case where death appears to have been due to suicidal, homicidal, accidental or suspicious causes and where any doubt exists as to the exact cause of death, or if it appears to the officer conducting the investigation whether under section 157 [1] or section 174, code of criminal procedure [1] expedient to do so, the body shall be sent to the nearest medical officer authorized by the local government to conduct postmortem examination. The sending of the body for examination may only be dispensed with, where such action is otherwise required when condition exist, such as advanced putrefaction, which would clearly makes examination useless.

Many a times, it has been observed that after the post-mortem the attendants request for keeping the dead body in the cold storage and to take the body on the next day. Such a request may be considered depending upon the circumstances related to the availability of cold storage and if at all it is allowed, these bodies should be kept separately to avoid mixing with other cadavers in the mortuary.

Ordinarily, a dead body is sent to the morgue for autopsy, but in exceptional cases [2] the medical officer may be taken to visit the scene of death. Preferably, this practice should be avoided as far as possible because it will increase the workload on already meagre number of experts.

The medical officer must establish the identity of the deceased before the start of the post-mortem by at least one relative or accompanying person and the police official. The signatures should be obtained on the post-mortem report before the start of the autopsy. In cases of unidentified dead bodies, it is the primary duty of the Police personnel accompanying the dead body to identify such bodies before the start of the autopsy. This is very essential as there may be mixing of such unclaimed dead bodies in the mortuary leading on to autopsy of wrong bodies as has been reported in literature.

All the details of the post-mortem observed by the medical officer should be carefully entered by him on the spot in the post-mortem report or in a notebook but whenever the rough notes are prepare, the same should be preserved, which can be used as evidence in a legal inquiry in case a serious discrepancy arises in the report submitted to police and the notes. He should not mind the report getting soiled; this will enhance its value, inasmuch as it goes to prove that it was written at the time

when facts were still fresh in the mind. If there is an assistant, the best plan is to dictate to him as the examination proceeds step by step, and then to read, verify and attest the report. [2]

In the absence of an assistant, a tape recorder may be useful. It is not safe to trust memory and to write the report later after completing the examination. There must be no discrepancy in the notes and the report to be sent to court and must tally with each other. Nothing should be erased and all alterations should be initialled.

However, the recent judgment by The Hon'ble High Court of Punjab & Haryana ordering submission of computerized Medico-legal reports to police/courts at time of autopsy must be kept in mind in the present scenario. [11] However, keeping these orders in view with regards to limited infrastructure and trained computer operators, in our department we have devised procedure to give hand written reports immediately to the police with directions to collect a computer generated copy after about a week.

To decrease this workload, only those post-mortem reports should be computer generated where the police decide to file a charge sheet in the Hon'ble courts. Medical officer should note the timings of the arrival of the body at the morgue, the date and hour of the post-mortem examination. The necessary papers authorizing the medical officer to hold an autopsy are frequently brought by the police long after the body has arrived.

This dilatory method on the part of police has occasionally led to the decomposition of the body in post-mortem room even when it has arrived in a good condition. It is, therefore, safer to note the exact time of delivery of these papers. The accused person is not entitled to inspect any document (including post-mortem and other medico-legal reports) or property in the custody of the investigating agency till such time that a charge report had been filed against him in the court.

Comparison of Medico-legal issues related to Autopsies in Different States of India:

Night Post-mortems: as far as possible, post-mortem examination should be performed in daylight, and not in artificial light. However in the recent past, various state governments have issued orders to introduce night post-mortems. This has led to objections from Forensic Medicine experts regarding the verification of colour matching which is more accurate in natural light than in artificial light in different

injuries. [2] It has been observed in almost in every facility that the dead bodies should be received along with inquest papers only up to 4 pm, as it will take one to one and a half hours to complete an autopsy.

This suggested time frame is contrary to the authors experience that it takes more than three hours to complete an ordinary autopsy; at times even more. Therefore, the dead body should be sent to the doctor for autopsy sufficiently early to avoid inconvenience to the relatives of the deceased. Some glaring differences with respect to night autopsies in various states are detailed below:

- Gujarat government permits post-mortem at night if it is not a case of poisoning or suspected poisoning, if it is not a case of woman below thirty years, if it is not a case of woman dying in her husband's or in-laws place, if the body is not distorted and if adequate light resembling day light is provided. [2]
- The Medico-Legal Advisory Committee of the Ministry of Home Affairs based on the opinion of the standing committee of Forensic Medicine in the Bureau of Police Research and Development has recommended that the present practice of doing post-mortem during daytime be continued. [12]
- The Government of Kerala permits post-mortems from 8 am to 5 pm only. [13] Government of Kerala has given instructions to all district collectors, superintendent of police, revenue divisional officers and district police surgeons that post-mortem examination should be conducted in day light and not in artificial light as far as possible and that it should be as thorough and complete as circumstances permits. [14]
- In Tamil Nadu in 1996, post-mortems was permitted to be conducted on all the government hospital during night if the claimant of the body insisted and the cause of death was due to accidents.
- The order of Tamil Nadu states that the post-mortem can be conducted at night because cause of death is already well known. It is axiomatic to say that in case where the cause of death can be established by clinical examination and other attendant factors, the conduct of post-mortem can be dispensed with altogether. [15] In Tamil Nadu the post-mortem is permitted from 06.00hours to 18.00 hours on all days and the requisition for autopsy can be received up to 16.00 hours. [16]

Post-mortem is not an emergency and it should be remembered that the autopsy are performed as part of scientific investigation in aiding the administration of justice. Therefore, providing night post-mortem services cannot be equated to the absolute and paramount duties of a medical practitioner to save the life of a person in emergency situation. [2] It is only the politically influential and affluent who are able to obtain permission for night post-mortems. [17]

According to Hindu mythology, the cremation of dead bodies is never conducted after sunset. In fact, whenever death occurs after sunset, the body is kept at a calm and cool place till sunrise; some sects even worship the dead body by keeping lamp lighted throughout the night. Other religions such as Islam and Christianity also bury their dead in the day and never at night. However, in the modern age, people reside in multi-story apartments where it is not possible to carry the body up a high rise building; for such cases it may be useful to conduct the autopsy after sunset with facility of cremation nearby.

Remuneration for Medico-Legal Work:

To make the often avoided and unsung speciality of medico-legal work interesting, attractive and lucrative, remuneration of a suitable amount must be sanctioned. Such remuneration has already been sanctioned in states like Kerala, Madhya Pradesh, Manipur, etc. However for the majority of states, no such provision exists. However, way back in 1882, the provincial Government of Punjab sanctioned Rs.16/- for conducting post-mortem examinations and Rs. 10/- for conducting a medico-legal examination, that is still being ignored till date throughout this country, notwithstanding the appreciation of the rupee in 131 years. [4]

Conclusion:

The main aim of this paper was to attempt to formulize a uniform streamlined autopsy guideline in Indian context. Therefore, we have tried to compile the same considering

all the available instructions and rules with a critical and skeptical analysis of the same.

There are different guidelines, Performa and rules for autopsy work all over India, whereas the investigative protocol is uniform for all investigative agencies almost throughout. This leads to a confusing and compromising situation as far as medico-legal autopsies are concerned.

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Review Research Paper

Dental Stem Cells: Harnessing Newer Possibilities

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Abstract

Over the years, there has been a startling increase in the incidence of tooth decay and tooth loss which necessitates the need for dental tissue replacement therapies. Recent research in the field of stem cells and in the dental tissue engineering strategies suggests bioengineered tooth replacement to be the need of the hour. Adult dental ectomesenchymal stem cells seem promising for future therapy and have been identified in several oral and maxillofacial tissues, which suggest that the oral tissues are a rich source of stem cells. Dental stem cells are found to have different expression profiles and reside in specific niches. Identification and channelization of these properties of dental stem cells is needed for the optimal utilization of stem cells in the field of Regenerative medicine and Dentistry. Apart from these applications dental stem cells have also found their use in Forensic dental investigation and anthropology which is an exciting new area of research. This article throws light on various sources of stem cells in the orofacial region and their current clinical applications.

Key Words: Stem cells, Exfoliated deciduous teeth, periodontal ligament, Dentin-pulp complex

Introduction:

Many tissues of the human body undergo normal physiological renewal. These renewing tissues have some capacity to repair damage due to disease or trauma. Recent therapeutic modalities of some diseases have taken advantage of this phenomenon and included tissue engineering in which biologic materials are employed to replace, repair, maintain, and/or enhance tissue function.

The materials required for tissue engineering include stem cells, morphogens (or growth factors) and a scaffold to guide cell growth. Scientific study into cell-based therapies has identified tremendous potential for the use of these stem cells to treat a number of diseases and disorders.

It is now accepted that progenitor/stem cells reside within orofacial region. Stem cells residing in the orofacial region have been classed as the Mesenchymal stem cells (MSCs) /Adult stem cells (ASCs) / Tissue stem cells (TSCs). [1] Studies have identified several niches of multipotent mesenchymal progenitor cells, known as dental pulp stem cells, which have a high proliferative potential for self-renewal. These progenitor stem cells are now recognized as being vital to the dentine regeneration process following injury.

More recently, researchers have discovered that stem cells harvested from deciduous teeth may be a source of tissue regeneration and repair. [2] Advances have been made in identifying dental stem cells and their differentiation potential. Five different types of dental stem cells isolated from dental soft tissues are **dental pulp, apical papilla, dental follicle and periodontal ligament**.

The characteristic features of these cells have been explored. They express various arrays of biomarkers including those specific for mesenchymal and/or embryonic stem cells. In vitro and in vivo studies have revealed that these stem cells varied in their proliferation and differentiation potential. [1]

Thus it is imperative to know about the various sources of stem cells in dental region their characteristics and possible clinical applications before harnessing their full potential towards the field of Dentistry.

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Sources of the Stem Cells in Orofacial Region:

Mesenchymal stem cells (MSCs) are a prospective source of adult stem cells (with mesodermal and neuroectodermal origin) for regenerative medicine as they are extraordinarily plastic and when expanded into colonies, retain their multilineage potential.

MSCs are able to differentiate into cells of mesodermal origin like adipocytes, chondrocytes or osteocytes, as well as give rise to representative lineages of the three embryonic layers. [3, 4] MSCs are also found within the dental pulp (DP), an extremely rich site for stem cell collection: owing to its peculiar formation, it acts as "sealed niche" and may explain why it is possible to find a rather large number of stem cell there. [4, 5]

The first type of dental stem cell was isolated from the human pulp tissue and termed dental pulp stem cells (DPSCs). [6] Subsequently, four more types of dental-MSC-like populations were identified:

- Stem Cells from Exfoliated Deciduous Teeth (SHED) [6] ,
- Periodontal Ligament Stem Cells (PDLSCs),
- Stem Cells from Apical Papilla (SCAP). [3-7]
- Dental tissue from human third molar. [8] These dental stem cells are derived from the neural crest, and thus have a different origin from bone marrow-derived MSCs, which are derived from mesoderm. [3]

In teeth, two different stem cell niches have been suggested: the cervical loop of rodent incisor for epithelial stem cell and a perivascular niche in adult dental pulp for MSC. In addition to the dental pulp MSC, other MSC populations have been isolated from human dental tissues such as the periodontal ligament and the dental follicle but nothing is known about the existence of a niche in these tissues. In the dental pulp, MSCs are thought to reside in a perivascular niche, but little is known on the exact location and molecular regulation of this niche. [5, 8, 9]

DPSCs, on the other hand, are thought to be arising from two different sources: ectomesenchyme of the neural crest or ectoderm of the dental lamina and thus possess two different cell lines. [7]

The comparison of the osteogenic and adipogenic potential of MSC from different origins shows that, even if cells carry common genetic markers, they are not equivalent and are already committed toward a specific differentiation pathway. [10, 11] Commitment could arise from conditioning of stem cells by their specific microenvironment or stem cell

niche. [2, 7, 8] A brief account of different sources of stem cells in orofacial region and their properties is as follows: [2-17]

Dental Pulp Stem Cells (DPSC):

Their source is dental pulp mesenchyme (neural crest mesenchyme). They slow cycling cells, have restricted potential and represent mature adult pulp stem cells. They have better immunologic/host acceptance. In vitro they formed odontoblasts, osteoblasts, endothelial cells, adipocytes, Chondrocytes, neurons and smooth muscle cells while in vivo, various directions like odontogenic, myogenic, adipogenic, angiogenic and osteogenic are found and were able to form complete dentin pulp complex. It's in vitro developmental capability and in vivo therapeutic targeting is yet to be explored. (Fig. 1)

Stem Cells From Human Exfoliated Deciduous Teeth (SHED):

Their source is human exfoliated deciduous teeth (coronal pulp). They are multipotent cells with very high proliferative potential and higher cell doublings. In vitro they can differentiate odontogenically, osteogenically, adipogenically, chondrogenically, or neurally. In vivo they can form neurons, adipocytes, odontoblasts, and osteoinductive and endothelioid cells. But they failed to form complete dentin pulp complex in vivo.

