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From Editor's Desk

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I feel immense pleasure to present before you the Third issue of 2015. 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 commmended 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

Editorial

Criminal Justice Delivery System and Role of Forensic Science Services in Delhi: Status at a Glance

Criminal Justice Delivery System has been suffering due to lack of political will, insensitive executive, unaware public, corruption, etc. NCT of Delhi which is also Capital of India facing lot of infrastructural problem, lack of space, lack of trained and skilled manpower. Many PIL has been filed and pending final disposal in various High Courts have issued directions to improve the situation for the reprieve of the common man.

Post Nirbhaya incident (16th Dec 2012) a lot of changes has been enacted to improve the criminal justice delivery system in the India, especially issues related to safety and security of woman. Suo Motu cognigence has been taken by the Delhi High Court and a series of direction has been issued since 2013. There is need to review the current scenario of Forensic Science Laboratories, one of the most important reasons for high acquittal rate and delay in disposal of cases in Delhi.

Delhi has been divided into five zones for administrative reasons, out of which only one FSL is functional and there is need for establishment of four more zonal FSLs. There are challenge to decide the area and allotment of land for establishment of FSL in each zone not having any FSL till date.

With the intervention of the Delhi High Court the Forensic Science Laboratory Delhi is expected to be a dynamic multi-disciplinary organization devoted to the ideals of excellence that provides leadership to advance forensic science and its application to the legal system. The objectives of the Laboratory is to promote professionalism, integrity, competency, education, foster interdisciplinary research, embrace new technology, improve practice, nurture young minds and encourage collaboration in the scientific fraternity.

It appears that there was no coordination among various departments and authorities to expedite the process of establishment of more FSLs.

Reasons for delay in disposal of cases in Delhi:

Bench of Delhi High Court noted with surprise that it is shocking to note that there is only one State FSL (Forensic Science Laboratory) in Rohini in GNCT of Delhi to cater to the needs of the entire Delhi State. Taking into consideration the number of matters pending, it appears that a case for examination in Chemistry Division takes two years, three-four years in DNA Division and five years in Documents Division. However, it was stated that this Laboratory examines some cases on priority basis on the direction of Courts/request of Investigating Agencies and Competent Authority etc.

Table 1: Pendency in years in various Units of FSL, Delhi

Division/Unit	Year	cases received	cases disposed off	pending cases
1. Document	2008 till 31.03.2014	6237	3851	2386
2. Chemistry	2011 till 31.03.2014	13618	9949	3669
3. DNA	2012 till 31.03.2014	3239	944	2295
4. Biology	2012 till 31.03.2014	2968	2491	477
5. Ballistics	From 2012 to 31.03.2014	1845	1719	126
6. Physics	2013 till 31.03.2014	409	312	97
7. CFU	From 2011 Till 31.03.2014	808	507	301
8. Lie-Detection	2013 till 31.03.2014	84	65	19

Source: Compiled from Information available on website of Dept. of Delhi FSL [Online] [2015 May 25]. Available from: URL:http://delhi.gov.in/wps/wcm/connect/doit_fsl/FSL/Home/Case+Stats

Table 2: Pendency in years in various Units of FSL, Delhi

Division/Unit	Year	Pendency in years
1. Document	2008 till 31.03.2014	One to Six Years
2. Chemistry	2011 till 31.03.2014	One to Three Years
3. DNA	2012 till 31.03.2014	One to Two Years
4. Biology	2012 till 31.03.2014	One to Two Years
5. Ballistics	From 2012 to 31.03.2014	One to Two Years
6. Physics	2013 till 31.03.2014	One Year
7. CFU	From 2011 Till 31.03.2014	One to Three Year
8. Lie-Detection	2013 till 31.03.2014	One Year

Source: Compiled from Information available on website of Dept. of Delhi FSL [Online] [2015 May 25]. Available from: URL:http://delhi.gov.in/wps/wcm/connect/doit_fsl/FSL/Home/Case+Stats

It was also stated before the Delhi High Court that FSL has seen significant increase in cases in Chemistry, DNA and Document Division and more equipment and instruments are required to liquidate the pendency.

Three Regional FSLs need to be established:

GNCT of Delhi has decided to establish three Regional FSLs in order to increase the disposal of cases and following steps are being taken by the GNCT of Delhi:

1. For setting up of the **03 Regional Forensic Science Laboratories,** blue prints for land, construction cost, machinery and equipments and manpower etc. have been prepared which is under consideration/approval of the competent authority. We are pursuing the matter with the Delhi Development Authority (DDA) for allotment of land in the East Zone, South Zone and West Zone on priority basis. Recently, DDA has considered the matter and has asked for proper justification of requirement of 10,000 sqm. Land for Regional Forensic Science Laboratories which has been submitted on June 2013.
2. DDA has been requested to allot a plot of land lying vacant adjacent to FSL, Rohini for its use. The matter is under consideration in DDA.
3. The Govt. of NCT of Delhi has taken note of the concerns expressed by the Hon'ble High Court in this regard. The Govt. of NCT of Delhi is committed to taking all possible measures so that the disposal of cases in FSL, Rohini is expedited?

It was stated that the additional plot of land, which the Home Department requested to DDA to allot, is lying vacant adjacent to FSL, Rohini, Delhi, but there has been no response from DDA.

Issue of pendency of cases and Manpower shortage:

There are 337 sanctioned posts in the Laboratory out of which 140 posts have been filled by regular employees and 90 posts have been filled up through direct contract walk-in-interviews. Even after that, 107 posts of various categories are lying vacant.....?

It was also further stated that the recruitment process of additional posts has been initiated, but when will it materialize is not mentioned. [Para 6]

Role of the Hon'ble Lieutenant Governor, Delhi:

Consequently, Delhi High Court felt it appropriate to direct the concerned departments to sort out their issues with the help of the Hon'ble Lieutenant Governor, Delhi. Accordingly, court requested the Hon'ble Lieutenant Governor to convene a meeting with the concerned Department Heads and Commissioner of the Police so that the aforesaid issues are resolved as expeditiously as possible.

The Secretaries who filed the affidavits before this Court are directed to place all the relevant material before the Lieutenant Governor to enable him to ensure that adequate infrastructure is available for detection and investigation of crime.

Delhi High Court hoped and trust that Lieutenant Governor will take necessary action in this regard as the same would enable the Courts to dispose of the maters expeditiously. [Order dated: October 03, 2013] Delhi High Court directed Ld. Counsel for the Central Government that he would file an affidavit disclosing therein the time consumed for exhibits to be examined at the CFSL at Rohini and report furnished to the Investigating Officer. The Central Government shall file an affidavit disclosing the number of forensic laboratories. Government of NCT Delhi may likewise file an affidavit with respect to forensic laboratories established by the Government of Delhi. [Para 4] [September 12, 2013]

Establishment of Regional FSL:

With respect to setting up of **Regional Forensic Science Laboratories**:

i. Though it was informed that **"DDA will allot a plot at Sheikh Sarai"** but neither is any time limit within which the land will be so allotted is stipulated nor is it informed whether the requisite expenditure for construction is being sanctioned;
ii. No such statement even with regard to the areas of **East Delhi** and **Dwarka** has been made; with respect to the plot adjacent to FSL, Rohini, it is stated that since the said land is a commercial plot, DDA has not allotted the plot for the purpose of FSLs; there is no explanation why change of its land use was not considered or is not possible. [Para 3] **[Order dated 04.02.2013]**

Need for Coordination:

Delhi High Court felt need for coordination and directed the concerned Departments of Govt. of NCT of Delhi and DDA to immediately hold a meeting with Lt. Governor in this regard. Ms. Zubeda Begum, learned Standing Counsel for the GNCTD seeks two weeks time to get the allotment of land for establishment of **Forensic Science Laboratories at East Delhi and Dwarka** and to report about construction on the allotted land at **Sheikh Sarai.** [Para 4] **[Order dated 04.02.2013]**

Five Zones in Delhi: Issue of Land Allotment

Delhi High Court observed that in Delhi there is only one Forensic Science Laboratory which is operational and that is at Rohini. This is clearly inadequate for the purposes of criminal investigation in Delhi. The Government of NCT of Delhi has a proposal for setting up at least one Forensic Science Laboratory in each zone. It was informed that there are five zones in Delhi.

In other words that even if we go by the submissions made by the learned counsel for the Government of NCT of Delhi **four Forensic Science Laboratories have to be set up.** The whole process of setting up four FSLs in Delhi is being delayed on the ground of non-allotment of land for the purposes of establishing such laboratories. There is no impediment in setting up FSLs in any existing building which can be hired by the Government of NCT of Delhi for this purpose. This could be a stop gap measure till land is acquired and full-fledged FSLs are established thereupon.

Consequently, Court directed the Government of NCT of Delhi to immediately search for buildings where FSL could be established in four other areas of Delhi so that the work of criminal investigation is not hampered and consequently there is no impediment in the administration of justice in Delhi. This direction for setting up FSLs as an interim measure will not come in the way of the Government establishing FSLs in any area for which land has already been allotted. The Status Report with regard to the availability of building for setting up interim FSLs shall be submitted within three weeks.

The court directed that the Government of NCT of Delhi and Delhi Police to immediately furnish the requisite clarification and the Ministry of Home Affairs (MHA) to thereafter immediately deal with the same. [Order Dated: March 12, 2013]

Issue of Stop Gap Arrangement:

The court also focused on the establishment of FSLs. It was indicated that there should be at least one FSL in each of the five zones in Delhi. Consequently, Delhi High Court had directed that the Government of NCT of Delhi, as a stopgap measure, till land is allotted to them and FSLs are constructed, could take up space in Government/private buildings for setting up the FSLs.

Role of NDMC:

In this regard a status report has been submitted on behalf of the **Department of Home, Government of NCT of Delhi** in the form of an affidavit. In the said affidavit it has been indicated that vacant space at the **NDMC premises at Yashwant Place, Chanakyapuri, New Delhi** has been identified by the Government of NCT of Delhi and the team of FSL officers, after visiting the said premises, has recommended the same as suitable for setting up a FSL after making necessary renovations.

In this regard a letter has been sent to the Chairman, NDMC on 07.04.2014. The learned counsel for NDMC is present and assures this court that action on that letter shall be expedited. We find that the space identified by the Government of NCT of Delhi at the Yashwant Place premises is to the extent of about 13323 sq. ft. which is a substantial space and would go a long way in reducing the pressure of work in the FSLs in Delhi. It was, therefore, hoped that the process of allotment would be expedited and that by the next date of hearing the same would have been completed.

Role of DDA:

The affidavit filed on behalf of the Government of NCT of Delhi also reveals that the DDA has allotted three plots of land for establishing Regional Forensic Science Laboratories. The said plots are located at (1) between Sector 21 and 22, Rohini, (2) Sheikh Sarai and (3) Sayurpur. The dimensions of the plots are 4000 sq.mt, 5379 sq.mt. 5425 sq.mt respectively. Possession in respect of the first plot has already been taken over by the Government of NCT of Delhi on 27.03.2014 and the possession of the other two plots is in the process of being taken over.

Issue of Expeditious Construction of Buildings for FSL:

Court was hopeful that the Government of NCT of Delhi shall expedite the work of constructing buildings thereon to house the FSLs at the earliest. Two other plots have been mentioned in said affidavit at **Geeta Colony and Pind Walan Kalan**. The land owning agencies have been requested to allot these plots and we hope that they shall expedite the same.

Issue of FSLs in Govt. Hospitals of Delhi

In addition to the above Court was informed that FSLs had been set up in Seven Government Hospitals to aid in clearing the backlog but those laboratories are not now functioning because of the dearth of personnel from the FSLs. [Order dated: April 16, 2013]

Forensic Science Laboratory, Yashwant Place/ Government Hospitals

Even Delhi High Court was not aware of the non-existence of FSLs in the Seven Govt. Hospitals. Court was now informed **that there were no FSLs in Government Hospitals.** Therefore,

Court noting in the previous order that there were FSLs in Seven Government Hospitals does not appear to be correct. Anyhow the **Director, Forensic Science Laboratories** is present and he states **that he would examine the proposal of setting up such laboratories in Government Hospitals, if feasible.**

Insofar as the FSLs are concerned, court was informed that with regard to the NDMC premises at Yashwant Place, the process of allotment has been completed and possession would be taken over within two weeks. Court was also informed that simultaneously **procurement of equipment** is also underway. Court hoped that the entire process is continued to be expedited so that the FSL at Yashwant Place can be commissioned at the earliest.