Periodontal Ligament Stem Cells (PDLSC):

They can be extracted from periodontal ligament of the roots of the extracted teeth. They are the primary source for treatment of periodontal disease. These cells are multipotential. In vitro, PDLSCs differentiate into osteoblasts, cementoblasts, and adipocytes. In vivo, after transplantation into mice, structures resembling bone, Cementum, cartilage, and periodontal ligament have been found. They can contain multiple stem cells lineages. But their utility is yet to be explored.

Dental Follicle Stem Cells (DFSC):

They are extracted from dental follicle of the impacted teeth and possess multiple potentialities. They have lesser ability to form adipocytes and their potential yet to be identified for forming odontoblasts, neural cells and other tissues.

Stem Cells From Apical Papilla (SCAP):

They are taken from extraction sites of third molars or other teeth. They are easily accessible and have a higher proliferative potential than PDLSC. In vitro, SCAPs can

differentiate osteogenically, odontogenically, and adipogenically. In vivo, SCAPs have been found to differentiate into odontoblasts and osteoblasts. Differentiation potential of apical papilla progenitor cells has not been established yet. The nature of all embryonic dental papilla, mature dental pulp and apical papilla progenitor cell populations remain to be characterized further.

Bone Marrow Stem Cells (BMSC):

They are derived from bone marrow of mandible/maxilla. They have lower odontogenic potential than DPSCs and are a secondary source for periodontal disease. Orofacial BMSCs are less adipogenic than BMSCs from other sources. Collectable amount of cells from orofacial region is much less than from other sites so safe cell expansion techniques are to be used.

Epithelial Stem Cells (EpSC):

These stem cells developed from third molars of newborn or juvenile animals or from the cervical loop of rodent incisors. They possess clonogenicity and are unipotent.

Stem cells from third molars are promising for tooth formation/ regeneration. Cells from cervical loop can only be used to study characterization of dental epithelial stem cells and analyses of dental epithelial tissue. Their clinical application is difficult as it requires tooth donation from children. Cells from cervical loop of rodent incisor cannot be used for treatment as it would need introduction of rodent cells in mouth.

Induced Pluripotent Stem Cells (iPSC):

Adult human cells are reprogrammed to form embryonic stem like cells called Induced pluripotent stem cells. These are immunologically more acceptable and an attractive alternative source. Oral fibroblasts are able to form IPS cells in lab applicable for future use. However, the downside is that some of the transcription factors used is well known oncogenes. Viruses used in the technique have intrinsic risk in regard to cell transformation.

Immature Dental Pulp Stem Cells (iDPSC):

They can be extracted from pulp of primary teeth. They co-express mesenchymal and embryonic stem cell markers and present the capacity to differentiate into derivative cells of the three germinal layers. In vitro, these cells can be induced to undergo uniform differentiation into smooth and skeletal muscles, neurons, cartilage, and bone under

chemically defined culture conditions. After in vivo transplantation of these cells into immunocompromised mice, they showed dense engraftment in various tissues and they can be used for corneal reconstruction. Their applications need to be further explored.

Oral Epithelial Stem Cells (OESCs):

They are derived from oral epithelial progenitor cells from basal layer of oral mucosa. They are unipotent stem cells and possess clonogenicity. They can form highly stratified and well organized graft. But they cannot differentiate into mesenchymal cell lineage.

Gingiva derived MSCs (GMSCs):

These cells are derived from lamina propria of gingiva. They possess clonogenicity, self-renewal and multipotent differentiation capacity similar to BMSCs and proliferate faster than BMSCs, display stable morphology after extended passages. These cells exhibit adipogenic, osteogenic and chondrogenic potential along with immuno-modulatory effect on lymphocytes. Their applications further need to be explored.

Tooth Germ Progenitor Cells (TGPCs):

They are the stem cells in the mesenchyme of the third molar tooth germ and possess very high proliferative activity. They can differentiate into lineages of three germ layers including osteoblasts, neural cells and hepatocytes. Their applications further need to be explored.

Salivary gland stem cells (SGSCs):

They are derived from the stromal tissue of salivary glands. They are useful for regeneration of salivary gland damaged from irradiation and can be guided to osteogenic, chondrogenic and adipogenic differentiation. It is difficult to isolate salivary gland stem cells from the collection of stromal cells.

Periosteum derived Stem Cells (PSCs):

They lie in the inner membrane of periosteum. They undergo preferential osteogenic differentiation and possess mesenchymal multipotentiality. They can differentiate into osteoblasts, adipocytes and chondrocytes. But, they have limited potential for cell differentiation.

Dental Applications of Stem Cells:

For centuries, dentistry has been devoted to the healing of defects with durable materials or the patient's own (autologous) tissue. However, amalgam, composites and

even titanium dental implants can fail, and all have limited service time.

Stem cells from a tiny amount of tissue, such as the dental pulp, can be multiplied or expanded to potentially sufficient numbers for healing large, clinically relevant defects. Stem cells offer the possibility that a common (stem) cell source can heal many tissues in the same patient, as opposed to harvesting healthy autologous tissue to heal like tissue.

Finally, stem cells can be seeded in biocompatible scaffolds in the shape of the anatomical structure that is to be replaced. [11, 15] Stem cells from dental sources have found applications in treatment of various diseases and defects. (Table 2)

Table 2: Dental Applications of Stem Cells [1, 4-9, 12-22]

Application	Source
Craniofacial regeneration	J. Chang, W. Sonoyama, Z. Wang et al. J. J. Mao, W. V. Giannobile et al
Dentin regeneration	Y. Zheng, X.Y. Wang et al
Periodontal regeneration	K. Kim, C. H. Lee, B. K. Kim, J.J. Mao
Cementum regeneration	Chun Han, Zhenhua Yang, Wei Zhou
Pulp regeneration	M. Nakashima, K. Iohara
Cleft lip and palate	Daniela Franco Bueno, Daniele Yumi Sunaga, et al
Salivary gland regeneration	C.Y. Lin, F.H. Chang, C.Y. Chenet A, I Pringle, S., Van Os, R. and Coppes et al
TMJ reconstruction	Kuo Yuan, Tzer-Min Lee, Jehn-Shyun Huang
Whole tooth regeneration	Aous Dannan, Vela D Desai, Beena Varma, Shruti Maheshwari, Dipika Bumb
Uses in Dental research	
Cancer therapy	Doyel Mitra, Stephen P. Malkoski, Xiao-Jing Wang
Cancer models for biology of cancer	Dalerba P, Cho RW, Clarke MF
Oral mucosa models for studying oral biology	K. Moharamzadeh, I.M. Brook, R. Van Noort, A.M. Scutt, M.H. Thornhill
Cell and organ models for studying molecular physiology behind processes like tooth eruption	A. Pretty, D. Sweet
Forensic dental profiling	A. Pretty, D. Sweet
Correlation and collection of Ante-mortem and Postmortem data	Nagesh K and A. Pretty, D. Sweet

Conclusion:

Through the present review it was possible to come to the conclusion that apart from embryonic stem cells, cells from dental

origin can also serve as remarkably good and safer sources of stem cells for harvesting.

The minimal intervention required to obtain dental soft tissues within the oral cavity provides an advantage and may help avoid rejection by recipients. Advances in the isolation and understanding of dental stem cells have opened areas of research into the possibility to 'regrow' lost dental tissues.

Dental stem cells can grow not only dental tissues but other non-dental tissues as well. They are not only being investigated in the field of Medicine have found their place in the field of Dentistry as Forensic Odontology as well opening newer insights and avenues for research in this hitherto less ventured arena of Forensic dental investigations using stem cells.

Thus it was needed that the stem cells should be made available for use not only in the present time but in the future as well.

Like the well known cord blood stem cell banking, currently, the concept of dental stem cell banking has come up which relies on these sources of dental stem cells.

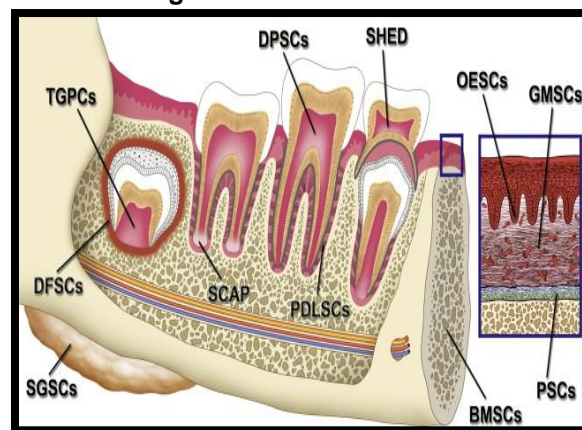
Dental stem cell banking will be an easy way to store one's own stem cells. Nevertheless, challenge for the dental professional in the anticipated era of stem cells and tissue engineering is imminent. [1]

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Fig. 1: Different Sources of Stem Cells in the Orofacial Region



ICFMT 2014
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Case Report

Death due to Sickle Cell Anaemia: Autopsy Diagnosis

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Abstract

Sickle haemoglobin is highly prevalent in Vidarbha region with prevalence rate of 4-40%. It has variable clinical presentation and most of the Indian patients remain asymptomatic for longer periods. Less numbers of deaths are reported due to this cause because of ignorance of autopsy surgeon in considering this disease as a cause of death despite of its high prevalence. While doing autopsy in cases of deaths with no apparent cause and physical over activity medical officer must keep in mind the possibility of death due to vaso-occlusive crisis in sickle cell disease. Presenting herewith two case reports that highlight the importance of considering sickle cell disease as a cause of death in cases with no apparent cause especially in highly prevalent areas. Similarly during autopsy, the role of proper histopathological sampling, haematology slides, Hb electrophoresis and toxicological analysis is considered with proper analysis of results.

Key Words: Sickle cell Disease, Vaso-occlusive crisis, Autopsy

Introduction:

Sickle haemoglobin is highly prevalent among the tribal of central, southern and western India [1, 2] with variable frequency ranging from 10-23%. Increased prevalence is also reported in the non tribal communities of the above said areas. Amongst all states Maharashtra, Madhya Pradesh, & Tamilnadu have higher prevalence of this disease.

Central India region is a focus of sickle cell disorder and the prevalence in Vidarbha region of Maharashtra ranges between 4-40% with average sickle cell gene frequency being 4.3%. [3] This disease has variable clinical presentation and most of the Indian patients remain asymptomatic for longer periods due to higher levels of HbF. Sickle cell disease presenting as death in clinically asymptomatic patients with sickle cell disease or sickle cell trait is not uncommon. But, unfortunately less numbers of deaths were reported due to sickle cell anemia because of ignorance of an autopsy surgeon in considering this disease as a cause of death despite of its high prevalence.

Hence, while doing autopsy in cases with no apparent cause and history of physical over activity medical officer must keep in mind the possibility of death due to sickle cell anemia.

Here we are presenting two case reports that highlight the importance of considering sickle cell disease as a cause of death in cases with no apparent cause especially in highly prevalent areas. Similarly during autopsy, the role of proper histopathological sampling, haematology slides, Hb electrophoresis and toxicological analysis is considered with proper analysis of results. Many times disseminated intravascular sickling is without any evidence of organ damage can be an agonal phenomenon due to hypoxia.

Case Report 1:

A 30 year old married female was brought for medico legal autopsy at IGGMC, Nagpur with history of death during coitus at home as narrated by her husband to the police. Allegations were raised against her husband by the relatives of deceased as she was not suffering from any major illnesses. There was no history of prior hospitalization or treatment. Also, family history of the deceased was not significant.

At autopsy on external examination, she was thin built weighing 42kg. Tongue was clinched between the teeth with facial cyanosis and congestion. There were neither external injuries nor any evidence of injury to genitals. Internally, the brain was congested and oedematous. Laryngeal cartilages were intact. Except for congestion the heart was

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unremarkable. Liver and both kidneys were congested and of normal weight. But, the spleen was markedly atrophic and weighing only 30 grams. Uterus was non pregnant and multiple hemorrhagic cysts were present in the ovary. Stomach contained semi-digested food material. After analysing internal findings especially considering splenic atrophy all organs were kept for histopathological examination. Similarly viscera were also sent for chemical analysis at Regional Forensic Science laboratory, Nagpur.

Chemical analysis report of viscera did not reveal any poison. Histopathology report showed congestion and sickled RBC's in the blood vessels of brain, heart (Fig.1), lungs, liver, kidneys (Fig.2), spleen and ovaries. So, considering the histopathological findings the cause of death was given as **"Cardiogenic Shock due to Sickle Cell Crisis"**.

Case Report 2:

A 42 year old male was brought for medico legal autopsy at IGGMC, Nagpur with the history of accidental skidding and fall from a scooter. After the fall deceased complained of severe bilateral chest pain and died within few minutes on the way to hospital. And police registered a case of vehicular accident.

At autopsy, on external examination the deceased was moderately built, weighing 58kgs with multiple abrasions of size 2cmx2cm to 1cmx0.5cm present over dorsum of both hands. The face, tongue and nails were cyanosed. No other significant external findings were present. On internal examination, brain, both lungs, liver, both kidneys, and pancreas were congested.

Heart weighed 310 grams with normal myocardial thickness and all the coronaries were patent. But, the spleen was markedly enlarged weighing 800 grams and congested. All organs were kept for histopathological examination as internal findings were inconclusive. Viscera were sent for chemical analysis.

Toxicological analysis did not reveal any poison. And the histopathology report confirmed sickled RBC's in the blood vessels of all organs with congestion. Peculiar finding in the spleen was marked congestion, Gamma- Gandy bodies and evidence of fibrosis with sickled RBC's. After considering histopathological findings we concluded the cause of death as **"Vaso-occlusive crisis due to sickle cell anemia"**.

Discussion:

Sickle cell disease, the classical prototype of hereditary hemoglobinopathy has an autosomal recessive inheritance. It manifests in two forms viz. heterozygous (sickle cell trait) or homozygous (sickle cell disease). It

results from the point mutation in the genetic code where glutamate is replaced by valine at the sixth residue position of the beta globin chain. [4] Acute events in the sickle cell disease include painful vasoocclusive crisis, infarctive stroke, acute chest syndrome, priapism, aplastic crises, splenic sequestration, haemolytic crises, & infections. [5] The trait patients are mostly asymptomatic and sickle cell crisis can occur in them only if the patient is exposed to extreme hypoxic conditions. [5]

Hypoxia due to exertion induces a chain of events in a person with sickle cell anemia that causes sickling, leading to vascular occlusion, potentiating hypoxia and culminating in sudden death. [6, 7] Similarly infection, fever, anxiety, abrupt changes in the body temperature or hypertonic dyes are precipitating factor for sickle cell crisis. [7] But, in many cases no cause is obvious. [8] The factor precipitating sickle cell crisis in the first case was physical exertion while in the second case anxiety associated with the vehicular accident may be the triggering cause.

Hence, in sickle cell disease related deaths circumstances of death as well as gross and histopathological findings must be considered. [9] Grossly Cardiomegaly, hepatomegaly, cholelithiasis, evidence of infections and splenic findings suggestive of haemolytic anemia are classical features of the disease. [13] Recurrent infarctions of the spleen due to occlusion of the splenic vasculature by non-deforming sickled RBCs lead to auto splenectomy as observed in the first case.

Tendency for increasing splenic size is associated with higher HbF [10]; similar increase in splenic weight was observed in the second case. So, evaluation of splenic size and weight is important at autopsy.

In both the cases histopathological sections of all organs show disseminated intravascular sickling suggestive of vaso-occlusive crisis leading to multiorgan failure and death. The vaso-occlusive crisis which is manifests as multiorgan failure and acute chest syndrome is an important cause of death in sickle cell patients. [11] But, interpretation of histopathological findings should be cautious as death itself involves hypoxia, hypo- perfusion and other processes that could initiate sickling.

Differentiating whether the sickling occurred in antemortem or Post-mortem period is difficult as many of these processes with hypoxia and acidosis do occur during the peri-mortem period causing intravascular sickling like that in sickle cell disease. Identifying the pattern of haemoglobin of the deceased on Hb

electrophoresis is useful in differentiating sickle cell disease, trait and other hemoglobinopathy. [12] 'S' band is seen on haemoglobin electrophoresis of the patients with sickle cell disease. (Fig.3) The blood samples should be sent in EDTA bulb and should not be frozen or allowed to clot. Also, sampling error during autopsy can alter the results. DNA and amino acid sequencing are the definitive methods for identification of the specific HbS variant and should be done if the facility for such tests is available. Other tests like peripheral smear and imprint smears of the cut sections of the organs are also important in identifying sickled RBC's.

Conclusion:

Clinical profile of sickle cell patients in Central India is less severe as compared to African countries and characterized by late age of presentation, more asymptomatic patients, less frequency of vasoocclusive crisis and low mortality. Hence, most of the patients remain undiagnosed. This fact is observed in both these cases presenting as deaths without any significant present or past symptoms of sickle cell disease. So, it is not uncommon to see such cases presenting as deaths without any significant history.

This can lead to many medico legal complications if autopsy surgeon fails to consider this disease as a cause of death. Hence during autopsy, circumstances of death, gross findings in the organs, proper histopathology samples, Hb electrophoresis, molecular studies and toxicological analysis is important.

Fig.1: Myocardial vessel filled with sickled RBC's (H&E, 250X)

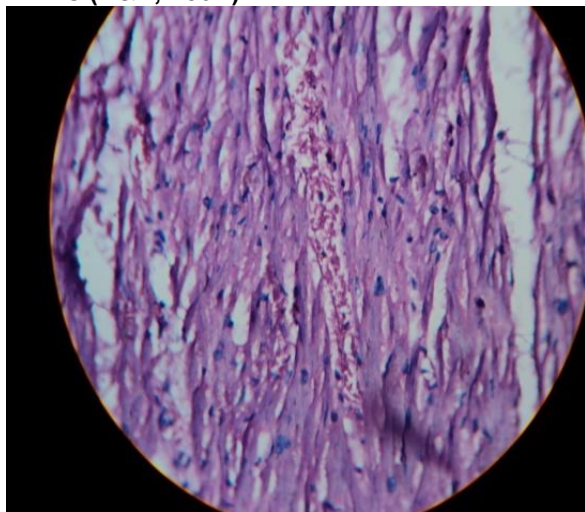


Fig.2: Renal vasculature filled with sickled RBC's (H&E, 250X)

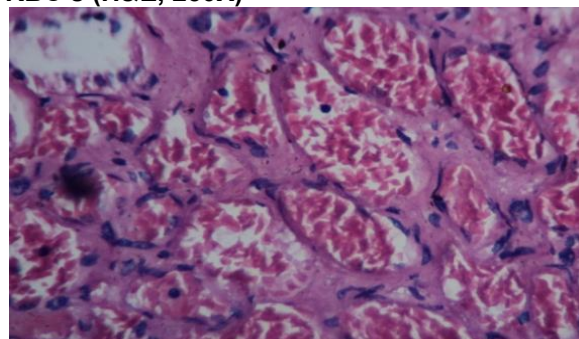
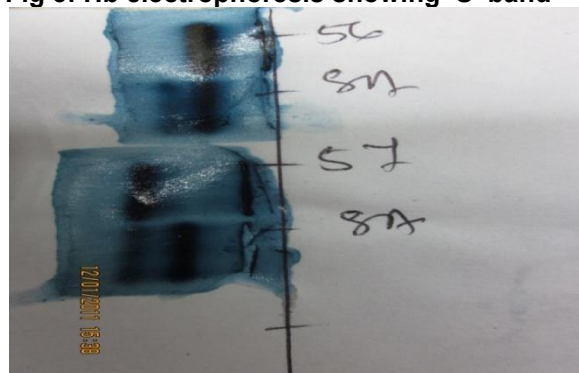


Fig 3: Hb electrophoresis showing 'S' band



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Case Report

Death due to Complication of Morquio Syndrome

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Abstract

Morquio Syndrome is an autosomal recessive disease, categorized as Type-IV Mucopolysaccharidosis. The Mucopolysaccharidosis are a group of syndromes that results from deficiencies of lysosomal enzymes involved in the degradation of mucopolysaccharides (glycosaminoglycans), resulting in their accumulation in various parts of the body. In case of Morquio syndrome, the glycosaminoglycan that accumulates in the connective tissue is Keratan sulphate. The disease can lead to various complications, out of which more risks are associated with cervical myelopathy, restrictive pulmonary disease and cardiac disease. We report a case of six year old male suffering from Morquio syndrome having classical features like pigeon chest, Knock-knee deformity, coarse facial features and hepatomegaly. The parents had consanguineous marriage and two out of their children were affected. The boy was suffering from recurrent chest infections and died as a result of bilateral pulmonary pneumonitis. The individuals having Morquio Syndrome should be considered as high risk cases for the chest infections and should be treated accordingly.

Key Words: Morquio, Mucopolysaccharidosis, Pectus Carinatum, Knock-knee

Introduction:

Morquio Syndrome is an autosomal recessive disease which is named after "Luis Morquio", a Uruguayan Pediatrician. [1] It is categorized as a Type-IV Mucopolysaccharidosis.

The Mucopolysaccharidosis are a group of syndromes that results from deficiencies of lysosomal enzymes. The deficiencies of these enzymes are genetically determined. These lysosomal enzymes are involved in the degradation of mucopolysaccharides (glycosaminoglycans). The Mucopolysaccharides are chemically long chain of complex carbohydrates characterized by their content of amino sugars, which when linked with proteins form proteoglycans. They are abundant in the ground substance of connective tissue.

Due to the deficiencies of lysosomal enzymes, there is a block in the degradation pathways of these glycosaminoglycans resulting in their accumulation in various parts of the body. In case of Morquio syndrome, the glycosaminoglycan that accumulates in the connective tissue is Keratan sulphate. [2]

There are two types of Morquio syndrome: '**Morquio A**' (MPS IVA) and '**Morquio B**' (MPS IVB). In '**Morquio A**': the enzyme deficient is Galactosamine 6-sulfatase and the urinary metabolite is Keratan Sulphate and Chondroitin-6-sulfate. In '**Morquio B**': the enzyme deficient is β -Galactosidase and the urinary metabolite is Keratan Sulphate. [3, 4]

In Morquio syndrome, there is no racial predilection and both males and females are equally affected (M: F=1:1). [5] The frequency of the syndrome in general population is 1 in 2, 10, 000 live births. [4]

Case History:

A case of six year old male brought to VMMC & Safdarjung hospital for post-mortem examination. According to the parents, he had a history of recurrent chest infection. He was suffering from high grade fever, cough and severe difficulty in breathing. So, the child was taken to a nearby Medical practitioner in Faridabad, Haryana, who advised them to immediately shift the child to Safdarjung hospital, New Delhi. The child was declared brought dead in casualty and the body was shifted to mortuary for post-mortem examination.

A detailed history of the deceased and previous hospital records revealed that the child was a diagnosed case of Morquio syndrome. His parents had consanguineous marriage. He was their first child. The boy was delivered through normal vaginal delivery at home with no natal or postnatal complications. The child had normal

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growth and development till the age of four years when his family noticed chest and knee deformity and started taking medical consultation. There was no history of fever and trauma. He was then investigated and it was found that the Epiphysis of upper end of Femur was small and dysplastic, with irregular Acetabular articular margins. Metaphyseal splaying with irregular margins was present in B/L Knee.

Punctate calcification was present around the Epiphysis of distal Femur, upper Tibia and upper Fibula. The lab investigations also revealed a low level of Galactose-6-Sulphate-sulphatase. He then started having recurrent episode of cough and cold with difficulty in breathing, which subsequently developed into the chest infections and was treated over time for the same. His two younger siblings were also evaluated and it was found that the older of the two, also had features suggestive of Morquio's syndrome.