Court was not at all happy with regard to the progress made with regard to the three plots which were identified in the previous order where FSLs could be established. [Order Dated: 16.07.2014]

Issues related to Space for FSL:

Insofar as the position of FSLs is concerned, Court was informed by the Government of NCT of Delhi, that the space provide by the NDMC at Yashwant Place has been taken possession of by the Director, FSL and it is expected that the work being carried out by the **PWD** as also the **procurement of equipments** would all be completed in a short duration so as **to commission the laboratory at Yashwant Place by the first week of November, 2014.**

Insofar as the plots are concerned, Court was informed that possession of the plot at Rohini has already been taken and construction has started. The plot at Sheikh Sarai would be taken possession of today itself and possession of the plot at Sayurpur would be taken within two weeks from today.

Issue of Non-feasibility of FSLs in Govt. Hospitals:

The Court shall be informed of the progress of the matter within three weeks. Insofar as the proposal of setting up FSLs in government hospitals is concerned, we are informed that the same was considered in a meeting convened under the chairmanship of the Secretary (Health), Government of NCT of Delhi on 31.07.2014 and after due deliberations it was decided that it was not feasible to provide the premises of hospitals of Delhi Government for setting up FSLs because there was a great paucity of space in the government hospitals which are required to meet the increasing needs of patients. In view of this, no further steps are required for the time being for setting up FSLs in government hospitals.

FSL, Yashwant Place/Sheikh Sarai/Sayurpur:

With regard to the FSL, we note that insofar as the laboratory at Yashwant Place is concerned, the work is going on and there should be no reason, according to us, for any re-scheduling of the commissioning date of first week of November, 2014 as recorded in our order dated 06.08.2014.

The Plot at Sheikh Sarai has not yet been taken possession of although in the order dated 06.08.2014 it had been specifically stated on behalf of the Government of NCT of Delhi that the possession thereof would be taken on that date itself. It appears that they have run into some road blocks. However, it was assured us that the possession at Sheikh Sarai shall be taken shortly.

Insofar as Sayurpur is concerned, the plot has already been taken possession of on 14.08.2014 and has been handed over to PWD for construction of the boundary wall so as to secure the said plot. The expected time of commissioning of the FSL as given by her stretches on to 2017, this was not acceptable to the High Court. Delhi High Court asked for the process of construction has to be expedited and a fresh time schedule submitted to the court. [Order Dated: September 17, 2014]

The FSL at Yashwant Place is stated to have been commissioned. However, only a skeletal staff is functioning there at the moment and the equipments are still in the process of being procured/ installed. Full commissioning of the Forensic Science Laboratory at Yashwant Place should be completed within two months. The plot at Sheikh Sarai has been taken possession of on 03.11.2014. Insofar as the Sayoorpur plot is concerned, possession was already taken on 14.08.2014 and the matter for construction of the boundary wall is still pending with the PWD and the Finance Department.

Issue of Non-Seriousness of Delhi Govt.:

The court observed that the Government of NCT of Delhi is not taking up this matter as seriously as it should. In order to obviate any coercive measures being taken by this Court, we direct the Government of NCT of Delhi to expedite the proposals which are in the pipeline for setting up of the FSLs at the earliest and that all departments of the Government of NCT of Delhi including the **Finance Department**, the **Forest Department** and the **PWD** should be apprised of the seriousness of this matter. We also permit Ms Zubeda Begum to write a letter to the DDA indicating that it should expedite the making of the link road for the purposes of the Sheikh Sarai FSL. [Order dated: December 24, 2014]

Issue of Operationalization of FSLs till May 2015:

With regard to the setting up of the FSLs, on 30.01.2015 we had noted that progress had been made in respect of the **FSL at Yashwant Place, Chanakyapuri** and we had been informed that the said laboratory would be fully operational by 31.03.2015. [Order dated: 30.01.2015]

Today we are told by Ms Zubeda Begum that the laboratory at Yashwant Place is operational but not fully. She states that certain equipments including audio, video, computer forensics and DNA testing are awaited. We direct that the Finance Department shall expedite the clearance and necessary sanction for procurement of these equipments. We hope that the procurements are completed within two months. Insofar as the **FSL at Rohini** is concerned, we are informed that the drawings and plans have been prepared and the project is at the stage of receiving the **No Objection Certificate from the Fire Department, et**c., and approval from the Finance Department. We direct the **Fire Department** as well as the Finance Department to expedite the same and to dispose of the said request within three weeks from today. As regards the **FSL at Sayurpur,** a request was made by the Delhi Government for 10000 sq. meters of land. The **Delhi Development Authority** has handed over 5425 sq. mt of land to the Government of NCT of Delhi. [Order dated: 30.01.2015]

Insofar as the remaining approximately 5000 sq. mt of land is concerned, Mr Verma, the learned counsel appearing for the DDA, informs us that they are in the process of verification of title with regard to the same. He states that the said process would take a maximum of 6 weeks from today. We hope that the exercise is concluded within that period so that the balance land that is available for handing over to the Government of NCT of Delhi would be done by the DDA within the period of six weeks. **The FSL at Sheikh Sarai** has also met a stumbling block and that is in the form of lack of any approach road. Mr Verma, the learned counsel appearing for the DDA, states that the allotment of land for the approach road would be done within two months from today. Court was also informed that certain personnel are required for manning **the FSLs including the Crime Scene Management Division** and, therefore, a request has been sent by the **FSLs to DSSSB** for selecting appropriate personnel. [Order dated: 30.01.2015] Next date for listing has been fixed on 29th July 2015.

Future Plans of Delhi, Dept. of FSL (Modernization/ Renovation/ Expansion)

- Cold storage facility for Chemistry and DNA Division.
- Renovation and up-gradation of Toxicology Laboratory under progress.
- Firing range for Ballistic Division.
- Modernization of Biology/ DNA/ Photo/ Physics/ Ballistics Divisions
- A Staff Canteen and Driver's room
- Proposal to start Explosive Division/Unit.
- Proposal for Transformation of Computer Forensic Unit into Computer Forensic Division.

Establishment of Regional Forensic Science Laboratory (RFSL)

- Plots for Regional Forensic Science Laboratories (RFSL) handed over/ allotted at sector-21/23 Rohini, Sheikh Sarai and Sayurpur, Mehrauli by DDA to FSL.
- RFSL due to start functioning at 7th Floor, NDMC Building, Yashwant Place, Chanakya Puri Delhi from 29 January, 2015.

Summary and Conclusions:

Delhi High Court in its order dated 3rd Oct 2013 observed that it is clear that trial courts are unable to expeditiously dispose of criminal cases for want of medical and scientific evidence as a number of issues are pending in the labortories for years together.

Court further emphasized that to improve the administration of criminal justice system, strengthening of these laboratories is of utmost importance; otherwise the delay will only be compounded. Hence, there is urgent need to resolve these issues. Court closely monitored the progress of establishment of FSL in various zones of the NCT Delhi and issued directions from time to time.

It is hoped that with the establishment of FSLs and their early operation help in reducing the pending investigations and speedy disposal of cases in various courts. Other states in India can follow the actions taken in NCT Delhi to improve the Criminal Justice Administration System.

Dr. Mukesh Yadav
Editor, JIAFM

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Original Research Paper

Pattern of Defence Injuries in Homicidal Deaths

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Abstract

Defence wounds are injuries which are suffered by an individual in an attempt to save oneself from assault or while defending oneself from the offenders. Based on the presence of such injuries it can be opined that the victim was conscious, could comprehend the attack and provided resistance during the assault. The type of injury sustained also gives an idea regarding the weapon of offence. This study is a retrospective study conducted at Mysore Medical College & Research Institute, Mysore. The study was conducted for a period of five years 2008 – 2013. Of the total 216 cases of homicide during this period 88 cases had defence injuries. Males outnumbered females in presence of defence injuries. Sharp weapon was used in 64.8% cases where as blunt weapon in 21.6% cases. The probability that defence injuries can be seen is rising with the number of wounds. Forearm was the commonest site of defence injuries.

Key Words: Defence wound, Injuries, Assault, Weapon of Offence

Introduction:

Homicidal crimes are as old as the existence of human civilization. Since time immemorial revenge, family feuds, anger, jealousy and other personal motives have been the precipitating cause for murder.

Rapid increase in population, urbanization and industrialization has led to an increase in the incidence of murder for gain, robbery, dacoity, etc. Defence wounds are the result of immediate and instinctive reaction of the victim to save himself. [1] Defence wounds are usually noted in those cases where the assault occurred at close range.

Defence wounds are of great significance in differentiating manner of unnatural deaths i.e. homicide, suicide and accident. In an assault, the natural reaction of the victim is to protect oneself and certain vital parts of the body like eyes, face, chest and head. Forearms, hands, elbows and legs are raised instinctively; hence defence wounds are more common on these parts of body.

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Defence wound depends on suddenness of assault and other factors like type of weapon used, Nature of wound, Intoxication, Position of assailant and victim.

Presence of defence wounds indicate that victim was conscious, partly mobile and was not taken completely by surprise or was not taken unaware. [2] Absence of defence wounds in few cases of homicides does not mean that defensive activity did not take place and hence does not rule out the possibility of homicide.

In females defence wound at times indicate sexual assault apart from homicide. [1] Also defence wound forms a valuable evidence for reconstructing the fatal incidence in homicidal deaths. [3] The defence wounds are classified into active and passive wounds.

Active defence wounds occur when the victim grasps the knife with hand and the injury thus located on palmer aspect of hand. The passive wound is sustained when the victim raises their hands or arms to protect the attacked body region and in this case the injuries will primarily be located on the extensor side. [4]

Materials and Methods:

This retrospective study was conducted at Mysore Medical College and Research Institute, Mysore for a period of 5 years from 2008-2013. A total of 216 cases of homicide were conducted during this period.

Details of the cases were obtained from police inquest reports, hospital case records and autopsy report. All the injuries mentioned the PM reports were noted and then the defence injuries were sorted out. The defence wounds thus

sorted were analysed in a systematic way.

Results:

Out of the 216 cases of homicide on which autopsy were conducted during this period 88 cases showed presence of defence injuries. (Table 1) In total of 88 cases 75 were males and 13 were females. Males were more defensive than females. The commonest age group was 21-30 years. In our study among the 216 homicide cases 129 deaths were due to sharp weapons out of which 44.2% showed presence of defence wounds. Among the 61 deaths due to blunt weapons 31.1% showed defence wounds.

In 26 deaths both sharp and blunt weapons were used and defence wounds were present in 46.2%. (Table 2)

Present study showed that the forearm was the most common site (29 out of 88) and arm as the least common site (3 out of 88) for the presence of defence injuries. (Table 3)

In this study passive defence wounds were the commonest followed by mixed and active defence wounds respectively. Incised wounds are the commonest type of defence wounds in our study. Fracture was the least common type of defence injuries.

An attempt was made in our study to co relate the presence of defence injuries with the total number of injuries present in the victim.

In 89.5% of the defence injuries due to hard and blunt weapons more than 4 injuries were present. In 68.4% of the defence injuries due to sharp weapons more than 4 injuries were present. In 75% of the defence injuries due to both sharp and blunt weapons more than 4 injuries were present. (Table 4, 5 and 6)

Discussion:

In our study the incidence of defence wounds is 40.7%, which indicate that in all these cases the victims could apprehend the attack just prior to the moment of assault. Thus they sustained defence injuries. This study was in correlation with the findings of Mohanty and Saurabh Chattopadhyay [5, 6] but contrast to Singh [7] and Gupta [8] study.

Males out-numbered females. It may be due to the fact that males are more often the victims compared with females. Males have more resistance power to physically ward off an attack. This may be due to the dominant and outdoor works of males. Many studies were in agreement with our study. [5, 6, 9] However the study conducted by Katkichi [10] was in contrast to our study.

Sharp-edged weapons were used in 57 cases and hence incised wounds were the most common type of defence wounds noted in this study. Pollak [11] found that the frequency of defence injuries among victims killed by sharp force ranges between 30% and 50%. In our study 19 out of 61 cases showed presence of defence wounds. In the study conducted by Sheikh [3] defence wounds by blunt objects were 35.19% cases.

Metter [12] in his study reported incised wounds to be the most common defence injury followed by stab wounds and cutting through.