Autopsy Findings:

External Examination:

The body was of a male child, with thin built and short stature for his age [6], with axial length of the body being 99 cm. The rigor mortis was present all over the body. The Post-mortem Lividity was faint and present on back and dependent part of the body except over pressure areas. No signs of decomposition were present. The Cornea was hazy in appearance and all the other natural orifices of the body were devoid of any discharge or any abnormal findings. There were no external injuries present over the body.

There was a slight protrusion of lower jaw with coarse facial features. The nose bridge was flat and broad. The Teeth were widely spaced and malformed. There was little hypertrophy of the gums. There sternum was protruded and ribs were flared out at the bottom, leading to a pigeon chest deformity. Kyphosis of dorso-lumbar spine was present. The Abdomen was protruded. The fingers of hands were short and broad. There was deformity of the knees with knock knee presentation.

Internal Examination:

The SellaTurcica was widened in the base of skull. The pituitary gland was small. There was hypoplasia of odontoid process. The lower five ribs were widened anteriorly on both sides. Pulmonary cavity was containing about 300 ml of turbid fluid. Both lungs were edematous, congested and having patchy areas of consolidation. On cut sections, fluid mixed with pus was oozing out of the lungs. The

Hepato-splenomegaly was present. The lumbar vertebrae were wedge shaped.

The cause of death was **Bilateral Pulmonary Pneumonitis.**

Discussion:

The Morquio syndrome is inherited as an autosomal recessive disorder. If both the parents are carriers, they are not affected but their children have one in four chances (25%) of inheriting both the recessive genes and consequently the disease. [2] In this case, the parents had consanguineous marriage, were normal and their two out of the three children were affected. Their family clan has the tradition of consanguineous marriages. So, it may be safely concluded that the affected gene might be running in the family line and it expressed itself twice in this generation.

The Patients with Morquio syndrome appear healthy at birth and have normal intellectual growth. The common presentation is skeletal deformity and growth retardation in the second or third year of life. [7, 8] The child in our case was initially normal at birth with normal intellect and had first medical consultation for chest and knee deformity at the age of four years. The patients with the Morquio syndrome also have the following sign and symptoms: [4, 7, 9, 10]

- Abnormal heart development.
- Hyper mobile joints.
- Large fingers.
- Genu Valgus, Knock-knee deformity.
- Widely spaced teeth with Thin tooth enamel.
- Bell-shaped chest with flared ribs at the bottom.
- Pectus Carinatum ("pigeon chest").
- Odontoid hypoplasia, atlanto-axial instability; may be associated with myelopathy with gradual loss of walking ability.
- Kyphosis or scoliosis.
- Compression of spinal cord.
- Short stature and short neck.
- Dwarfism.
- Joint laxity, mild dysostosis multiplex, dysplastic hips, large unstable knees, large elbows and wrists and flat feet.
- Progressive Deafness.
- Mid-face hypoplasia and mandibular protrusion.
- Corneal clouding.
- Mild hepatosplenomegaly.

If we consider the postmortem findings, in our case the boy had several of the above mentioned sign and symptoms.

The disease can lead to various complications like atlanto-axial instability, recurrent respiratory infections, aortic regurgitation, valvular defects, obstructive sleep apnoea, coronary heart disease, hearing defects, visual impairment, corneal clouding and dental caries (enamel abnormalities) etc, out of which more risks are associated with cervical myelopathy, restrictive pulmonary disease and cardiac disease. Due to atlanto-axial instability these patients are prone to spinal cord damage and resulting in paralysis. The chest and back deformity predisposes to recurrent respiratory infections. [4, 11, 12]

In the reported case, patient was suffering from recurrent chest infections which ultimately caused his death due to bilateral pulmonary pneumonitis. The death of most individuals is at an early age. In our case also, the victim died at the age of six years.

Conclusion:

The Morquio Syndrome is an autosomal recessive disease, the chances of a child being affected by this disease is increased if both the parents happen to be carriers of the recessive gene. So, genetic counselling with investigations should be done with such couples who are planning to start family, during pregnancy, and who already have a suffering child.

The affected children have a high tendency to develop breathing problems, recurrent chest infections, spinal cord damage, vision problems, and walking problems. Atlanto-axial instability and recurrent chest infections are important cause of mortality and morbidity in these cases. So, these children should be treated as a high risk case and provided with frequent screening, prevention, treatment and rehabilitation for the above mentioned complications.

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Photo 1: Pectus Carinatum ("Pigeon Chest")



Photo 2: Knock-knee Deformity



Photo 3: Protrusion of Sternum



Case Report

Fact Speaking Blood Vessel A Case Report on Ligature Strangulation

*O. Gambhir Singh, **K. Thangaraj

Abstract

Ligature strangulation is a common method of homicide encountered in Forensic practice. In true sense, all cases of strangulation should be assumed to be homicidal until the contrary is proved. When the body is fresh, the optimal medical proof of strangulation can be at ease obtained by autopsy. However, examination of body in advanced stage of decomposition poses a great challenge because most of the neck structure including skin will be missing or obliterated by decomposition. Decomposition is a known contributory factor in missing essential information. Moreover, it presents special difficulties since the smell and sensation of handling putrefying tissues and maggots can be very distasteful. This could be even tougher if it is an exhumation case with little remains of soft tissues and mutilation, due to advanced decomposition and previous autopsy. But if we pay proper attention and take a little pain then we still can come out successfully even with such a difficult case.

Key Words: Exhumation, Adipocere Formation, Ligature Strangulation, Thyroid Cartilage Fracture, Carotid Artery Contusion

Introduction:

Violent actions against the neck may be quite variable: hanging, manual and ligature strangulation, strangling, beating, kicking and compression of different types and they can produce variable injuries on the neck. [1] These injuries may be in the soft tissues, cartilaginous structures like laryngeal cartilage, thyroid cartilage, cricoid cartilage, hyoid bone or blood vessels and may be seen as petechial haemorrhage, ecchymosis, fracture or frank tear of muscles or blood vessels at autopsy. [2]

Fractures of thyroid cartilage and hyoid bone are more common with ligature strangulation. [3] Carotid artery is vulnerable to neck trauma and compression due to the anatomical location and its short course. [1, 4, 5] Carotid arteries lesions may occur easily even during domestic violence like an attempt of manual strangulation. [4] However, if the ligature material is soft and broad, externally visible lesions may be absent or only very discreet and may escape undetected. [6]

Especially this may happen when the ligature is not found in situ or valuable external as well as internal findings are grossly obliterated by changes of decomposition. [7] In such cases of decomposition we must always bear in mind the possibility of pseudo-strangulation due to post mortem artefact caused by creases in the skin fold or pressure of the clothing on a bloated neck. [2, 5]

Due to softening and putrefaction of tissues there may be abnormal mobility of hyoid, cricoid or thyroid cartilages which may be misinterpreted as ante-mortem fractures. In spite of all these hindrance, currently we don't have any alternative, so in doubt cases; autopsy is the gold standard for the detection of strangulation. And definitely, if our approach is scientific and meticulous we can arrive at the right opinion.

Case Report:

It was a case of second medico-legal autopsy conducted on an exhumed body of an adult male. The first autopsy was done at a Taluk Head Quarter Hospital (a Government rural Block Hospital) about 17 days earlier when the body was recovered as an unknown body in a decomposed state from a thorny bush along a highway by the local police.

As per the post-mortem report issued by the first autopsy doctor, the deceased would have died due to "septicemia" and the time since death was about 3 to 4 days prior to the post-mortem examination.

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During the course of investigation arrest was made of two men and a woman, who were close friends of the victim and they confessed to the police that they had strangled the victim with a nylon rope from behind and the motive for the murder being non-payment of a heavy loan. Police established the chain of events and reconfirmed the whole history by visiting the place of disposal of the body and accordingly the exhumation was conducted and the second autopsy was done at the site as soon as we got instruction from the district collector.

The exhumation site was wet and clayey. On little digging we found the body wrapped in a black polythene bag and tied with ropes but without any coffin. The head was found facing south and legs facing north in a semi prone position. The body was lifted from the grave for the second post mortem examination.

Autopsy Findings:

The victim wore one deep blue trouser and there was one cast of plaster of Paris covering the left ankle. On removal the plaster, two stainless steel screws were seen over the medial malleolus of the left leg bone. Soft tissues including the skin over the head, neck, chest and abdomen were found to be missing and in advanced state of decomposition exposing underlying bones and cavity. Soft tissues over the other parts of the body were also in advanced stage of decomposition with adipocere formation at places. (Fig 1)

The skull cap was found to be open with irregular margins (first post mortem examination). The neck, chest and abdomen up to umbilicus were also found to be open (first post mortem examination). Coils of intestine, some portions of liver and kidneys were found in the abdominal cavity. Most of the neck tissues including the hyoid bone, cricoid cartilage, lungs, heart and whole stomach were found to be missing (first post mortem examination).

On the left side of the neck, a dark red colour decomposed mass of about 5x3 cm size was seen and the same was recovered and preserved in 10% formalin.

The thyroid cartilage was found to be broken into pieces without much surrounding soft tissues. All the available viscera pieces were also collected for chemical analysis.

The soft tissue mass which was recovered from the left side of the neck was examined with meticulous dissection after 10% formalin fixation. We could identify presence of carotid artery and some segments of laryngeal cartilage. The whole mass was forwarded to The

Institute of Pathology, Madras Medical College and The P.G. Institute of Basic Medical Sciences, University of Madras, Chennai, Tamil Nadu, India for histo-pathological examination.

The histo-pathological observation of the carotid artery revealed an irregular shaped contusion which is stained deep violet colour in the tunica media of the carotid artery. (Fig- 2; Fig 3: normal carotid artery as a control). Under high magnification, the contused area showed infiltration of RBCs and WBCs probably due to acute inflammatory reaction. (Fig. 4) The tunica adventitia is also stained with hematoxylin stain (violet color) due to acidic reaction of the tissue during acute damage of the tissue.

Chemical analysis report of the available viscera was non-informative so the final cause of death was ascribed to "Neck compression".

Discussion:

From the available history and police investigation, we came to know that the person would have been murdered by ligature strangulation with a rope. So, our main target was the neck region. However, the neck examination was not so informative because skin and most of the soft tissues including the hyoid, cricoid, larynx and major blood vessels were missing due to either decomposition or mutilation caused by the first autopsy.

Only corroborative finding of neck compression left with us at the end of a tiresome lengthy autopsy was the multiple fracture of thyroid bone. Is it fully justified to conclude final cause of death as "Neck compression" based only on this single criterion? Moreover, this fracture could be an artefact introduced during the first autopsy.

Many available literatures [4, 5, 8, 9, 10] mention that thyroid fracture is commonly seen in cases of homicidal ligature strangulation and even though in rare cases there may be no injury to indicate an assault. [10] However, we could not conclude anything from this because the possibility of presence or absence of soft tissue injury or ecchymosis could not be ruled out as the body was in advanced state of decomposition. Due to adipocere formation and presence of plaster of Paris, the fractured leg was well preserved and we found the wound healthy. So, we could not digest this hypothetical theory of 'Septicaemia' as a cause of death, remember even the plaster was not opened during the previous autopsy.

On one hand, the histo-pathological report showed contusion of the carotid artery and this contusion was ante mortem in nature. This finding was actually the main breakthrough

in our case. We have never come across any literature commenting on authenticity of histology report in case of advanced decomposition. The present case is unique as the time since death was almost about 21 days, 4 days lying in open and 17 days in earth. The weather was hot and humid with frequent monsoon rains, favourable condition for early onset of decomposition and adipocere formation. In India adipocere formation may start as early as 3-4 days. [11] The only possible reason for prolonged preservation of tissues in the present case may be the early adipocere formation and no remarkable mutilation from wild animals.

We reconstructed the whole thing and it correlated with the multiple fractures of thyroid bone and carotid artery injury. Therefore, after exclusion of other possible causes of death, we finally concluded the cause of death as "neck compression". The three accused confessed to the court of law that they killed the victim by strangulation with a nylon rope.

Conclusion:

In every case the autopsy must be complete, all the body cavities must be opened and every organ must be examined even in cases of advanced decomposition. If necessary, viscera must be preserved for chemical analysis and tissues for histo-pathological examination. The present case is a good example that decomposition is not at all a deterrent for histo-pathological examination. In fact a poor autopsy is worse than no autopsy at all as it is more likely to lead to a miscarriage of justice.

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Fig. 1: Body showing Adipocere Formation



Fig. 2: Carotid Artery shows Contused Area as Deep Violet Color (20X, H & E stain)

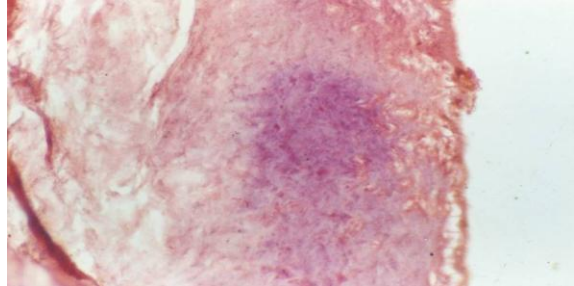


Fig. 3: Normal Carotid Artery as a Control (20X, H & E stain)

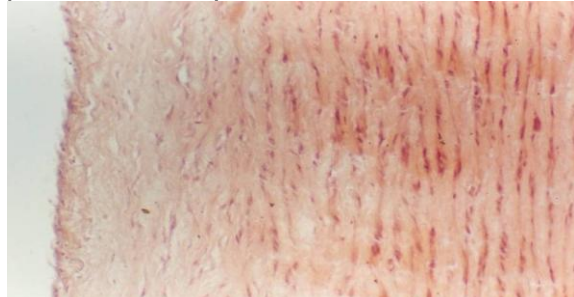
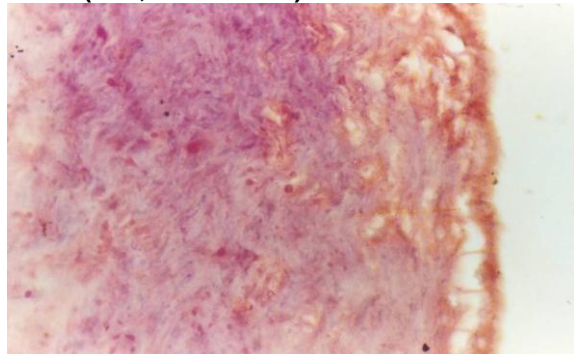


Fig. 4: Enlarged view of the Contused area of the Carotid Artery with Infiltration of WBCs & RBCs (40X, H & E stain)



Case Report

Penetrating Missile Injury by Sudden Oxygen Release From Compressed Oxygen Cylinder: A Case Report

*Millo Tabin, **Piyush Sharma

Abstract

This is an interesting case report to show how devastating and fatal could be the pressure effect of oxygen gas. A 25 years man, a lorry driver was loading a large completely filled oxygen cylinder to his lorry along with two other at an oxygen cylinder production factory. He was rolling the cylinder keeping it slant with the pressure valve facing to his abdomen. All off a sudden the pressure valve came off and the compressed oxygen within the cylinder burst out through the outlet and hit his abdomen directly. He flew 20 feet far and died at the spot. An autopsy was conducted which revealed extensive fatal abdominal injury along with fracture of T11, T12 & L1 vertebrae. Death due to oxygen cylinder is a rare but dangerous entity and in this paper we have discussed on various injuries associated with it. We have also highlighted on the various groups of people who could be in danger and safety measures to be taken to prevent them.

Key Words: Compressed Air, Penetrating Missile Injury, Oxygen Cylinder, Pressure Valve

Introduction:

Oxygen is the life gas of all the living organisms on this earth except few anaerobes. The atmosphere is made up of about 21 parts of oxygen and 78 percent of nitrogen, the remainder being other rare gases. Oxygen is commercially manufactured and marketed in two forms i.e. compressed oxygen and Liquid oxygen. It has become a part and parcel in functioning of all hospitals, medical laboratories, research laboratories and many industries. There is hardly any medical field in which oxygen has not found some use.

Oxygen is used both at high atmospheric as well as ordinary pressure to treat many medical conditions like chronic respiratory diseases, anaerobic bacterial infections, cardiac diseases, in anesthetic practices etc.

It has been used by many respiratory and cardiac patients used at their homes as part of their treatment. It also plays an emergency resuscitative role in aircrafts, military bases, trekking camps, etc. Since it has been widely used in our daily life, the dangers connected with the use of oxygen have also increased. [1]

The storage, handling and transportation are a very crucial issue. Most of the medical personnel are generally not sufficiently familiar with safety measures related to the handling of oxygen cylinders.

Any problem associated with the oxygen cylinder is life threatening be it a malfunctioning of pressure valve, explosion of the cylinder or a simple wrong labeling of cylinder. [1-3]

Therefore it is very important to impart knowledge regarding the safety in handling oxygen cylinder, which is the prime aim of this article.

Case Report:

A 25 years man, a lorry driver was loading the large completely filled compressed oxygen cylinder to his lorry along with two others at an oxygen manufacturing factory. He was loading the cylinder manually neither using any hand trolley nor any safety technique. He was rolling the cylinder keeping it slant with the pressure valve of cylinder facing to his abdomen. All off a sudden the pressure valve came off and compressed oxygen within the cylinder burst out through the outlet and hit his abdomen region directly.

He was thrown about 20 feet away by the pressure of compressed oxygen gas and he died on the spot. There was no fire during this explosion. The oxygen cylinder was intact except for the pressure valve which was detached and lying separately.

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This incidence took place at an oxygen manufacturing factory. The place where this happened was an oxygen cylinder storing unit of the factory having concrete wall on three sides and on the remaining side there was shutter door. The room contained many fully filled oxygen cylinders. The oxygen cylinder which gave up was 4.5 ft in length made up of steel. The wall of this cylinder was intact; the pressure valve was detached from it and was lying at a distance of 4 ft from this cylinder. (Fig. 1)

The dead body was lying between two cylinders at a distance of 20ft from the cylinder which gave up. The dead body was in completely flexed position at its abdomen region (Fig. 2) with a large laceration wound back of abdomen and loops of intestine visible through this laceration. Blood stains were present all around the body. (Fig. 3)

Autopsy Findings:

Postmortem was conducted in the Department of Forensic Medicine at AIIMS, New Delhi on the request of the police.

External Examination:

He was wearing a grey colored pant and white colored full arm shirt, both were blood stained. Lower three button of the shirt were broken. Deceased was moderately built and moderately nourished, 5 feet 4 inches with 62 Kg weight. The rigor mortis was well developed in all the four limbs and postmortem lividity seen on the back side and dependent parts of the body. Both the eyes were partially open. Blood was present at the angle of mouth.

There was a lacerated wound of size 10x8cm on left side of abdomen extending to left flank, triangular in shape, with underlying soft tissues and coils of intestine visible externally through it; surrounded by contusions and contused-abrasions. (Fig. 3) An elliptical shaped laceration was present on left lower abdomen over left iliac crest region of pelvic bone.

On the middle region of back of the abdomen there was a laceration of size 11x10 cm, oval in shape, with coils of intestine along with left kidney protruding through it. There was twisting of left arm at its lower region with compound fracture of humerus, with sharp fractured end protruding out through a laceration of size 3.5x2.5 cm over lateral aspect of lower part of left arm. There was open compound fracture of lower 1/3rd of tibia on both right and left side of legs. Contusions of size 2x3 cm and 2x2 cm were present on left side of forehead.

Internal Examination:

There was fracture of ribs on both side involving 3rd to 5th on right side and 3rd to 7th on

left side of chest. There were sub pleural hemorrhagic patches on both the lungs. Abdomen cavity showed blood clots of 500cc. Multiple contusions and lacerations were present on the wall of large and small intestine.

Laceration of size 3x4x2 cm was present on the anterior surface of left kidney and it was protruding through the laceration on the back of abdomen. Spleen was completely transected at its hilar region and it was lying free in the abdominal cavity. Contusion of size 4x5 cm was present on anterior surface of left and adjacent right lobe of liver.

Abdominal aorta, inferior vena-cava and adjacent large vessels were lacerated. Fracture dislocation of T11, T12 and L1 vertebrae at inter vertebral joints were present. The abdominal injury and injury on the back of abdomen was through and through. Compound fracture of lower 1/3rd of both tibia and lower end of left humerus was present. Sub-scalp hematoma in an area of 4x3 cm was present on left side of fronto-parietal region of skull.

The cause of death was ascertained as **"shock and hemorrhage due to above mentioned injuries caused by blunt external force which could be possible in explosion of oxygen cylinder."**

Discussion:

The cylinder involved in the above mentioned case contained compressed oxygen. The compressed oxygen cylinder has a pressure of 1880-2200 psi [4] or 140-151Atm 1 or 200 bars. The two main reasons for explosion of an oxygen cylinder are weakening of the cylinder from chance defects or by corrosion and failure to observe some of the rules for the safe handling of cylinders. [1] The other factors which increase the risk of oxygen cylinder accidents are heat and vibration. [2, 4]

In the above mentioned case, corrosion at the outlet of cylinder was present which in turn rendered the pressure valve viable for detachment. Also since no trolley was used to shift the cylinder causing the cylinder to undergo lot of manhandling which in turn resulted in detachment of already weakened pressure valve due to corrosion of outlet.

In the present case the deceased was rolling the cylinder towards his lorry by keeping it in a slant position; pressure valve of cylinder directing towards his anterior abdomen wall. The valve gave up and the valve along with the high pressure of compressed oxygen struck his abdomen like missile. The deceased was thrown away from the cylinder against the other cylinders which were kept in the same room.

He died on the spot and blood was spattered all around the body. On postmortem examination we found lacerations, contusions, abrasions and also fracture of bones. There were no burns anywhere on the body which excluded the chances of fire at the time of explosion. There was one large laceration on left side of anterior abdominal wall which was cavity deep and another large laceration on back of the abdomen. These two injuries were through and through penetrating injuries, but caused by a blunt external force. The high pressure (1800-2200 psi) of compressed gas could have acted as a high intensity missile causing this perforation of abdomen, lacerating the intra abdominal structures. The pressure waves and the vibrations generated during this explosion might have caused the high impact injuries such as fractures and thoracic injuries.

The pattern of injuries on the victims of explosion of cylinders varies widely depending upon the nature of explosion. [5] They could be any sort of injuries like abrasions, contusions, lacerations, incisions, and crush or could be burns and fractures. Also pattern of distribution and management of injuries varies widely with the nature of the explosive material. [1]

Several different factors cause injury following an explosion, and the relative importance of each varies considerably with the type of detonation. For example, pure blast effects are far more important with high-explosive projectiles designed for purely military use than with the home-made terrorist bombs, the lethality of which may be primarily caused by flying fragments. [6]

The causes of injuries in blasts can be categorized as-[7-8]

1. Primary blast injuries caused by a) force of explosion gases, b) wave of pressure called shock wave c) fire during blast resulting in burns
2. Secondary blast injuries caused by flying debris striking the victims
3. Tertiary blast injuries caused by victim impacted against the stationary objects or fall of stationary objects e.g., fall of wall; victim may also die of poisonous gases and fumes during an explosion. [2, 8]

During the gas cylinder explosions, people involved can be thrown off their feet and injured, and this could be the cause of death in these cases. [7]

Common Properties of Oxygen: [9]

- It is a colorless, odourless and tasteless gas hence any leakage cannot be appreciated manually.

- It is slightly heavier than air.
- It is non-flammable but supports combustion with other elements.
- Oxidation, an important property specific to oxygen causes rusting of ferrous metals, discoloration of copper and corrosion of aluminum. This property can lead to weakening of the storage cylinders which in turns may result in leakage and explosion.