The commonest site involved in defence is forearm, followed by hand in our study. Forearm is the commonest site both in sharp cutting and blunt weapon similar to others. [5, 10] Forearm is the most movable part of upper arm and its extensor surface is more resistant to trauma as compared to other surfaces.

The forearm and the hand sustained most of the injuries as it is a natural instinct to fend off an offending weapon by the hand or the forearm. In cases where the victim were cornered and more than one assailant were present. The defence wounds were present in multiple places including upper limb, lower limb and back. The chances of production of defence wounds was maximum when there were more than 4 injuries in total on the body, whether it was due to sharp, blunt or both.

The reason for this could be as if a single wound was fatal and death was sudden the defence wound were not produced. When the injuries were more than 4 and death was prolonged the victim the victim had a high chance of defending himself.

Conclusion:

The presence of defence injuries on the body strongly supports the opinion of the autopsy surgeon to establish the homicidal manner of death. Defence wound in homicidal cases is not only indicating the alertness of the victim but also the relative position of assailant and victim and types of weapon used.

Meticulous post mortem examination should be done before designating an injury as a defence wound. The fabricated nature of the Defence wound in homicidal cases has to be ruled out as this may lead to mal administration of justice. Defence wounds also indicate the relative position of assailant and victim and types of weapon used.

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Table 1: Incidence of Defence Wounds

Defence Wound	Cases(216)
Total homicidal cases	216
Defence wounds present	88(40.7%)
Defence wounds absent	128(59.3%)

Table 2: Type of Weapons producing Defence Injuries

Type of Weapon	Cases
Sharp weapon	57 out of 129 cases
Blunt weapon	19 out of 61 cases
Both sharp and blunt weapon	12 out of 26 cases
Total	88 of 216 cases

Table 3: Site involved in Defence Injuries

Site	Cases (88)
Dorsum aspect of hand	20
Palmar aspect of hand	9
Forearm	29
Arm	3
Multiple sites	27

Table 4: Co- relation between Defence Injuries and Total Number of Injuries in Deaths caused by Hard and Blunt Objects

Total number of injuries caused by hard and blunt objects	Defence injuries	
	Present(19)	Absent(42)
>4 injuries	17	39
2 - 4 injuries	2	17
Single injury	0	5

Table 5: Co- relation between Defence Injuries and Total Number of Injuries in Deaths caused by Sharp Objects

Total number of injuries caused by sharp objects	Defence injuries	
	Present(57)	Absent(72)
>4 injuries	39	05
2 - 4 injuries	18	46
Single injury	00	21

Table 6: Co- relation between Defence Injuries and Total Number of Injuries in Deaths caused by both Blunt and Sharp objects

Total number of injuries caused by both blunt & sharp objects	Defence injuries	
	Present(12)	Absent(14)
>4 injuries	09	03
2 - 4 injuries	03	11

Original Research Paper

An Epidemiological Study of Suffocation Deaths In Twin Cities of South India

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Abstract

In spite of advancement in medical facilities, the end of life is inevitable. Suffocation deaths have increased over the years and are becoming a large group in medico legal autopsies. In such deaths, a detailed and meticulous autopsy plays a major role to solve the case, while the scene visit and collection of samples have their own significance. To analyse the recent trends such as manner, methods, motive etc., in suffocation deaths, a prospective study was conducted for two years period. 34 suffocation deaths were studied, which comprised 0.18% of all Forensic autopsies; 38.23% of the cases were aged between 21-30 years. Males constituted 67.63% of all the cases. The most frequent method of suffocation death was smothering (35.29%) followed by environmental and traumatic asphyxia (20.58%), choking (17.64%) and positional asphyxia (5.88%). The most common manner of suffocation was found to be accidental (67.64%). But in homicidal cases (29%), the common motive was domestic disputes. Only 30% of suffocation victims were found positive for blood alcohol.

Key Words: Autopsy; Domestic Violence; Suffocation; Smothering; Traumatic Asphyxia

Introduction:

Suffocation is a type of asphyxial death upon which authors in different textbooks differ in definition and classification. Suffocation is a general term used to indicate death from deprivation of oxygen, either from lack of gas in the breathable environment or from obstruction of the external air passages. [1]

Suffocation is the most common term used for deaths associated with reduced availability of oxygen. [2] Di Maio [3] has described that in deaths from suffocation, there is failure of oxygen to reach blood. In the present study, suffocation is defined and classified.

It comprises of all forms of asphyxia where death occurs by deprivation of oxygen. It can be either from lack of oxygen in breathable environment (environmental asphyxia) or from obstruction of external airways (smothering).

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It can also be due to internal airways (choking) or restriction of respiratory movement either by pressure over chest.

It also included abdomen (traumatic asphyxia) or by body position (positional asphyxia). Asphyxia caused by inadequate oxygen in the environment by rebreathing in an air-tight enclosure is also considered as environmental/ entrapment suffocation.

Positional asphyxia is caused due to mechanical impediment to adequate respiratory movement when a person remains in a certain position for an extended time, either due to being trapped or being in a drunken or drugged state. [1, 3] In India, as per National Crime Records Bureau [4], during the year of 2011 & 2012, the numbers of accidental suffocation deaths were 2013 and 2075 respectively.

Suffocation deaths can pose considerable difficulties for the Forensic expert to distinguish between accident, suicide and homicide because in many situations, it leaves no specific findings supporting the diagnosis of manner, which mostly relies on the circumstantial evidence or sometimes on eyewitness.

Though the normal dictum says that smothering are homicidal [3, 5] and choking, environmental, traumatic & positional asphyxia are usually accidental [3] in nature but the Forensic experts all around world come across

suicidal smothering and choking and homicidal traumatic or positional asphyxia.

There were few studies available on a systematic study of all types of suffocation deaths. [6, 7] Mostly the studies of suffocation deaths were limited to a specific type in the form of case reports, case series and included specific studies such as lethal crush / traumatic asphyxia, suffocation in motor vehicle collisions, fatal entrapments in grain storage bins, cafe coronary deaths and suffocation by plastic bags.

In this part of India, no systematic study on suffocation has been carried out to our knowledge. The present study from victims profile has been under taken to find out the variables & specific pattern if any, in deaths due to suffocation.

Materials and Methods:

A total of 18648 medico-legal autopsies were conducted at the mortuaries of Gandhi Medical College and Osmania Medical College, Hyderabad, Andhra Pradesh, India, from 1st July 2009 to 30th June 2011 which includes 3960 cases (21.23%) asphyxial deaths. Among these asphyxial deaths, 34 deaths due to suffocation were taken as study material.

All the cases for study were meticulously examined externally and internally at autopsy. Data were collected from relatives, accompanying persons, eyewitnesses, investigating officer and inquest reports. The chemical analysis for alcohol and toxicological reports were incorporated.

Scene of Offences were visited. Suffocation associated with other types of major fatal injuries were excluded along with infants as in infant death, it is considered as SIDS rather than death due to any form of suffocation and it is quite impossible for autopsy surgeons to differentiate the two entities and stamp it as an absolute case of suffocation death.

Observations and Results:

There were 34 deaths due to suffocation which constituted 0.85% of 3960 asphyxial deaths and 0.18% of total autopsies. Almost 2/3rd of the victims was males (Fig. 1) and belonged to 21-30 years of age group. (Fig. 2)

In our study smothering (35.29%) was the commonest of all suffocation types followed by environmental and traumatic asphyxia. (Table 1) Accidental suffocation deaths (67.64%) were way ahead of homicidal and suicidal suffocation. (Table 2) But in homicidal cases (29%), the common motive was domestic disputes. (Table 3)

Only 30% of suffocation victims were found positive for blood alcohol (Fig. 4) while in accidental cases it increased to about 44%. (Table 4) Majority of incidents (62%) had happened at the home of the victim. (Table 5) In this study more than half of the victims were moderately built (Fig. 3) but all thin built victims were smothered to death.

Present study showed that most of the incidents took place during day time. (Fig. 5) Majority of victims were Hindu (82.35%) by religion & belonged to urban area. (Table 6) More than half of the victims were from the lower class society and either illiterate or educated up to school level. (Table 6) Majority of the victims were married and labourers by occupation. (Table 6)

Discussion:

The incidence of suffocation was found to be 0.85% of total asphyxial deaths and 0.18% of total autopsies. The incidence is a bit less as compared to the study from Canada [6] and a bit more when compared to the study from India. [8]

Strong male predominance was observed (M: F=1.47:1), consistent with the study from Canada and India. [6, 8] In Turkey, male preponderance was reported in deaths due to asphyxia. [9] Due to population explosion, poverty, stress due to competitive modern life and male dominated society, the males were more exposed to external environment being more susceptible to such incidents.

Suffocation deaths were most common in 21-30 years age group (35.79%) followed by 11-20 years and 31–40 years. This is consistent with studies on asphyxial deaths from India. [8, 10] Smothering is the most common type of suffocation but on subsequent gender wise analysis, traumatic and environmental asphyxia were the leading type of suffocation in males whereas smothering was the most common in females, in accordance with a study in Canada. [6] The victims were suffocated in accidental manner in majority of incidents.

All traumatic, environmental, positional asphyxial deaths and majority of choking and two smothering deaths were accidental in nature, similar to the study from Canada. [6]

Most of the smothering was homicidal (83.33%) in nature but in contrast, Boghossian E et al [6] observed smothering in a suicidal context (58.62%). Choking as a cause of sudden death has been recognized and well documented since the time of Hippocrates [11] and it is mostly accidental.

In our study, we encountered an elderly schizophrenic male with a long standing history and suicidal tendency, had committed suicide with a significant amount of cement powder in

the mouth, oropharynx and upper part of the larynx. The occasional occurrence of suicidal choking was also reported by Knight's Forensic Pathology [1] and Boghossian E et al. [6] Traumatic asphyxia were accidental similar to a study conducted by Gurudut K.S et al. [12]

Analysing homicidal suffocation deaths, it was observed that 80% of the victims were female & the main motive behind the crime was observed to be domestic disputes. Due to domestic disharmony, in sudden outrage of anger, the females were attacked and suffocated to death by hands of assailant (smothering), who happens to be a family member of the victim.

Murder was committed after sexual assault in two cases. It has also been reported that non domestic homicides are associated with sexual offences. [1]

In 62% of the cases, the time of occurrence was the day time. It could be explained by the fact that all suffocation occurring at workplace were during working hours of the day. Blood alcohol was detected in almost 30% of all suffocated victims. But on further analysis, it was observed that, all alcohol positive cases had died of accidental suffocation. Occasionally an alcoholic is found dead with face down on a pillow and death is attributed to smothering. [3]

Deaths due to Positional asphyxia virtually always an accident and are associated with alcohol or drug intoxication. [3] In our study, two accidental positional asphyxia cases were found dead with head down position from the bed on different incidents. Both had consumed large quantity of alcohol.

Deaths ascribed to acute alcohol intoxication are often the result of asphyxia caused by a depression of the respiratory centre or inhalation of vomit or die through positional asphyxia when lying face-down or in some other compromising position. [2] The chances of choking are higher if the subject is under the influence of alcohol (cafe coronary) as supported by Hangen RK. [13]

Amongst all suffocation deaths, majority of victims were moderately built, but most of the thin built victims were smothered to death. Usually children and weak or unconscious persons were killed by smothering. To affect a smooth act of smothering, there must be gross physical disparity between the victim and the assailant.

Majority of the victims were Hindu by religion & belonged to urban area similar to a study in India [8] and reflects the population structure of the locality. More than half of the victims were illiterates & belonged to low socio economic group followed by middle socio economic group. Most of the victims resided in the slum areas of the city without education and poor standard of living. Almost two thirds of the victims were married. So far the occupation of the victims concerned, majority of them were labourer followed by house-wife.

Conclusion:

Finally we conclude that suffocation deaths were predominant in males of 3rd decade. The common method of suffocation employed was smothering, common manner was accidental and houses of victims were the common place of occurrence. Suffocation deaths were predominant among illiterate, married, economically backward Hindus from urban area and labourers by occupation.

Some socio-cultural issues are to be addressed to reduce the homicidal & suicidal incidences in the domestic environment. Unemployment, marital disputes and family problems should be addressed by referring the parties to an appropriate agency or counsellor.

The police should be trained to recognize social problems which may lead to violence at home. Strict enforcement of law against sale of alcohol has to be done and awareness about the hazards of alcohol is to be conveyed to the public. Promote gender and social equality through the social and educational policies. Nonviolent methods of arbitration to resolve the conflicts at all levels possible, should be promoted.