Oxygen is obtained commercially either by the liquid-air process or by the electrolyte process. [9] Oxygen is commercially marketed in the form of compressed oxygen or liquid oxygen. Persons involved in manufacturing of Oxygen and also those who are involved in its transportation should be aware of the dangers associated with and the safety measures to be employed during those processes. Hospital personnel must be familiar with the potential problems arising from medical compressed gases in order to recognize and reject unsafe cylinders. [2]

Common Causes of Oxygen Cylinder Accidents:

Risks associated with oxygen cylinder vary widely and the causes for these risks also vary accordingly. [2] Since accidents associated with the oxygen cylinder irrespective of minor or major, could risk the life of either the patient, doctor or other personnel who are involved in handling the cylinder. It is important that the problems and their causes in handling of oxygen cylinders are properly understood in the domestic and commercial situations. Some of the common causes of accidents are:

- Contamination of oxygen cylinders with substances like carbon dioxide, nitrogen and hydrocarbons [2] which may lead to poisoning in patients; and could lead to explosion when contaminated with fuel gases. [1]
- Overfilling of the cylinders with high pressure exceeding the tolerance capacity of cylinder could result in explosion. [10]
- Malfunctioning of pressure valve and gas regulators may lead to non-delivering of oxygen to patients, leakage, and also explosion. [10]
- Abrupt starting and stopping of oxygen flow can produce frictional heat that may ignite any contaminant that might be in the system. [10]
- Wrong identification of cylinder due to incorrect labeling, painting over the labels, wrong color coding of cylinder. [2]
- Though oxygen is a nonflammable gas, it can ignite when it comes in contact with

ignition sources like electric cautery, defibrillators, cigarette lighters, match stick or any spark or heat producing appliances. [10]

- Some organic materials such as grease, oils and petroleum products can react violently with oxygen if ignited by a hot spark. [11]
- In MRI investigation rooms, ferromagnetic oxygen cylinders may turn into missile when they are drawn into magnet. [12]
- A cylinder can also turn into a missile when there is a damage in the cylinder wall or when the pressure valve give up all of a sudden; sudden escaping of high pressure gas will propel the cylinder with a great force which could be life threatening. [2]
- Corrosion and rusting of cylinder wall due the oxidizing property of oxygen may lead to leakage resulting in fire or explosion of cylinder. [11]
- Shifting of cylinders without trolley could be dangerous since it can lead to manhandling of cylinders, dragging, rolling and sliding the cylinders. [10]
- Improper storage of cylinder e.g. ill ventilated areas, exposing the cylinder to excessive heat and friction, not placing the cylinder in upright position, storing near other flammable products, frequent falling and knocking over of cylinders. [2,10]
- Improper transportation techniques like improper padding of cylinders, not using specially designed trucks for cylinder carrying, over speeding, over loading and also failing to use safety measures like fire extinguishers in the vehicle.
- Refilling of gas cylinders at noncertified centers and by untrained non qualified personnel. Unsafe modifications to cylinder design. In some cases, the materials may appear to be compatible but the shape and configuration of components may be important in minimizing the fire risk. Only components approved by the manufacturer should be used when maintaining oxygen equipment. [10]

Lack of regular maintenance of cylinders by not getting them tested and certified by concerned authorities.

Precautions for Safe Handling and Use: [13, 14]

It is essential to follow several safety guidelines to prevent the accidents related to

oxygen cylinder. The users, such as hospital professionals, home care patients, laboratory personnel; and also persons who are involved in refilling of gas, shifting and transportation must be familiar with the correct use and potential risks associated with oxygen gas

General safety measures and precautions that are to be followed during the usage of oxygen cylinder by home care patients and hospital personnel are as follows

- Never smoke nor allow visitors to smoke near you while using oxygen. Post a 'No Smoking' sign in a prominent place at the entrance of the room.
- Stay at least 5 feet away from gas stoves, candles and other heat sources while using oxygen.
- Secure oxygen cylinders to a fixed object or place in a stand. Cylinders must remain upright at all time.
- Never use the oxygen at fuel stations.
- Always operate cylinder valve slowly; and turn off the valve when not using the oxygen.
- Do not use any flammable products like aerosol sprays, paint thinner and cleaning fluids while using the cylinder.
- Use water-based lubricants on your lips and hands; and don't use an oil based product like petroleum jelly, creams and lotions.
- Use bedding and cloths made of cotton material which will avoid sparks from static electricity which are seen with wool, nylon and other synthetic fabrics.
- Do not allow children or untrained individual to handle the cylinder.
- Never use the cylinder beyond expiry dates.
- Ensure that you have an all purpose fire extinguisher close by and have your gas supplier's number handy.
- Never discard pressurized cylinders in the normal trash.
- Pressure regulators constitute a critical interface in the area of safety in the use of compressed gas pressure valve is the most vulnerable portion of the cylinder. [15] The design manufacture, operation and maintenance of these pressure regulators must be handled by suitably qualified persons with expertise and knowledge in the area concerned.
- The use of copper alloys and bronze for the body of oxygen regulators during manufacture is strongly recommended and

the use of aluminum and plastic should be minimized. [16, 17]

- Do not use flammable organic materials such as oils, greases, cream, etc
- Do not operate the pressure valve/regulator with dirty and greasy hands; this may lead to unregulated sudden release of gas.
- Regularly check the integrity of the pressure valve/ regulator connection, e.g.: position of gaskets, condition of mating surface etc
- While opening the cylinder valve, position yourself behind the valve, opposite the pressure regulator.
- Open the cylinder valve gradually and in case of adjustable regulators, ensure that the regulator screw is in "zero" position before opening the cylinder.
- In the event of impact or leak the user should not attempt to make unauthorized repairs or adjustments of regulators, remove the equipment from the service and have it repaired by an authorized person.
- Ensure that maintenance is carried out at the periods specified by manufacturer.
- The storage area should be in a cool, clean area that is constructed of fire-resistant materials. Conductive flooring must be present where flammable gases are stored but is not required where only nonflammable gases are kept.
- Adequate ventilation should be provided so that if there is a leak in a cylinder, gas will not accumulate in the room.

Easily visible signs with texts such as **"GAS CYLINDERS, REMOVE TO A SAFE PLACE IN THE EVENT OF FIRE"** **"NO SMOKING,"** **"NO OPEN FLAMES OR SPARKS,"** **"NO OIL OR GREASE,"** and **"NO COMBUSTIBLE MATERIALS"** should be posted inside the room and on the door.

Knowledge regarding proper storage of the oxygen cylinder is very essential to prevent accidents. [15, 17] Cylinders should be stored in well ventilated areas. The temperature of cylinder storage area must not exceed 125°F. Direct sunlight exposure must be avoided; and precautions should be taken to not to expose the cylinders to extreme climate conditions. Cylinder should be protected from the ground to prevent bottom corrosion.

Full and empty cylinders should be stored away from other flammable products. Keep cylinders away from electrical circuits. Oxygen cylinders (empty or full) in storage should be separated from fuel-gas cylinders and combustible materials by a minimum distance of

20 feet or by a barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

Cylinders must always be kept in upright position, use stands and hand trolley should be used for their movements. Cylinders should be properly secured by using storage racks, carries and by chaining them to a fixed object to prevent them by falling and tipping.

The personnel involved in transportation, shifting, manufacturing cylinders and refilling of oxygen gas should made aware of proper techniques and safety measures.

- Personnel involved in refilling and shifting of the cylinders must use safety goggles, insulated gloves, safety shoes and protective jackets.
- Avoid dropping, knocking over, rolling and dragging of cylinders and also striking the cylinders against each other. Never carry a cylinder by the valve.
- Cylinders should be lifted by crane using the pallet.
- While loading the cylinders to the truck use trolley and Fork Lift Trucks.
- Drivers should be trained in the potential hazards and dangers, safe handling, emergency procedures and the use of fire fighting appliances.
- There should be no passengers other than driver and helper in the vehicle.
- Vehicle must be turned off while refueling and also it should be made sure that no other vehicle is present in the vicinity.
- It is imperative that all cylinders must be secured and stabilized while transportation.
- Fire extinguisher should be present.

Gas Cylinder Disposal: [18]

The following information applies to the disposal of compressed gas cylinders:

1. If possible, purchase compressed gas only from manufacturers that will agree to take back the empty cylinder.
2. A cylinder is considered empty when the container pressure is at atmospheric pressure.
3. Refillable cylinders should be returned to Chemistry Stores, materials handling personnel or directly to the vendor.
4. Maintain manufacturer labels and label the cylinder with an "Empty" or "MT" tag.

Conclusion:

Oxygen is used for various purposes in the hospitals, laboratories and industries. This case report highlights the hazardous effects of mishandling of oxygen cylinder leading to fatal blast. The high pressure effect can cause missile like injuries in the victim. The forensic

pathologist should be aware of the pattern of injuries possible in blast injuries. It is important for the people using and handling oxygen cylinders to know the ill effects and precautions to be taken while handling the cylinder.

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Fig. 1: Oxygen Cylinders kept for loading and cylinder that acted as missile



Fig. 2: Complete flexion of Body due to Fracture of Spine



Fig. 3: Visceral Organs Protruding Through the Back of Abdomen



Case Report

Doctor's Perspective in a Post-Mortem Burn Solving of a Crime: A Case Report

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Abstract

Medico-legal autopsies are conducted routinely in every case of death due to ante-mortem burns. In a common autopsy, the absence of the ante-mortem signs of burns on the body of the deceased provides enough evidence for it being a post-mortem burn. Still such evidences are missed due to large number of autopsies or lack of diagnosing by the inexperienced doctor. The police on the other hand will present such cases as simple burns cases which can further lead to misdiagnosis of the case. The charring associated with the post-mortem burns makes the diagnosis more doubtful. Many of the post-mortem burns are result of afterthought, to conceal the evidence of a crime. Such burns are done in the perimortem period or when the victim have just died, making their diagnosis more difficult. This case highlights one such situation where the findings of strangulation were concealed behind post-mortem burning of the body.

Key Words: Postmortem burns, Concealed Homicide, Carboxyhaemoglobin

Introduction:

The Forensic Pathologist plays a paramount role in the investigation of a crime. His part significantly increases in the bodies which are found dead on the spot, with no witnesses and no proper history. Their post-mortem findings in these cases give vital clues to the police investigators. The ignorance, lack of experience or misinterpretation by the doctor conducting the post-mortem can lead to misguiding of the investigation agencies.

Some examples of cases where the police investigation is based on the findings of the autopsy are; bodies found in decomposed stage, on the railway tracks with multiple injuries, hanging at unusual places, decapitated bodies, and found in the burnt condition with no witnesses etc. Every time a body comes to autopsy with a history of on-the-spot death due to burns, it poses a challenge to the Forensic Pathologist whether it's an ante-mortem or post-mortem burn. Its distinction is always paramount to the investigator.

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We report a case of a female with history of burns where the correct interpretation of the post-mortem findings by the doctor led to the discovery of her homicide.

Case History:

The dead body of the deceased was brought to the mortuary of Safdarjung hospital for autopsy suspecting death due to ante-mortem burns. The cause of death as per the inquest report of the Police Investigating Officer was burn injuries. The deceased was a resident of North- eastern state of India who was visiting her elder sister on vacation and was about to return back in few days. She also had a brother in the city, living separately.

Their living premises consisted of a building on rental basis with many people living in different rooms around a corridor, with shared toilets and separate kitchen. On that particular day her elder sister had gone on her job and the deceased was alone at home.

Her brother had come to visit her and found that she was not in the room. Then he went towards the kitchen where he found her lying on the ground in a partially burnt state. After the discovery of the body, he called her elder sister and told her about the incident.

The police had brought the body to the emergency department of the hospital suspecting ante-mortem burns, where she was declared as brought dead. The burnt clothes sticking to her body were preserved neither by the I/O nor by the doctors of casualty.

Subsequently the dead body was subjected to the autopsy.

Autopsy Findings:

The dead body was of an adolescent female, normal built, moderate nourishment, and fair complexion. The eyes were closed, pupils were dilated and fixed. The post-mortem staining was present at the back and rigor-mortis was well appreciated all over the body.

External injuries:

1. Deep burns were present on the posterior aspect of the neck extending on to the lateral aspects of the neck. Similarly deeply burnt areas were present between the two shoulders and the occipital scalp. Superficial to deep burns were present on the posterior aspect of both the arms and on the lateral aspect of the chest. Muscular planes of the upper back region, posterior neck and of shoulder regions were exposed and charred. Blackening was present on the burnt areas. No erythema, line of redness or vital reaction was present at the burnt areas.
2. A Crescentic shaped reddish abrasion of size 0.5 cm X 0.1 cm, was vertically placed just above the middle of the left eye brow.
3. A Crescentic shaped reddish abrasion of size 0.3 cm X 0.1 cm, was vertically placed parallel and medial to injury no 2.
4. A reddish abrasion 2 cm X 1.2 cm, was present on the left temple.
5. A reddish abrasion 2.2 cm X 1 cm, was present on the upper neck region just beneath the ramus of mandible, 1.8 cm medial to the right angle of mandible.