To prevent industrial deaths, continuous observation on machineries and other protective measures are required. Further studies on different populations are required, particularly to obtain evidence-based data to support our common body of knowledge and assess the discrepancies with the textbook literature.

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Fig. 1: Sex Wise Distribution of Suffocation Deaths

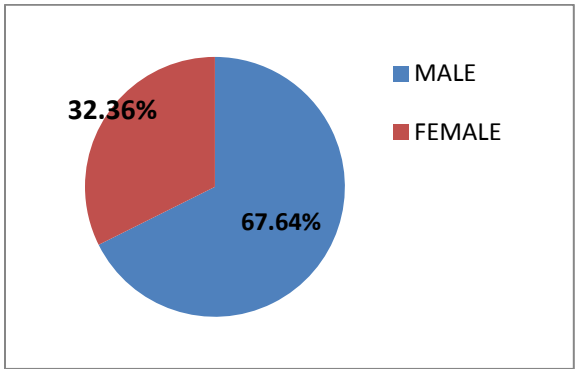

Fig. 2: Age Wise Distribution of Suffocation Deaths

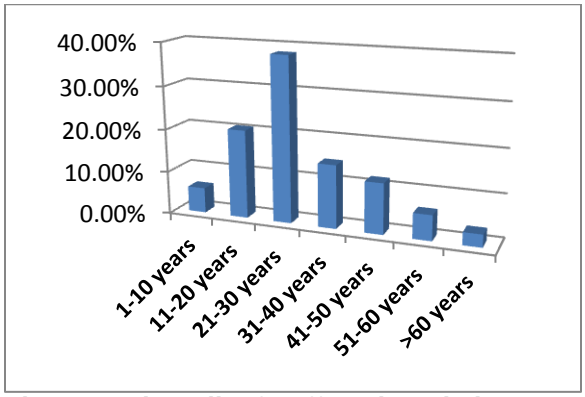

Fig. 3: Body Built of Suffocation Victim

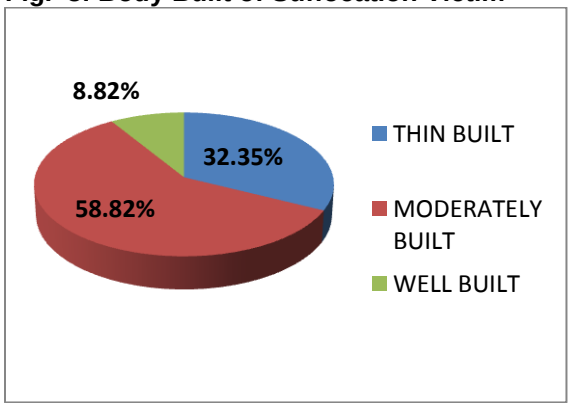

Fig. 4: Analysis of Blood Alcohol

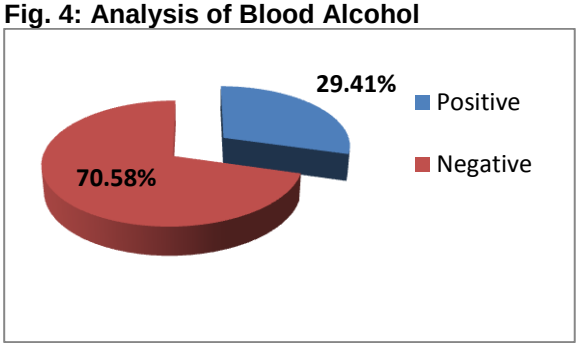

Fig. 5: Diurnal Variation

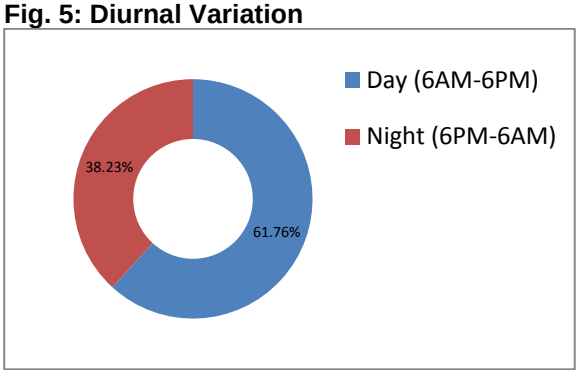

Table 1: Profile of Suffocation Deaths

Type of Suffocation	Cases	Percentage
Smothering	12	35.29
Choking	6	17.64
Environmental Asphyxia	7	20.58
Traumatic Asphyxia	7	20.58
Positional Asphyxia	2	5.88
Total	34	100

Table 6: Socio-Demographic Profile

Religion	Cases	Percentage
Hindu	28	82.35
Muslim	4	11.76
Christian	2	5.88
Total	34	100
Area of Domicile		
Rural	10	29.41
Urban	24	70.58
Total	34	100
Socio - Economic Status		
Lower Class	18	52.94
Middle Class	11	32.35
Higher Class	5	14.70
	34	100
Educational Status		
School Level	11	32.35
Graduation and above	5	14.70
Illiterate	18	52.94
	34	100
Marital Status		
Married	25	73.52
Un Married	9	26.47
	34	100
Occupation		
Students	4	11.76
Labourer	12	35.29
Employee	6	17.64
House Wife	10	29.41
Business persons	2	5.88
	34	100

Table 2: Manner of Suffocation

Manner of Death	Cases	Percentage
Accidental	23	67.64
Suicidal	1	2.94
Homicidal	10	29.41
Total	34	100

Table 3: Motive in Homicidal Suffocation

Motive	Cases	Percentage
Revenge	1	10
Domestic Disputes	5	50
Lust	2	20
Dowry	2	20
Total	10	100

Table 4: Analysis of Blood Alcohol in Accidental Suffocation Deaths

Types of Suffocation	Alcohol +VE	Alcohol -VE	Total
Smothering	2	0	2
Choking	3	2	5
Environmental Asphyxia	1	6	7
Traumatic Asphyxia	2	5	7
Positional Asphyxia	2	0	2
Total	10	13	23

Table 5: Place of Occurrence

Place of Occurrence	Cases	Percentage
Home	21	61.76
Work Place	11	32.35
Open Field	2	5.88
Total	34	100

Original Research Paper

Forensic Pathological Study of Drivers Exploring the Role of Alcohol in Road Traffic Accidents

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Abstract

Road traffic accident is one of the leading causes of trauma, disabilities and deaths. Nearly 50 crore people are injured across the world every year of which more than 12 million turned into fatal. Amongst the various causes of road traffic accidents, rash driving is one of the major causes of accident which is substantiated by driving under the influence of alcohol. Alcohol not only inhibits self-control but impairs the judgment and visual acuity, affects safe driving that's why it is restricted all over the world. In this study, the person who were driving and injured in road traffic accidents, were investigated for epidemiological and clinico-pathological characteristics including causes/factors responsible for the accidents. All the victims were male above 15 years of the age and motorcyclists were the most (82.52%) injured. Fault of the driver was the commonest (53.39%) reason behind the accident and large number of them (23.30%) had consumed alcohol before driving. This was also confirmed by estimating concentration of alcohol in blood by Vitros Auto-analyzer.

Key Words: Road traffic accidents, Driver, Blood alcohol concentration, Head injury, Two-wheelers

Introduction:

Road traffic accident is one of the most serious health problems throughout the world by killing and crippling thousands of persons every day. In India, 1, 37, 423 people died in 2013 due to Road traffic accidents, of which 34,187 (24.87%) were from motorcycles. Thus the average death from RTA is 377 per day. [1] For every death, 4 people suffer with severe disabilities, 10 require hospitalization and 30 emergency room treatment.

"Forensic pathological study of drivers exploring the role of alcohol in road traffic accidents" is a project designed to find out causes and factors responsible for high incidence of RTA. Here the persons, who were driving the vehicle at the time of accidents, were studied for epidemiological and Forensic pathological aspects.

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The aim of this study is to explore the nature of injuries and factors responsible in road traffic accidents. Large number of studies on RTA is conducted throughout the world but very few on drivers alone and no one in India so far to the best of my knowledge. That's why this study was taken to look into the causes and factors including the role of alcohol behind the road traffic accidents so that preventive measures can be suggested.

Material and Methods:

The present study was carried out on the people who were driving a two, three, four-wheeler vehicle or a heavy motor vehicle, injured and admitted in Chhattrapati Shivaji Subharti Hospital (CSSH), Meerut for treatment from 1st September 2012 to 31st march 2014.

Persons, other than drivers injured in the accident, are not included in this study. The drivers, if they were brought dead or died in the hospital before registration/admission, are also not included in this study.

All these cases were studied for epidemiological, Clinico-pathological and medico-legal aspects. After consent, the personal information of the victim such as age, sex, education, occupation, socio-economic status, habit, disabilities, diseases such as hypertension, epilepsy, cataract etc. and use of medicines inducing sleep etc. were gathered from the patient and their relatives.

The information regarding the accident particularly how it occurred, was the driver

drunk, number of person injured/died in the accident and duration for which patient was lying unattended were noted from accompanying person and from persons present at the scene of accident. The condition of the patient including level of consciousness, injuries, features of alcoholic intoxication and investigations were noted with the help of residents posted in surgery department and from the hospital records. Blood alcohol level was estimated by Vitros auto-analyzer in cases where suspicion of alcohol consumption was found during clinical examination. All the data thus collected was analyzed and presented in table and bar/pie diagram.

Observation and Results:

One hundred and three drivers, injured in the road accidents and admitted in CSS Hospital Meerut were studied for epidemiological and medico-legal aspects. All the victims in this study were male; none of them was female.

The maximum number of the victims (38.83%) belonged to 21-30 years of age-group followed by 26.21% in 31-40 and 14.56% in between 15-20 years of age. (Table 1) None of the victims was below 15 years.

Amongst the person who were driving the vehicle and injured, the maximum 82.52% were the drivers of two-wheelers (mostly motorcyclists) followed by 8.73% of four-wheelers, 4.85% of three-wheelers and 3.88% of heavy vehicles. (Table 2) Most of these drivers (81.56%) were not driver by occupation. Only 18.44% of the victims were drivers by occupation. 30.09% of the victims were students and 20.38% the businessmen. (Table 3)

On examination of victims, injuries to the head and face alone or with other parts of body were seen in majority (72.82%) of the cases in which fracture of skull bones were seen in 41.75% cases. Limbs alone or with other parts of body were injured in 44.67% cases. (Graph A)

In our study fracture of upper limb bones in 20.39% and lower limb bones in 22.33% of the victims. Ribs were found fractured in 5.83% and pelvis in only 0.97% cases. (Table 4)

Apart from injuries, drivers were brought unconscious in 7.76% orientation was disturbed, in 30.09%, bleeding from mouth/nose or ear in 48.54%, smell of alcohol from breath/body in 23.30% and signs of muscles in-coordination by negative finger-nose test in 33.96%, negative Romberg's test in 17.46% and inability to pick up object in 23.29% cases. (Table 5)

According to the statement of drivers and/or their attendants, 24 (23.30%) of the victims had consumed alcohol half to one hour before started driving. BAC was also analyzed by Vitros auto-analyzer in these cases and found more than 60 mg% in all these cases. BAC was 60-120 mg% in 45.83%, 120-180 mg% in 25% and more than 180 mg% in 29.16% cases at the time of collection and investigation of sample. (Table 6) In majority of the cases road traffic accidents occurred either by collision with other motor vehicles (65.04%) or by slipping of the vehicle (23.31%). Accidents also occurred by striking with animal carts in 1.94%, with divider in 4.85%, with other stationary objects such as tree, railings etc. in 2.91%, and with wandering animals in 1.94% cases. (Table 7)

Among the 67 vehicles, which were collided with other motor vehicles, half (49.25%) of vehicles collided with LMVs, 26.86% with HMVs and 20.89% with two-wheelers (Table 8) and these were hit from back in 41.79%, from sides in 35.82% and from front in 22.38% cases.

The vehicles which were slipped, most of them were motorbikes and slipped due to presence of sand and gravels at the side of road (25%), rain and mud (16.66%), pits on road (12.5%) and flattening of tire (8.33%). (Graph B)

The causes of road traffic accidents were explored and fault of victim or its vehicle was found in 2/3rd (68.93%) of the cases and of the driver or vehicle of opposite side in 1/3rd (31.06%) of the cases. As a total, human error (fault of drivers of either side) was responsible for most (78.64%) of the casualties of which victims were at fault in 50.48% and drivers of opposite side in 28.15% cases. (Table 9)

Here over speeding and driving under the influence of alcohol were the two most important predisposing factors behind the accidents. Over speeding was seen in 36 (34.95%) cases, of which injured drivers were at fault in 16 (15.53%) and drivers of offending vehicles in 20 (19.41%) cases.