Internal Examination:

The occipital aspect of the scalp was completely burnt with charring of the bone underneath. Brain matter in the region was partly cooked with a heat hematoma present in the region.

There was bruising present in the left side of the neck along the carotid sheath. Tracheal walls were congested with no soot particles present in it. The muscles of the posterior segment of the neck were charred. The Lungs were edematous and congested. The heart had petechial haemorrhages at the apical region. The stomach contained about 30 cc mucoid material. The hymen was intact and admitting fingertip. No injuries were present around vulva or perineum.

The cause of death was **"Asphyxia as a result of manual strangulation (Throttling)."**

Discussion:

In this case, the autopsy findings confirmed that the primary cause of death was

asphyxia due to manual strangulation and not ante-mortem burns, as was suspected by the police investigators. During the post-mortem the kin's of the deceased were interviewed.

The deceased's sister stated that her sister had complained of being stalked by a stranger male who lived in the same corridor as occupied by these females and was subjected to some physical advancement by the same person. This lead was given to the investigating officer. On suspicion, that male was arrested and he later on confessed that he was fascinated by the girl and was trying to establish relationship with her for some time.

On the day of incidence he found her alone in the kitchen and all the other rooms in the corridor were locked. Gaining from this opportunity he advanced towards her, but the girl resisted. To keep her voice down and to restrain her he held her by the neck and ended up throttling her to death.

To conceal the signs of struggle on the neck of the female, he placed the dead body of the female on the burner stove with posterior neck area directly in contact with the flame. In cases of burns where history or chain of events is not clear and the doctor should look for the signs of post-mortem burns.

Postmortem burns are characterized by absence of vital reaction, absence of line of redness, no soot particles in the trachea and bronchus, no cherry red colour of blood, and absence of reparative process. [1] The internal organs are usually roasted with emission of peculiar odour. [1] Vesicles may be present both in the ante-mortem and post-mortem burns but in the Postmortem burns they contain mostly air and the little fluid comprises of very little albumen with no chlorides and have dull, yellow, dry hard base. [2] While increased enzyme reaction is present in the periphery of ante-mortem burns, no enzyme activity is present in cases of post-mortem burns. [2]

The carboxyhaemoglobin level can be used as a useful indicator for distinguishing post-mortem burns from ante-mortem burns. The level greater than 10 % indicates that the victim inhaled smoke and was alive at the time of fire. [2] Tumer [3] studied a series of thirteen cases of homicides involving post-mortem burning of the body and observed that the level of carboxyhaemoglobin was less than 10 % in all of the cases. In 12 cases, there were no soot particles in the respiratory or gastrointestinal tract and only one case contained soot particles that too in the oropharyngeal area only. They further noted that there was no line of hyperemia or redness in any of the case.

Taghaddosinejad [4] studied 47 cases of burns and found that carboxyhaemoglobin was positive in some of the ante mortem burns and was negative in all of the postmortem burns.

The post-mortem burning of the body is a phenomenon repeated again and again by the assailants to hide the findings of the ante-mortem homicidal attack, thus misleading the investigators of law.

In the famous **'Naina Sahni Tandoor'** case, the initial autopsy mentioned the cause of death due to burns, but in the repeat autopsy it was revealed that the victim was shot prior to her death and the same findings helped in linking the accused to the crime and their prosecution. [5, 6]

Paliwal [7] and Meshram [8] also reported similar cases where post-mortem burning of the body has been done to conceal murder. The most common error which can happen in such cases by the autopsy doctor is to believe in the inquest of the police and this can lead to falsity in the post-mortem report.

The investigation technique of the police in our country is more based on circumstantial evidence and the statements of the witnesses rather than relying upon the scientific evidences.

Timely and correct interventions by the doctor in this case lead to detection of a crime and apprehension of the criminal. This case also exemplifies the importance of interviewing the near relatives in uncertain and doubtful cases

Conclusion:

The cases of burns where the death is on the spot of the incident should be carefully looked for the signs of assault like gunshot, strangulation, stab injuries, head injuries, poisonings etc. The doctor should hold his reasonable doubt or suspicion while conducting the post-mortem examination in such cases. He should apply his expertise, knowledge thoroughly instead of relying upon the history given by the police or relatives.

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Fig. 1: Dead Body as Found on the Crime Scene



Fig 1A



Case Report

Death by Strangulation or By Love

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Abstract

It is said "A mother's love is patient and forgiving, where as all others are forsaking, it never fails or falters ever, though the heart is breaking." But what about the love she should get in return from her children. Mother cares for her child from the womb regardless of everything. But at times her own child turns against her and takes her life. The present case showed how the "infatuation, may be love" clouded the years of motherly love, which is considered next to God's grace on earth and led to the gruesome death of the mother in the hands of her only daughter. This case came into light after missing persons report was filed by her mother's brother. After police intervention and days of daughter's interrogation, she confessed to have strangled and buried her mother with the help of her lover. Though, the body was recovered after one month, ante-mortem injuries were still appreciable.

Key Words: Homicide, Ligature Strangulation, Death, Ante-mortem injuries

Introduction:

It has been rightly stated by Shakespeare that a dead body will speak through its most remarkable organ. In the present case, a daughter killed her own mother, the one she had known all her life for the love of someone who was relatively new to her life, just because her mother didn't approve of her recent, yet forming relations.

The body was then buried close by a river after being sprinkled with salt. However, even after one month when the body was recovered along with its ligature material in situ on the neck, the ante-mortem injury on the neck was well appreciable. Thus, even decomposition could not obscure the ante-mortem injuries, being the telltale of the gruesome experience of last moments of death of the most pious relation on the earth.

Case History:

The victim was staying along with her only daughter. One day, the mother suddenly disappeared and when the brother of victim enquired about her, daughter didn't give any satisfactory reply.

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A police complain was lodged regarding the missing of her mother. Police when interrogated the daughter she confessed that she along with her lover strangled her mother and buried the body in mud around one month ago and also sprinkled some salt thinking that it will fasten the decomposition thereby obscuring the crime.

On the demarcation by the daughter, the place was identified and the body was recovered and was sent to local Government hospital for post-mortem examination and then, referred to Department of Forensic Medicine at Pt. B. D. Sharma Post Graduate Institute of Medical Sciences, Rohtak on account of its decomposed state where the autopsy was finally conducted.

Autopsy Findings:

It was found that the body of the female and the cloths were smudged with mud and white coloured granular substance, supporting the statement of the accused that she sprinkled salt over the body. (Fig. 1) The body was then cleaned. The skin was found to be blackened, hardened, and dried up, leathery and mummified on touch. Epidermis was peeled off from all over the body. Facial features were distorted making it unidentifiable. The eye sockets contained putrefied remnant tissue.

The ligature material in the form of black coloured metallic wire and encircling the neck in two loops was found in situ. Each end of the wire was having a wooden stick at its extreme ends. The right side wooden stick was of irregular shape and of length 24cm whereas left side was of length 21cm and approx 4cm diameter. (Fig. 2, 3) On the left sided stick, the

wire was fastened in the form of a loop where as on right side; the wire was tied to stick with a fixed knot.

The length of ligature material was 85cm in between the two sticks while the width of the ligature material (individual wire) was 0.3-0.4cm. The 2nd loop of wire was crossing in midline with free ends on either side. On nape of the neck of the victim, hairs were entangled. The ligature material was carefully removed.

The underlying ligature mark was well appreciated in the form of two blackish marks with imprinted pattern of wire on it, running parallel to each other (Fig. 4, 5, 6) with little space in between, encircling the neck at the level of thyroid cartilage. The left arm was situated 3cm below the left angle of mandible, extending anteriorly, 5cm below the center of chin, further extending on the right side of the neck, 5cm below the right angle of mandible and moving posterior, on the nape of neck, 10cm below the level of external occipital protuberance.

It was placed transversely on front of neck and going backwards on both sides and visible faintly on nape of neck. On dissection, superficial underlying tissues and (Fig. 7) the laryngo-tracheal structures showed ecchymosis. A reddish contusion of size 6 x 5cm was also appreciated on the left malar region.

The systemic examination showed that all the solid organs were putrefied and softened. The organs of generation were also softened. It was then opined that it was the dead body of an adult female individual and the cause of death in this case was ligature strangulation. The injuries described were ante-mortem in nature and caused by hard blunt object/ surface impact.

Discussion:

Strangulation is a form of violent asphyxia which is caused from constriction of the neck by a ligature without suspending the body. [1] Strangulation is almost always homicidal (except in children where they tend to be accidental). A person may be strangled by another person's hands (manual strangulation) or by a ligature (ligature strangulation). Also, a person may be strangled by virtually any object that is pushed onto and compresses the neck, such as a forearm, a knee, or any type of fixed object such as a metal bar. [2]

In ligature strangulation, the ligature material used is usually handy and available near the place of occurrence, may belong to murderer but may be part of victim's garments. [3] All types of ligature can be used like rope, wire, string, electric and telephone cable,

scarves, stockings, pieces of cloth etc. The mark on the neck will usually reflect the material used for the ligature: if a wire or thin cord was used, the mark will usually be clear-cut and deep with sharply defined edges. When a narrow wire is used as the material of strangulation it is called as "cheese-cutter" method. [1]

If a soft fabric is pulled taut, it will commonly fold into a series of firm ridges or bands that may produce interlacing deeper areas of bruising on the neck of the victim, which can suggest the use of a narrow ligature.

The ligature mark is a vital piece of evidence, especially when the killer has taken away the actual ligature. The mark on the neck may reproduce the pattern of the object, such as spiral or plaited weave, and the width of the mark can sometimes give a clue as to the size of the ligature. Occasionally, a ligature mark may lie only across the front of the neck, which indicates that the assailant either pressed from the front or pulled from the back using a cord stretched between two hands. [4]

Death is usually due to asphyxia (anoxic hypoxia), but it may be due to other causes namely cerebral ischemia, venous congestion, shock due to reflex cardiac arrest or combination. Very rarely cervical vertebrae may be fractured. [5] When a wire or cord is used, it often completely encircles the neck.

If there is more than one loop of the ligature around the neck, there could be bruising of the skin if the ligature pinches the skin between two loops. The marks resist decomposition presumably because the ligature has compressed the underlying blood vessels, restricting access to the area by the putrefying bacteria. So, despite decomposition, ligature marks tend to be well preserved and recognizable. [6]

Conclusion:

Strangulation is a common method of homicidal deaths especially in females who are easy to subdue and strangle. It is commonly seen nowadays that females are first raped and then strangled to death. Though easily accessible ligature materials and or hands are used but materials like clutch wires of automobiles or bicycle chains etc. when found in situ, indicate pre-meditated and pre-planned murder, rather than a provoked one. In present case, the death of a mother in the hands of her offspring is the most heinous crime on earth which can make God thinks twice of his own creation...Human.

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Fig.1: Body along with the Ligating Material



Fig. 2: Ligating Material with the two ends



Fig. 3: Ligating Material with the stick used to tighten the ligature



Fig. 4: Ligature Mark in front of Neck



Fig. 5: Ligature Mark on back of Neck



Fig. 6: Ligature Mark on the Neck with Pattern of Wire



Fig. 7: Underlying Tissue Showed Ecchymosis



Case Report

Fatal Scorpion Envenomation: Report of Two Cases

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Abstract

Scorpion stings are a major health problem in tropical countries like Africa, India where the incidence of serious envenomations are very high. Among the different species of scorpions available, the Indian red scorpion, *Mesobuthus tamulus* is of medical importance in India. Its venom is water soluble, antigenic and consists of a heterogeneous mixture of cardiotoxins and neurotoxins. Scorpion envenomations are a life threatening time limiting emergency. Although adults are more often stung, the fatality rates are high in children because of their lower body mass. Scorpion sting causes a wide range of clinical symptoms ranging from severe local skin reactions to neurologic, respiratory and cardiovascular collapse. Most of the envenomations results in acute painful local reaction that can be treated with local analgesics. But some cases become fatal where death occur secondary to cardiac or respiratory failure. We present two such cases where the reported cause of death was pulmonary oedema.