Driving under the influence of alcohol was observed in 24.27% cases mostly (23.30%) in the drivers of injured vehicles. cases. Besides this inexperienced driving (5.82%) and driving on wrong side or giving wrong signal (5.82%) were responsible for substantial number of casualties. Amongst other causes, defective road conditions in 8.73%, environmental variation in 6.79% and vehicular causes in 5.82% cases.

Discussion:

In "Forensic-Pathological study of drivers exploring the role of alcohol in RTA", the person who were driving the vehicle, injured and admitted in CSS Hospital, Meerut were examined for epidemiological, Clinico-pathological and medico-legal aspects of road

traffic accidents and these were 103 in number, all were male and above 15 years of age.

This is because most of the vehicles are driven by male after being adult. Laws also do not permit driving below 18 years of age but few boys start driving even before without bonafide driving license and get injured. Females drive less and if drive, they are more careful.

Drivers of two-wheelers were most often (82.52%) injured in RTAs. This is probably due to inherent instability in motorbikes and covered protection in three wheelers, LMV and HMV. This corresponds to the data released by NCRB. [1] Similar results were also observed in Rajasthan. [8] The majority of the people (81.56%) who were driving the vehicle at the time of accident were not driver by profession.

These were students (30.09%), businessmen (20.38%), and employees in different sectors (8.73%) etc. driving vehicle, mostly motorbikes, for their personal use. Majority of the vehicles in RTA were two-wheelers which were driven by common people not by drivers. That's why, majority of the drivers are not driver by profession.

Injuries to the head and face alone or with other parts of body were seen in 72.82% of the cases which corresponds to the studies conducted in different parts of the country as 89.36% in Delhi [2], 84.7% in Haryana. [3] 60.61% in Rajkot [6] and 76% in Ahmadabad. [7]

Fracture of skull bones were seen in 41.73% corresponds with the study done in Aligarh where skull fractures were seen in 40.65% cases. [5]

In this study 23.30% of the drivers consumed alcohol which corresponds to the BAC in the drivers of RTA in South East Asian countries. [4]

Collision with other motor vehicles is the most common cause of accident seen in 65.04% cases. Vehicles usually hit by heavier vehicles as by LMV in 49.25% and HMV in 26.86% of the accidents. Amongst the causes of accidents human error is the most important seen in more than three-fourth (78.64%) of the cases, of which fault of the victim is seen in 52 (50.48%) and fault of the driver of the opposite vehicle in 29 (28.15%) cases.

Amongst the faults of victims, driving under the influence of alcohol is the commonest (23.30%) followed by over speeding of the vehicle in 15.53%. This corresponds to the data mentioned in All India Road Statistics. [9]

Conclusion:

In road traffic accidents large number of casualties occurs every day in which not only the person who is driving the vehicle is injured but other co-passengers, drivers and passengers of other vehicle which collided in the accident and other road users such as pedestrians, cyclists etc. are also involved. Drivers of motor vehicles injured in the RTA were males and above 15 years of age. No-one was female.

Majority (82.52%) of the vehicles injured in road accidents are two-wheelers (especially motorbikes) and driven by the person other than the drivers in most (81.56%) of the cases.

Injuries to head and/or extremities were present in most of the cases of which fracture of skull bones were found in 41.74% and limb bones in 37.86% case. Collision/hit by other vehicle (65.04%) is the commonest cause of accident of which most of them are hit by LMV/ HMV especially from back.

Motorcyclists also slipped in significant number of cases mostly due to defective road conditions as gravel and sand (25%), mud (16.66%) and pits (12.5%) on road.

Human error was the most important cause of accident found three-fourth (78.64 %) of the cases, of which fault of the victim was seen in 52 (50.48%) and fault of the driver of the opposite vehicle in 29 (28.15%) cases.

Amongst the faults of victims, driving under the influence of alcohol was the commonest (23.30%) followed by over speeding of the vehicle in 15.53%. Over-speeding is the main fault of opposite driver seen in 19.41% cases.

Measures to Curb Road Traffic Accidents:

The four basic reasons behind the accident are fault of the road users, defect in the vehicles, poor roads conditions and adverse weathers. It can be minimized by:

- Making people aware of traffic rules, threats of alcohol and rash driving in accidents and advantage of protective gears such as helmets, seat belts etc. during driving through posters and hoardings, television and documentaries. Traffic rules and preventive measures can be added in the school curriculum so that people may aware of traffic rules from childhood.
- Enforcing the traffic rules and not allowing driving without driving license, helmet and seat belt. Drivers should be monitored regularly for alcohol, rash driving and use of protecting gears and also checked for B.P., visual defects, colour blindness, epilepsy etc. once in a year after the age of 40.
- Maintain road by improving road surfaces, removing obstacles, encroachments and

blind turns, constructing guards/rails at turns, widening of bottle necks and proper signs and signals throughout the highways. If feasible, mix traffic should be avoided on main roads and highways.

- Regular inspection and maintenance of vehicles is necessary for safe driving. Now large number of safety devices such as air bags, laminated windshields, improved automatic break system, anti-glare/anti fog lights, sensor device and camera etc. are available. They should be made mandatory in all the vehicles on roads.
- There should be traffic aid posts at suitable distances on the highways to assist injured in accidents and quick transport to trauma centres after giving first-aid/resuscitative measures.

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Table 1: Age and Gender wise Distribution of the Drivers of RTA

Age (yrs)	Male (%)	Female (%)	Total (%)
< 10	-	-	-
11-20	15(14.56)	-	15(14.56)
21-30	40(38.83)	-	40(38.83)
31-40	27(26.21)	-	27(26.21)
41-50	12(11.65)	-	12(11.65)
51-60	06(5.82)	-	06(5.82)
61-70	03(2.9)	-	03(2.9)
Total	103(100)	-	103(100)

Table 2: Type of Vehicles Involved in RTA

Type of Vehicle	Number	%age
Two-wheeler	85	82.52
Three-wheeler	05	04.85
LMV (four-wheeler)	09	08.73
HMV	04	03.88
Total	103	100.00

Table 3: Occupation of the Person who drive the Vehicle

Occupation	Number	%
Driver	19	18.44
Student	31	30.09
Service	09	08.73
Businessman	21	20.38
Others	23	22.33
Total	103	100.00

Table 4: Fracture of Bones in Victims of RTA

Bones fractured	Number	%
Skull	26	25.24
Skull + Upper Limb	11	10.67
Skull + lower limb	05	4.85
Skull +chest+ both extremities	01	0.97
Upper limb only	05	4.85
Chest	03	2.91
Chest + upper limb	02	1.94
Pelvis	01	0.97
Lower limb only	13	12.62
Upper + lower limb	02	1.94
Total	69	66.99

Table 5: Other Clinico-pathological Features in Victims of RTA

Clinical features	Assessment	Number (%)
Mental condition	Unconscious	08(7.76)
	Altered Orientation	31(30.0)
Smell of alcohol	Present	24(23.3)
Speech	Slurred	12(11.65)
Muscle Co-ordination	(-ve) Finger nose test	35(33.96)
	(-ve) Romberg's test	18(17.46)
	Inability to pick up objects	24(23.29)
Bleeding	From mouth/ nostrils/mouth	50(48.54)

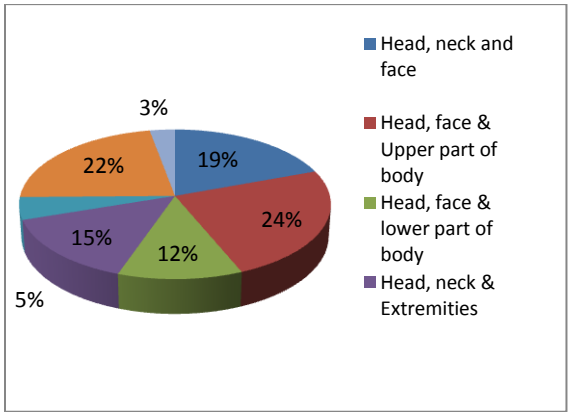
Table 9: Causes of Accidents

Causes of accident	Driver	Opposite party
MANUAL		
Alcoholic Intoxication	24 (23.30%)	01 (0.97%)
Sleep/Exhaustion	-	-
Inexperienced driver	06 (5.82%)	01 (0.97%)
Medical illness	-	-
Over Speeding	16 (15.53%)	20 (19.41%)
On Wrong side	02 (1.94%)	04 (3.88%)
Giving wrong signal	-	02 (1.94%)
While preventing other people	03 (2.91%)	-
Others	01 (0.97%)	01 (0.97%)
VEHICULAR		
Break failure	01 (0.97%)	01 (0.97%)
Head light defective	01 (0.97%)	-
Tail light defective	-	01 (0.97%)
Flattening of tire	02 (1.94%)	-
ENVIRONMENTAL		
Fogging	02 (1.94%)	01 (0.97%)
Heavy raining	04 (3.88%)	-
ROAD CAUSES		
Open manholes	-	-
Speed breakers	-	-
Mud/gravel	06 (5.82%)	-
Pits	03 (2.91%)	-
Total	71 (68.93%)	32 (31.06%)

Table 6: BAC in Drivers Having Suspicion of Alcohol Consumption

S. No.	Range of BAC (mg/dl)	Number	%age
1	61 – 90	05	20.83
2	91 – 120	06	25.00
3	121 – 150	04	16.66
4	151 – 180	02	08.33
5	**> 180**	**07**	29.16
	Total	24	100.00

Graph A: Major Body Areas Involved in Victims of RTA



Graph B: Causes of Slip of Vehicle in RTA

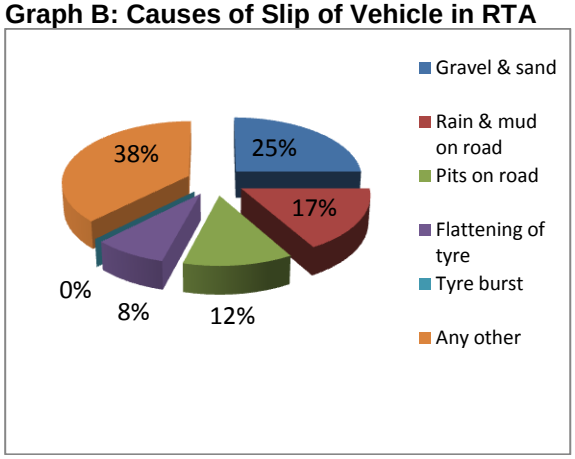


Table 7
Causes of Accidents

Victim's Vehicle	CAUSE OF ACCIDENT							
	Collision with						Slipped (%)	Total (%)
	Motor vehicle (%)	Animal cart (%)	Divider (%)	Stationary object (%)	Animal (%)	Total (%)		
Two-wheelers	54(52.42)	02(1.94)	04(3.88)	01(0.97)	02(1.94)	63(61.16)	22(21.35)	85(82.52)
Three-wheelers	03(2.91)	-	-	-	-	03(2.91)	02(1.94)	05(4.85)
LMV	07(6.79)	-	01(0.97)	01(0.97)	-	09(8.73)	-	09(8.73)
HMV	03(2.91)	-	-	01(0.97)	-	04(3.88)	-	04(3.88)
Total	67(65.04)	02(1.94)	05(4.85)	03(2.91)	02(1.94)	79(76.69)	24(23.30)	**103(100)**

Table 8
Collision with Other Motor Vehicles

Victim's vehicle (67)	Collided with Motor Vehicles				
	Two-wheeler (%)	Three-wheeler (%)	LMV (%)	HMV (%)	Total (%)
Two-wheeler	13(19.41)	02(02.98)	28(41.79)	11(16.41)	54(80.59)
Three-wheeler	01(01.49)	-	01(01.49)	01(01.49)	03(04.47)
LMV	-	-	04(05.97)	03(04.47)	07(10.44)
HMV	-	-	-	03(04.47)	03(04.47)
Total	14(20.89)	02(02.98)	33(49.25)	18(26.86)	67(100.00)

Original Research Paper

Pattern and Distribution of Head Injuries in Fatal Road Traffic Accidents in Bhopal Region of Central India

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Abstract

Accidents are not due to external factors all the time but often they occur due to failure of control of self -conscience and free thoughts. Road Traffic Accidents is still the major cause of death worldwide including India. A prospective study has been conducted in Gandhi Medical College Bhopal, in the year 2010 to study the pattern and distribution of Head Injuries of fatal road traffic accidents and to prepare the demographic profile of it. Out of total 282 cases, male to female ratio was 10:1, and commonest age group affected was 21-30 years (30.5%). Among total victims, Hindus were 255 (90%) and rests were Muslims (9%) and other religions. Total hospitalized cases were 172 (61%). Head injury was the most common injury, present alone in 130 cases (46%) and in 220(78%) cases along with other injuries. Skull fractures were found in 195(69%), in which linear/fissure fracture (32.9%) was most common. Most common bone fractured was temporal bone (n=122, 43.26%).The commonest variety of intracranial hemorrhage was subdural hemorrhage (n=214, 75.88%) and craniotomy was done in 20 (7.09%) cases.

Key Words: Road traffic accident, Fatal, Head injuries, Fracture, Skull

Introduction:

Road traffic accidents, since years claim the highest number of life worldwide. As per Institution of Road Traffic Education, India accounts for about 10% of RTA fatalities worldwide (2008). [1] Road accidents have earned India a dubious distinction, with over 130,000 deaths annually; in 2009 itself the country has overtaken China and now has the worst road traffic accident rate worldwide, with the death toll rose to 14 per hour in 2009 as opposed to 13 the previous year. [2]

In 2013, The Global status report on road safety estimates that more than 231000 people are killed in road traffic crashes in India every year. Approximately half of all deaths are among vulnerable road users - motorcyclists, pedestrians and cyclists. [3]

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The present study is therefore conducted in the Department of Forensic Medicine in Bhopal to emphasize the increasing incidence of the fatal RTA and to study the pattern of Head Injuries present in these RTA victims in this central region of India in order to establish a demographic profile of the Victims.

Material and Methods:

The present study was conducted at Gandhi Medical College and Associated Hamidia Hospital, Bhopal (M.P.) from June 2010 to November 2010. Material included all dead bodies (n = 282 cases) of fatal RTA brought to the Department of Forensic Medicine Gandhi Medical College for autopsy.

A proforma, for recording the pattern of injuries and demographic profile was prepared and data was collected from Police, relatives, doctors, Hospital records and also from post-mortem findings. The relevant history about the injuries to the victims was also collected.

All RTA victims dying on spot and hospitalized from the time of accident were included in the study.

Observations and Results:

It was observed in the study that most affected age group was between 21-30 years having total 86 cases (30.5%), followed by 31-40 years (24.1%). All age groups are dominated by males with maximum sex differentiation in 21-30 years age group. (Table 1)

Females were affected maximum in age group of 31-40 years, whereas males were affected maximum in 21-30 years age group. In the present study males (n=258, 91.5%) outnumbered females (n=24, 8.5%) significantly with male to female ratio of nearly 10:1. (Table 2) In this study total 255 victims were Hindus (90.5%) and 27 were Muslim (9.5%). (Table 3)

Total numbers of hospitalized cases were 172 (61%) and rest was non hospitalized 110 (39%), which showed that either the victims died on spot or on the way to the hospital. (Table 4**)** Head injury alone was most common injury (excluding minor abrasions, laceration and ecchymosis) and was present in 130 cases (46.09%). Other injuries were present in different regions in different combination in 97 victims. (Table 5)

Injury to the face was seen in 64 deceased (22.69%), with facial fractures in 8 victims. Scalp was ecchymosed in 239 cases (84.75%), lacerated in 121 (42.90%).

In present study Skull fractures were seen in 195 cases (69.14%). Intracranial hemorrhages were seen in 220 cases (78%), cerebral contusion and laceration in 149 cases (52.83%) and cerebral necrosis in 116 cases (41.13%). Surgical intervention was done in 35 patients (12.41%) in which 20 (7.09%) had undergone craniotomy. (Table 6)

Among the Skull Fractures, Frontal bone was fractured in total 102 cases (36.17%), Temporal bone in total 122 cases (43.26%), Parietal bone in 108 cases (38.29%) and Occipital bone was fractured in total 77 cases (27.30%). Base of the skull bone (including all cranial fossa) was fractured in total 114 cases.

Multiple fractures were most common (60.28%) followed by temporal bone fracture alone (43.26%) and parietal bone fracture alone (38.29%) respectively. (Table 7)

Out of 282 cases, Linear/Fissure type of skull fracture was most common (n=92, 32.97%) followed by Radiating fracture in 72 cases (25.53%), But Multiple fractures (more than one type) being most common seen in 142 cases (50.35%). (Table 8)

In our study 73 victims had Extradural haemorrhage, 214 (75.88%) had Subdural haemorrhage, whereas subarachnoid haemorrhage was present in 198 cases (70.21%). Intra-cerebral haemorrhage was seen in 27 cases (9.57%).

Combined haemorrhage (more than one type) was seen in 192 victims (68.085%). Most common type of individual Intracranial Haemorrhage was subdural followed by subarachnoid haemorrhage. (Table 9)

Discussion:

In the present study young people of age group 20-30 years (30.5%) were the most common victims, which is similar to findings of multiple authors from various geographical regions of India. [4-7] Pramod Kumar Verma et al [8] showed high incidence of traffic injuries in age group 15-55 years. H. Singh and Dhattarwal [9] found two third of cases are in age group 11-40 years. According to the NCRB Report for the year 2012 and 2013, the most common age group involved in RTA was 30-44 years followed by 15-29 years. [10, 11]

A large number of cases in the young age group can be justified by the fact that young persons in this age group are at the peak of enthusiasm, energy and creativity.

They lead active life and have the tendency to take undue risk like speed driving, overtake wrongly, triple riding of bike, boarding over running vehicle etc. which expose them to the hazards of accidents and injuries.

In present study it was observed that male outnumbered females with a significant male to female ratio of nearly 10:1. Almost all the studies over RTA have conclusively pointed out male dominance. Arvind Kumar et al, [4]

R. Ravikumar, [7] Dhaval Patel et al, [12] B. C. Shivkumar et al, [13] and Behera et al [14] also got the same findings. In NCRB report of 2013 out of all RTA fatalities 76.7% are male and 23.3% are female. [11] The predominance of male can be explained by the fact that males lead a more active life, travel more, drive more and so expose to the hazards of traffic, accidents and trauma.

Females generally stay at home, but now there is increasing trend of RTA among females too due to their awareness regarding career and their active participation in socio-economic activities. Our findings regarding sex ratio did not match with Akhilesh Pathak et al, [15] Harman singh et al, [9] Chandra et al, [16] and Agnihotri et al [17], who found lesser sex ratio in the range of 2:1 to 5:1.

Hindus (n=282) outnumbered Muslims in the ratio of 9:1 which is simply due to more numbers of Hindus in and around Bhopal region. Other religions are quite less populated in and around Bhopal region.

In our study 61.2% (172) cases sought Medical aid. Dhaval et al [14] reported 67% cases died on spot. This reflects the severity of injuries produced by the accidents as well lack of proper medical aids soon after the accidents. Large number of studies supports our findings. [9, 12, 16, 18] In our study Head Injury was the

most common type of injury sustained with total 239 cases (including superficial and serious injuries). A total of 195 cases had skull fractures and 220 cases had shown intracranial hemorrhages.

The reason might be that head is the most vulnerable part because of its top location in the body and immovability of brain tissue.

According to the Brain Injury Association Traumatic Brain injuries, mainly due to RTA is the leading cause of death in young people and Motor vehicle crash accounts for 50% of total fatal and non - fatal injuries. [19]

Majority of other studies are supporting our findings. [4, 14-16] According to B. R. Sharma et al [20] head injury accounted for 75% of all fatal road traffic accidents. Pamod Kumar Verma [8] et al and E. Ravikiran et al [18] contradicted our findings by concluding limb injuries and abdominal injuries respectively, are the major injuries in RTA. Like our study Cerebral contusion and laceration (n=149, 52.83%) was found in majority of other studies. [4, 13, 16]

We reported 69.14% (195) cases of skull fractures, which other studies also supported. [4, 9, 16, 20] Temporal bone was most commonly involved followed by parietal.

This finding tallied with the most other studies. [4, 6] but multiple skull bones fracture was most common type. Few studies like Dhaval et al [12] found Parietal bone fracture as most common whereas Arvind Kumar et al [4] stated base of skull as most common bone fractured.

More involvement of temporal bone in RTA might be due to inclination to fall towards one side in RTA. The lateral location of bone exposes it to the hazards of RTA.

Regarding individual types of fracture, simple/linear or fissure fracture was the most common type encountered in 32.97% cases followed by radiating fractures which is similar to findings of other studies. [12, 13, 15]

Over all Multiple types of fracture were most common comprising 60.28% (n=170) cases and can be explained by the fact that in majority of cases secondary impact is common after primary impact.

Our findings of subdural haemorrhage (75.88%) followed by subarachnoid haemorrhage (70.21%) as most common intracranial haemorrhage is similar to other studies. [4, 9, 12, 13, 15, 20] Combined haemorrhage was seen in 68.8% cases.

Chandra et al [16] in contrast found Subarachnoid haemorrhage most common. Subdural haemorrhage occurs mostly due to tear of bridging vein during frequent change in the velocity.

Conclusion:

In Present study, RTAs were more common in the younger age groups and in male sex. Majority of victims sought medical help.

Head injury was the major cause of death in majority cases of RTAs mostly due to Subdural and Subarachnoid Haemorrhages.

This further shows the need of strict implementations of rules for controlling the speed of vehicle. As Head injury is the major cause of death in RTA, the Government should make strict rules for implementation of use of safety helmets for bike riders, for prevention of driving under influence of alcohol, and for the proper training of Drivers, Police personnel, Traffic controller etc.

Government must also make arrangements for proper lighting and signaling over roads and install modern vigilance system.

Overall improvement in the Emergency Medical services is a must to decrease the death toll due to RTA.

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Table 1: Age and Sex-Wise Distribution of Cases

Age Grp.(yrs)	Male	Female	Total	Percentage
0-10	7	2	9	3.2
11-20	34	2	36	12.8
21-30	82	4	86	30.5
31-40	61	7	68	24.1
41-50	32	5	37	13.1
51-60	20	2	22	7.8
>60y	22	2	24	8.5
Total	258	24	282	100

Table 2: Sex-Wise Distribution

Sex	Cases	Percentage
Male	258	91.5
Female	24	8.5%
Total	282	100

Table 3: Religion Wise Distribution of Cases

Religion	Cases	Percentage
Hindus	255	90.5%
Muslims	27	9.5%
Others	0	0%
Total	282	100%

Table 4: Hospitalized and Non Hospitalized Cases

	Cases(N=282)	Percentage
Hospitalized	172	61
Non Hospitalized	110	39
Total	**282**	**100**

Table 5: Region Wise Distribution of Injuries

Region	Cases (n=282)		(%)
	Alone	Combination	
Head Injury	130	220	46.09
Chest/Thoracic	12	97	4.25
Abdomen	06	71	2.12
Pelvic Injury	18	33	6.38
Chest + Head	25		8.86
Abdomino-Pelvic + Head	23		8.15
Abdomen + Chest	19		6.38
Pelvic + Other Injuries	14		4.96
Head+ Chest+ Abdomino-pelvic	31		11.0
Multiple(>1 Region)	97		34.39

Table 6: Distribution of Head Injuries including Face (n=282)

Area involved	Cases	(%)
Face injuries	64	Simple – 64 (22.69) Fractures- 8(0.03)
Scalp ecchymosis	239	84.75
Scalp laceration	121	42.90
Skull fracture	195	R-165(58.5), L-159(56.3) R+L-102(36.1)
Intracranial hemorrhages	220	78.01
Cerebral Contusion/laceration	149	52.83
Cerebral necrosis	116	41.13
Surgical Intervention	35	12.41
Craniotomy/burr	20	7.09

Table 7: Distribution of Skull Fractures

Region	Right	Left	Right+ Left	Total (%)
Frontal	21	21	61	102(36.17)
Temporal	28	31	63	122(43.26)
Parietal	42	24	42	108(38.29)
Occipital	18	13	46	77(27.3)
Base	26	30	58	114(40.42)
Multiple	34	32	104	170(60.28)

Table 8: Types of Skull Fractures

Types	Cases(n=282)	Percentage (%)
Fissure/Linear	93	32.97
Commuted	67	23.75
Radiating	72	25.53
Sutural	14	04.96
Depressed	10	03.54
Hinge	05	01.77
Multiple(>1 Type)	142	50.35

Table 9: Distribution of Brain Haemorrhages

Types of Haemorrhage	Cases (n=282)	Percentage (%)
Extradural	73	25.88
Subdural	214	75.88
Subarachnoid	198	70.21
Intra Cerebral	27	9.57
Combined(>1 Type)	192	68.08

Original Research Paper

Mumbai Local: Life Line or Life Stealing

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Abstract

Mumbai is financial and commercial capital of India. Mumbai wouldn't have achieved this without the lifeline of the city–its local trains. Aim of our study was to find out most demographic profile manner and causes of death in railway deaths. Total number of 51 railway death cases was noted during study period. Most of the deaths belonging to younger age group 21 to 30 yrs (28%). Males (96.07%) preponderance was observed in our study. Maximum numbers of railway accidents were seen during the evening hours between 1600 to 2000 hrs. The majority of the victims were brought dead 27 (52%). Greatest number of deaths were accidental (98%) in nature. There were less suicidal cases (02%) and no case of homicidal death noted. Most common reason behind railway deaths was hit by train while crossing railway track 48% and 30% had fallen from running train due to overcrowding. Intracranial hemorrhage due to Head injury (47.05 %) was most common cause of death. Railway accidents can be preventable by taking appropriate measures such as attentive surveillance, ambulance availability at stations, safety engineering and awareness among passengers.