Key Words: Scorpion sting, Fatal envenomation, Pulmonary oedema, Cardiovascular collapse

Introduction:

Scorpion envenomation is an occupational hazard for farmers, farm labourers, villagers, migrating population and hunters. [1]

They are generally found in dry, hot environments, although some species are also present in forest and wet savannahs. All species are nocturnal, hiding during the day under stones, wood or tree barks, loose tiles of hut, inside empty shoes, pockets of trousers and shirt, crevices of doors and windows. [1, 2]

No reliable statistical data is available on scorpion envenomations as most of them remain unreported owing to the incident occurring in deserts and remote areas, where medical facilities are unavailable.

However, globally, the annual incidence has been estimated at around 1.2 million and Indian records suggest that approximately 10000 people die every year due to scorpion stinging. [2, 3] Scorpions are arthropods comprising about 1500 species, of which about 30, belonging to the family Buthidae, are potentially dangerous to humans. [4]

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The deadly species of scorpions are mainly found in the tropical and sub-tropical areas like Africa, Middle East, South America and India. [5] Among the 86 species of scorpions present in India, *Mesobuthus tamulus* (Indian red scorpion) and *Heterometrus swammerdami* (Indian black scorpion) are of medical importance. [6, 7] The commonest and most venomous species seen in India is *M. tamulus* which grows up to 3 inches in length. Its venom is water soluble, antigenic and consists of a heterogeneous mixture of cardiotoxins and neurotoxins. [2]

Case 1:

A 16 year old girl was referred to our hospital from a rural hospital, under endotracheal intubation.

On examination, she was found conscious, with pulse rate of 100/min and blood pressure 100/70 mm of Hg in supine position. On auscultation, bilateral extensive crepitations were heard over the lungs. Examinations of abdomen and rest of the cardiovascular system were unremarkable.

On evaluation, there was an alleged history of scorpion sting over the left foot while she was picking some woods nearby her house.

Soon she developed excruciating pain over the left foot and was admitted to a nearby hospital where she was given oral and topical analgesics. The pain subsided, but after 5 hours of the incident, she developed breathlessness, was intubated and referred to our hospital.

She died within 24 hours of admission and the body was sent for post mortem examination.

Autopsy Findings:

External Examination:

The skin over the dorsal aspect of base of the little toe of left foot over an area of size 2x1 cm was found to be thickened, indurated and pigmented. The subcutaneous tissue was found to be normal on cut section.

Internal Examination:

Blood stained secretions were present in the lumen of larynx and trachea. Both the lungs were found to be heavy (left and right lung weighed 400 and 450 gm respectively), congested, edematous and exuded blood stained frothy fluid on cut section. The heart weighed 180 gm with no visible abnormalities.

Except for congestion, rest of the viscera was found to be unremarkable. The viscera were sent for histopathological examination and toxicological analysis. The toxicological report was negative.

Microscopic examination showed marked congestion and oedema of the lungs. There was increased congestion of the kidneys; liver and heart were histologically unremarkable. Section of skin from the sting site showed hyperkeratosis and dermis was within normal limits. The control skin was histologically normal.

Case 2:

A 38 year old female was admitted to our hospital with complaints of increased sweating, palpitation and difficulty in breathing for the past one day. She was tachypneic at admission. As the breathlessness increased, she was intubated and admitted in ICU.

On auscultation, bilateral coarse crepitations were heard over base of both the lungs. History revealed that she was stung by a scorpion over the right foot, while trying to cut down banana trees. She developed pain at that site, which subsided on medications.

Later, she developed numbness extending beyond the site of sting, increased sweating, difficulty in breathing and was referred here. She was monitored in the ICU, but her condition gradually worsened and she died after two days.

Autopsy Findings:

External Examination:

There was thickening and pigmentation of the skin of size 4x3 cms seen over the dorsal aspect of base of the right little toe. Haemorrhagic marks were seen over that area and on cut section the underlying subcutaneous tissue was found to be haemorrhagic.

Internal Examination:

Both the lungs were congested, edematous and multiple petechial hemorrhages seen over the anterior and posterior surfaces.

The left and right lungs weighed 450 and 525 gm respectively. The heart was of normal size and weight, coronaries were patent, and there were no valvular deformities. Rest of the internal organs was found to be intact and congested. The viscera were sent for toxicological analysis which returned negative results. Microscopic examination of the lungs showed congestion and oedema.

Section from the heart showed oedema between the myocytes. Section from the aorta showed features of fatty streak. Section from both kidneys showed marked congestion and the pancreas was histologically unremarkable.

Discussion:

Scorpions are venomous arachnids belonging to the order Scorpionida, which are capable of inflicting fatal stings. They commonly inhabit the crevices of dwellings, under logs, paddy husk, coconut and banana plantations. [6]

Most of the species are nocturnal in habit, hiding under stones and seek cool and moist areas. Being shy creatures, they usually emerge at night which explains the reason for stings after dusk. Almost all the stings are accidental in nature as they sting for self defence or when provoked. Scorpion stings are more often encountered in summer months than in winter and most of the incidences were reported from rural areas, which correlate well with their natural habitat. [6, 8]

During summer months, they come out of their crevices because of the hot weather. Increased incidence was also noted in the month of October, which is the time to cut paddy. During this time, they do not get space to hide and come out of their crevices. [8] Indian red scorpion, which belongs to the family Buthidae, is known for its fatalities. Accidents due to *M. tamulus* are commonly seen in southern and western India.

The components of scorpion venom are complex and species specific, those of the family Buthidae being the most potent. [5, 9] The venomous apparatus consists of a venom vesicle comprising of a pair of joined glands in the telson, the last segment of the abdomen.

This venom vesicle is surrounded by a striated muscular layer which facilitates and regulates the ejection of venom. This explains the variation in the intensity of the symptoms and the dry stings, i.e., stings without inoculation of the venom. [4] The main toxins include acetyl

cholinesterase, hyaluronidase, phospholipase, serotonin and certain neurotoxins. [5, 9, 10]

The venom of *Buthus* species of India contains phospholipase A, which causes gastrointestinal and pulmonary haemorrhages, and disseminated intravascular coagulation.

The venom affects sodium channels with prolongation of action potentials and spontaneous depolarization of both adrenergic and parasympathetic nervous systems, giving rise to both adrenergic and cholinergic symptoms. [5, 9, 10] Hyperkalemia, hyperglycemia (with reduction in insulin secretion), and increased secretion of rennin and aldosterone are characteristic of stings by *M. tamulus*. [5]

A person who has been stung by scorpion may get intense local pain, erythema, tingling or burning, and occasionally discoloration and necrosis without tissue sloughing. [7, 9, 11] In both the reported cases, the deceased had experienced excruciating pain at the site of sting.

The pain subsided on medication, but after few hours they developed difficulty in breathing owing to pulmonary oedema. In addition, in the second case, the deceased gave a history of increased sweating and numbness beyond the sting site.

Infrequently, some persons may get serious complications like widespread numbness, blurred vision, and excessive salivation, difficulty in breathing and even seizures. All these symptoms constitute medical emergency and are to be treated promptly.

Cardiovascular manifestations are prominent in Indian red scorpion stings. It includes serious clinical sequelae like myocardial infarction, acute pulmonary oedema, cardiac arrhythmias, toxic myocarditis, cardiogenic shock etc. [7, 12] Other reported features include oliguria due to acute renal failure, disseminated intravascular coagulation, priapism, pancreatitis, seizures and cerebral infarctions in children. [2, 9, 11, 13]

Overstimulation of the sympathetic system increases blood levels of catecholamine's, resulting in a characteristic "adrenergic (autonomic) storm" which consists of cardiac (tachycardia, peripheral vasoconstriction, hypertension, diaphoresis), metabolic (hyperthermia, hyperglycemia), urogenital (bladder dilatation, urinary retention, ejaculation in males), respiratory (bronchial dilatation, tachypnoea), and neuromuscular (mydriasis, tremor, agitation, convulsions) complications. [4]

Children are more susceptible than the adults and the mortality rate is high in them. [2, 4] The severity of a scorpion sting mainly depends upon the ratio of the venom to the body weight of the victims. A smaller child, a lower body weight and a larger ratio of venom to body weight lead to a more severe reaction. A mortality rate of 20% is reported in untreated babies, 10% in untreated school-aged children and 1% in untreated adults. [2]

Cardio-respiratory manifestations like cardiogenic shock and pulmonary oedema are leading causes of death following severe envenomation. Cardiac failure can result from massive release of catecholamines, myocardial damage induced by the venom or myocardial ischemia. [7, 14] As per Cupo and Hering, haemorrhage and oedema in myocardium were observed after injection of sub lethal doses of scorpion venom. [15]

In one of our case, interstitial oedema was observed on microscopic examination. Factors usually associated with the diagnosis of pulmonary oedema were young age, tachypnoea, agitation, sweating, or the presence of high plasma protein concentrations. [16]

Pulmonary oedema is the dreaded complication in children. It may be cardiogenic or non cardiogenic and the mechanism remains unclear. It may be due to cardiac failure due to myocardial dysfunction, hemodynamic disorders due to increased preload or post load and severe dysrhythmias, or increased pulmonary vascular permeability due to the release of chemical mediators. [2]

In the above reported cases, pulmonary oedema is the terminal event, which is a consistent feature of envenomations by *M. tamulus*. Kinins, prostaglandins and other inflammatory mediators are implicated in the development of pulmonary oedema.

Histamine, by increasing the capillary permeability augments the development of pulmonary oedema. [17]

Conclusion and Suggestions:

In the absence of other causes of death, negative toxicological report of viscera, history, clinical, autopsy and microscopic findings, cause of death was concluded to be due to pulmonary oedema arising as a complication of scorpion sting. In areas of venomous scorpion sting, the people should be educated to check for the presence of scorpions in clothing, beddings, and shoes before blindly putting hands into them. All this items should be shaken out before use.

The rural people should be advised to wear shoes, especially at night, and to be

careful while handling wooden logs, paddy husks etc. Cracks and crevices should be filled, wood piles and rubbish piles eliminated, and insecticides used in infested areas. Pesticides like organophosphates, pyrethrins and chlorinated hydrocarbons are known to kill scorpions. Alternatively, a mixture of fuel oil, kerosene and a small amount of creosote can be used. Awareness has to be created in the endemic areas regarding the venomous nature of the stings and early approach to a medical centre, instead of approaching the traditional faith healers and quacks.

Since local pain is the predominant presenting symptom, patients are given some oral and topical analgesics and discharged. Here it is imperative to mention that, close monitoring of cases for some time in a medical centre with modern diagnostic and treatment facilities is absolutely essential in order to decrease the mortality.

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Book Review

Modern Textbook of Forensic Medicine and Toxicology

Modern Textbook of Forensic Medicine & Toxicology written by **Dr. Putul Mananta** a renowned Forensic Medicine Expert, a good teacher, researcher and an author contributed a large number of research papers to various national and International scientific journals. Currently serving as faculty of Forensic Medicine & Toxicology at Gauhati Medical College, Assam. He has served in various capacities in the Govt. and Private Medical Colleges. He has rich teaching experience of more than 13 years in the field of Forensic Medicine to share with students and teaching community.

This book has been targeted mainly for **undergraduate** (MBBS) student in particulars and **postgraduate students** of Forensic Medicine and Toxicology in general. It is also useful for the Medical officers, working in rural areas of India who deal maximum number of medico-legal cases, **police personals** and **lawyers**.

Book is simple, well illustrated and covered all the vital Chapter of the Forensic Medicine and Toxicology. The Book contains 52 chapters and a good number of new topics like Forensic Osteology; Forensic Odontology; Human Rights, Custodial Torture and Deaths; Crime Scene Investigation and Techniques in Museum, have increased the depth and width of the book.

All the text illustrations are updated with recent advancement on Forensic Medicine. Flow charts and excellent quality of coloured photographs, sketches, and tables make it favorite among students especially during examination hours.

Renowned Forensic Experts have contributed good numbers of academic inputs in their area of expertise make this book unique piece of treatise

It is my pleasure to write a review of this textbook, a treasure of an exemplary piece of communication skill conglomerated with experiences and intellectual potentials.

Mukesh Yadav
Editor JIAFM