Key Words: Railway deaths, Mumbai local train, Accidental, Head injury

Introduction:

The Indian Railway network (IRN) is one of the largest and busiest Railway networks in the world, handling massive numbers of passengers and quantities of goods daily.

Railways are the most popular means of long-distance transportation in India; hence the IRN is often described as the backbone of this nation's economy. More alarmingly, there has been a spate of Railway Accidents in India, leading to loss of a significant number of human lives. [1] The local trains are essential for a speedy cross-over of a large, densely populated urban area like Mumbai over long distances.

Millions of people travel regularly and commute by local trains over varying distances ranging from 10 to 60 kilometer a day. [2]

The major problem with these trains is overcrowding due to extensive population. Over 4,500 passengers are packed into a 9-car rake during peak hours, as against the rated carrying capacity of 1,700. [3]

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Many fatalities have been reported due to excessive crowding. Over the past 10 years (2002–2013), in our country, more than 46,476 lives have been lost on tracks and 43,834 people have been injured. Train accidents on suburban Mumbai local routes have claimed 23,473 lives in the past 11 years. This takes the average for injuries and deaths per day to 10. [4]

Main reasons are over- crowding, illegally crossing the railway tracks, standing on the foot boards of the doors of the compartments, electrocution due to commuters sitting on the roof of trains and Impact with Railway Electric Poles.

Travelers leaning out of local trains due to overcrowding and poor ventilation inside the train are at a risk of being hit by electric poles that are all along the tracks leads to a lot of accidents during the crowded hours.

Unfortunately, Mumbai's Suburban Trains have among the Highest Number of Accidental Deaths among suburban railway networks in the world.

This type of study is not carried out in central Mumbai region; hence an attempt is made here to study the railway deaths.

Material and Methods:

A prospective study was conducted in Department of Forensic Medicine and Toxicology at Seth G.S. Medical College and KEM Hospital, Parel, Mumbai during the period September 2013 to August 2014.

Out of 1444 medico-legal autopsies conducted during this period, 51 cases (3.53%) were due to train accidents. The data regarding information on age, sex, supposed manner of death and pertinent history was obtained from police papers (Requisition and inquest Panchnama), hospital records, statement from relatives, and report from station manager and autopsy report. All data are analysed and statistically treated with SPSS program.

Observations and Results:

In this study most common age group involved in railway deaths was (21-30 years) 14 cases (27.45 %), followed by (41-50 years) 12 cases (23.52 %), (31-40 years) 7 cases (13.72 %) and least in (11-20 years) 5 cases (9.8 %).

If we combine age group 21-30 years and 31-40 years then it was observed that almost 34% of deaths occurred in younger age group. (Fig. 1) Male preponderance was observed in our study contributing almost 98% of the total railway deaths. While only 2% cases belonging to female which are seen in (21-30 years) 1and (41-50 years)

Present study showed that most common time of incidence is between 1600-2000 hrs. During the evening hours 13 cases (33.33 %), followed by 0800 to 1200 hrs 8 cases (20.51 %) and least in 0000 to 0400 hrs. 2cases (5.12 %). (Fig. 2)

In this study most of the victims were brought dead 27 (52.94%) cases while 21 (41.17%) cases were survived for more than 24 hrs. In our study and only 3 (05.88 %) cases were survived for less than 6 hrs. (Table 1) Maximum number of deaths were accidental (98%).There were less suicidal cases (02%) and no case of homicidal death noted. (Fig. 3)

Present study showed that most common reason behind the incidence was hit by train while crossing the track 26 cases (50.9%), followed by fall from running train 18 cases (35.29%), hit by pole 03(5.88%), fall through gap between platform and train 03(5.88%) and least was observed in electric shock due to overhead wire 1(1.96%). (Table 2)

Most common cause of death in our study was intracranial hemorrhage (head injury) due to blunt trauma 24 cases (47.05%) followed by shock and hemorrhage due to blunt trauma 18 cases (35.29 %), injury to lungs due to blunt trauma five cases (09.80%) and least common were septicemia and pneumonia as a complication of blunt trauma each 02 (03.92%). (Table 3) Most of cases 37 (80%) did not get facility of ambulance after the incidence. (Fig. 4)

We observed in this study that most of the railway death took place at Parel to Curry road station 17 cases (43.58%), followed by Chinchpokli station 6 cases (15.38%), Elphinstone station 5 cases (12.82%), Dadar station 4 cases (10.25 %) and least common in Andheri to Jogeshwari 2 cases (5.12%). (Fig. 5)

Discussion:

In our study male (98%) predominates the females. this might be due to fact that males carry most of the responsibilities of their families like earning and care taking of their family.

In city like Mumbai where a common man cannot take house or rent in proper Mumbai, he has to reside in sub-urban region hence he has to travel a lot. Female also travel through local but they are more careful than males while travelling. Similar study in Nagpur region by Wasnik [4] stated that males (89%) predominates females (11%) this might be due to the fact that most of the outstation activity was carried out by males. Our study is also similar to other researchers work. [6-9]

While study carried out in Varanasi [5] is contrast to our study. This might be due to fact that females are more exposed to stress and occupational hazard.

Most common age group involved was 21-30 years (27.45 %), followed by 41-50 years (23.52 %), 31-40 years (13.72 %) and least in 11-20 years (9.8 %). If we combine age group 21-30 years and 31-40 years then it was observed that almost 34% of deaths occurred in younger age group. [4-10]

This might be due to fact that young peoples are more active and they take more risk as compared to others. They will try to board in running train, hanging on doors or bars, travelling on the roof in overcrowded trains.

Most common time of incidence was 1600 hrs to 2000 hrs (33.33%), followed by 0800 hrs to 1200 hrs (20%) and least common in 0400 hrs to 0800 hrs (11.76%.) This might be due to the fact that evening is time at which most of the offices closed and peoples rushing to their home. Similarly morning is also time at which most of the offices start their working.

At 0400 hrs.to 0800 hrs (Early morning) incidence was very low due the fact that most of the offices are not open.

Majority of the victims were brought dead (died on spot) 27 (52.94%) cases while 21 (41.17%) cases were survive for more than 24 hrs. similar to Wasnik [4] study in Nagpur region which stated that majority of victims died on spots (96.53%). This might be due to fact that

railway injuries sustain during accidents were fatal and lack of ambulance services.

Accidental deaths (98%) outnumbered the suicidal deaths (2%) and no case of homicidal deaths in our study. This might be due the fact that high population of the city, overcrowding of locals at peak hour, narrow foot over bridge, hanging on doors, hit by train while crossing the track in hurry and travelling on the roof. While a very low suicidal deaths, might be due to the fact that this is a very violent method of suicide, consistent with other studies. [4, 5 11, 12] Most common reason behind the incidence was hit by train while crossing the track 26 cases (50.9%), followed by fall from running train 18 cases (35.29%), hit by pole 03(5.88%), fall through gap between platform and train 03(5.88%) and least was observed in electric shock due to overhead wire 1(1.96%).

This might be due to the fact that Mumbai is highly populated city, fast lifestyle; peoples are in hurry to reach their offices and homes, insufficiency of foot over bridge, narrow foot over bridge, hence compelling them to cross the track to reach their destination in time. Overcrowding results in fall from running train and also vertical poles along the track.

In majority cases common cause of death was intracranial hemorrhage (head injury) due to blunt trauma (47.05%) followed by shock and hemorrhage due to blunt trauma (35.29 %).

This might be due to the fact that in our study most common reason behind the railway deaths was hit by train while crossing the train and local is having two protrusions on its front which is at the head level of the person which may hit head as primary impact during the crossing of the track. [4]

Most of the railway death took place at Parel to Currey road station 17 cases (43.58 %), followed by Chinchpokli station 6 cases (15.38 %) and Elphinstone station 5 cases (12.82 %).

This might be due to the fact that only one narrow foot over bridge at parel station, overcrowding and at the peak hours people are in quick rush hence they compel to cross the track and hit by train. Also insufficiency of barriers between the two tracks, vertical poles between Parel to Currey road station and inadequate frequency of trains are also other reason.

Conclusion and Preventive Measures:

In our study most of the railway deaths were males of younger age group and manner of death was accidental in nature most commonly during the evening hours.

Most of the railway deaths were due to hit by train while crossing the railway tracks and cause of death was due to intracranial hemorrhage as a result of head injury. Majority of deaths were brought dead to KEM Hospital and it was noted that only in 20% cases ambulance services were provided by railways.

Parel to Currey road station was the most common station involve in railway accidents in our study.

The railways should take steps for improving the rail-safety to prevent accidents, such as:

1. A boundary wall on both sides of the track wherever possible would be erected and existing wall be repaired.
2. Fencing should be done around the rail track and between the two railway tracks, especially within city limits to prevent suicides having easy access to it.
3. The railways must build sufficiently broad and strong foot-bridges/subways for crossing the tracks and also close the crossing points, frequented by the pedestrians for crossing the tracks with fencing, etc.
4. Removal of some of the vertical poles close to the tracks.
5. Reduction of the distance between compartments and platforms, by raising the height of the platforms up to 840 mm, the maximum limit.
6. Improvement and updating of the signal system, increasing the number of rakes to increase capacity, adding more tracks to increase capacity and speed up traffic.

Effective ways to avoid accidents for the citizens are: self-vigilance, adherence to the rules/regulations and following safe practices.

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Fig. 1: Total Number of Railway Deaths, According to Age Group and Sex

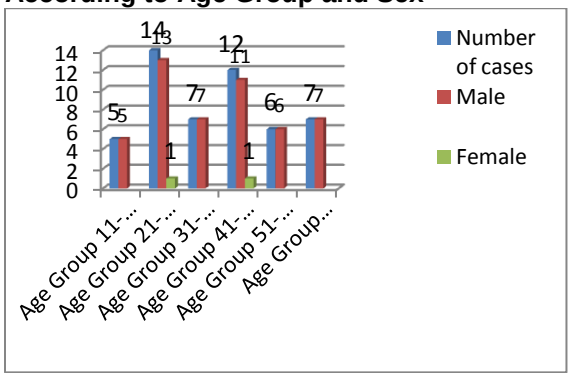

Fig. 2: Time of Incidence

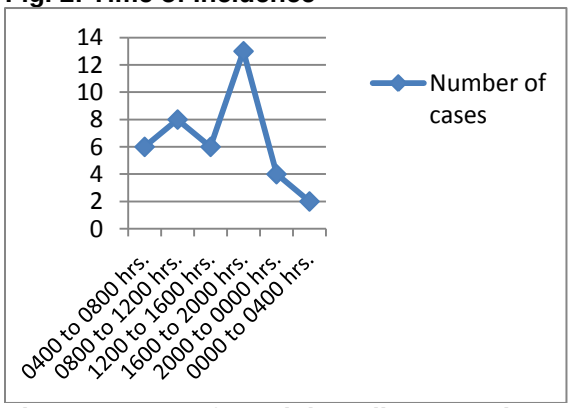

Fig. 3: Manner of Death in Railway Deaths

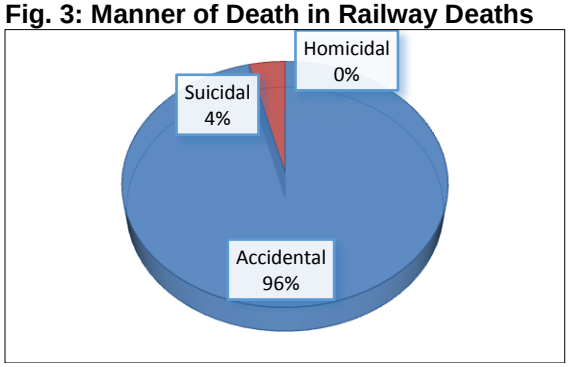

Fig. 4: Availability of Ambulance after the Incidence

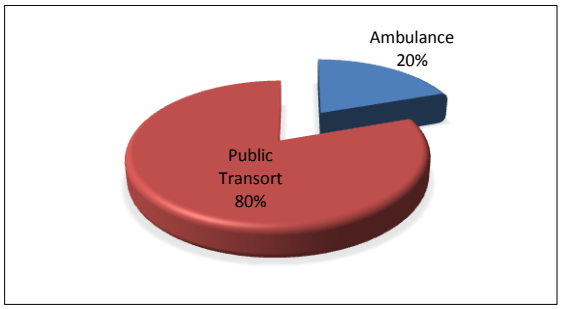

Fig. 5: Distribution of Railway Deaths at Various Railway Stations

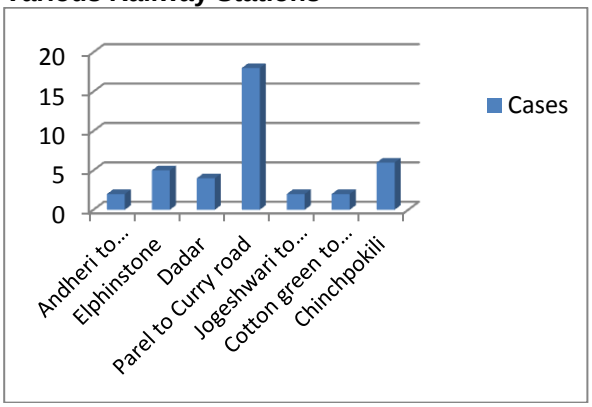

Table 1: Survival Period of Railway Deaths

Victims	Cases	%
Brought Dead	27	52.94
Survived less than 6 hrs.	03	05.88
Survived more than 24 hrs.	21	41.17

Table 2: Reason behind the Incidence of Railway Deaths

Reason behind the incidence	Cases	%
Hit by train while crossing track	26	50.9
Fall from running train	18	35.29
Hit by Pole	03	5.88
Falling through gap between platform and train	03	5.88
Electric shock over head wire	01	1.96

Table 3: Causes of Railway Death

Cause of Death	Cases	%
Intracranial Hemorrhage (Head Injury)	24	47.05
Shock and Hemorrhage (Due to blunt trauma)	18	35.29
Injury to Lungs (Due to blunt trauma)	05	09.80
Septicemia (Due to blunt trauma)	02	03.92
Pneumonia (Due to blunt trauma)	02	03.92

Original Research Paper

A Study of Socio-Demographical Profile of Dowry Death Victims in a Tertiary Care Unit of West Bengal

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Abstract

High incidence of unnatural deaths of young newly married females following disputes over the dowry is a dark spot on the noble tradition of our society.Sadly, awareness and education, particularly of young people and women, has not helped to control the situation. The aim of the present study is to describe the different pattern and socio demographic profile of dowry death cases. This study is a retrospective, observational Study which was conducted between July 2012 to June 2014 at the Department of Forensic Medicine & Toxicology, Nil Ratan Sircar Medical College & Hospital, Kolkata; where 216 cases were taken out of total 5589 autopsies conducted during the study period.Most of the victims of dowry deaths were aged between 18to 20 years (43%), religiously belonging to Hindu (67%). Joint family (83%) of lower socio-economic status (40%) in rural (58%) residence, housewife (73%) being educated up to primary school (55%) were predominant. Most common cause of death was due to burn injury (67%).

Key Words: Dowry death, Socio-demographic profile, Retrospective, Observational study, Autopsy

Introduction:

Where the death of a woman is caused by any burn or bodily injury, or occurs otherwise than normal circumstances, within 7 years of her marriage & it is shown that soon before her death, she was subjected to cruelty or harassment by her husband or any of his relatives for, or in connection with any demand for dowry, such death shall be called **Dowry death.** [1, 2]

Even after years of campaigning by voluntary organizations against the menace of dowry and their efforts to create awareness on it, the number of dowry deaths and dowry harassment cases is on the rise. They are well planned crimes, executed within the four walls of a house by the family members.

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Most of the victims die on the spot and those who survive hesitate to make a statement before a magistrate either due to fear psychosis on account of lack of alternative support, or they are persuaded or threatened not to do so.The present study is undertaken to evaluate the magnitude and study various socio etiological factors of dowry deaths in Kolkata, West Bengal and various other factors affecting the rise in incidence of dowry death.

Aims and Objectives:

The aim of the present study is to describe the socio-demographic profile ofdowry death victims brought to N.R.S. Medical College, Kolkata mortuary.

Materials and Methods:

This retrospective, observational Study was conducted from July 2012 to June 2014 at the Forensic Medicine Department of Nil Ratan Sircar Medical College; Kolkata. During this period a total of 5589 autopsies were conducted at this hospital. Out of which, there were 216 cases of death of married women within seven years of marriage.

In this study we included those cases in whichMarried women that died within seven years of their marriage and Unnatural deaths due to burning, hanging and poisoning. We excluded the Bridal death beyond seven years of marriage and all decomposed dead bodies.

The details of each case were obtained from police requisition and inquest, hospital

records & also from victim's available relatives which highlighted the main points: age, occupation, education, type of family, socio-economic status, place of residence, time of death etc. All data were documented in a master chart and analyzed & interpreted.

Observations and Results:

The study was conducted at the mortuary of NRS Medical College, Kolkata from 1st July, 2012 to 30th June, 2014. Out of 5589 autopsies conducted during this period, 216 (3.86%) were due to dowry death. Most of the victims (43%) were in the age of 18-20 years. (Table 1) Hindu married women (67%) (Fig 1) from the joint family (83.3%) were the main sufferer in our study. (Table 2)

Lower socio-economic status (40%) (Fig 2) from the rural background (58%) were affected highest in present study. (Table 3)

Women who are housewife (73%) (Table 4) being educated up to primary school (55%) (Table 5) and married for 1-2 year (33%) died most commonly. Most common cause of death was due to burn injury (66%). (Fig 3)

Discussion:

Most of the victims are aged between 18-20 years (43%) and only 1.4% case has occurred in > 32years of age. This was similar to studies by Sharma B.R. et al [3] who report 56% of victims belong to the age group of 18-25 years, and also Virendra Kumar et al [4], KusaKumar Saha and S Mohanty studies. [5]

With regard to type of family, this study showed that most cases were from joint family (83%). This was consistent with other researches. [4-6] In present study out of the total population, 58% were from rural residence. This followed the findings of Sharma BR [3], Bharati S et al [7] and Arora P et al [8]; but our study was in contrast to the findings of Chavan B S et al and Prajapati et al. [9, 10]

Among the married women, 73%were housewives, 11% were students similar to that of Prajapati P et al and Kumar P N S et al studies. [10, 11] In ourstudy, 54.7% were educated upto Primary level, followed by 18.5% illiterate, 16% were high school educated.

This wasin accordance to the findings of Shukla DG et al [12]; but in contrast to the findings of Bharati S et al. [7]

Regarding socio-economic status we observed that 39% belonged to lower class, 36% belonged to Middle class and only 4.2 % cases belonged to Upper class. These findings were similar to Bharati S et al [7], Chavan et al [9]; but were in contrast to the findings of Saha KK et al and Arora P et al. [5, 8]

Majority of dowry death was due to burn (67 %), followed by poisoning (20 %), hanging (12%) cases which was consistent with Sharma BR et al and Saha KK et al studies. [3, 5]

But several other studies like Prajapati et al [10], Suresh K et al showed that Poisoning (35.51%) was most common cause of death. In this study, most cases were from rural regions of West Bengal, where suicide by poisoning is far less than suicide by burn, as substances required to set fire are easily available.

Conclusion:

A social and public health response to Dowry death is crucial in India. Aim of medical science should be to bring forward some suggestions to reduce the incidence of dowry death. A social and public health approach acknowledges that Dowry death is preventable, and promotes a framework in integrated system of interventions across multiple levels within society including the individual, the family, the community and the health care system.

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Table 1: Age of Suicidal Victims (N = 216)

Age (Years)	Cases	Percentage (%)
18—20	93	43.1
21—23	58	26.8
24—26	39	18.1
27—29	19	8.8
30—32	4	1.8
> 32	3	1.4
TOTAL	216	100

Table 2: Type of Family (n = 216)

Type of Family	Cases	%
Joint	180	83.3
Nuclear	36	16.7
Total	216	100

Table 3: Type of Residence (N= 216)

Residence	Cases	%
Rural	126	58.3
Urban	90	41.7
Total	216	100

Table 4: Occupation of Victims (N = 216)

Occupation	Cases	%
Housewife	158	73.2
Student	24	11.1
Farmer	19	8.8
Labourer	13	6.0
Service	2	0.9
Total	216	100

Table 5: Education of Victims (N = 216)

Education	Cases	%
Illiterate	40	18.5
Primary	118	54.7
High School	35	16.2
Intermediate	17	7.8
Graduate	6	2.8
Total	216	100

Fig 1: Religion of Victims (N = 216)

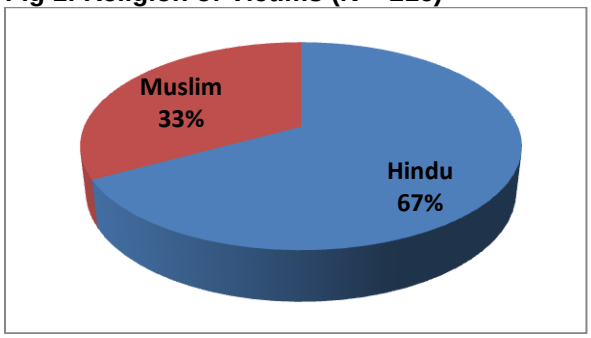


Fig 2: Socio-Economic Status (N = 216)

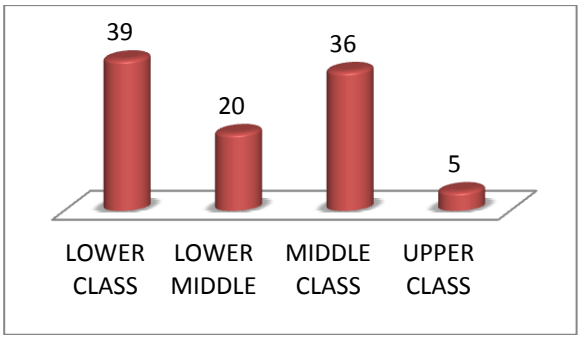
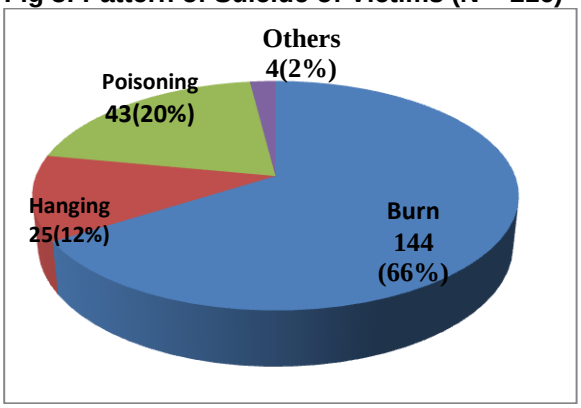


Fig 3: Pattern of Suicide of Victims (N = 216)



Original Research Paper

Estimation of Stature from Cephalo-Facial Dimensions by Regression Analysis in Gujarati Population

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Abstract

During investigation in cases of missing body parts or unknown identity, the expert is often required to opine about the personal identification of the body. Stature of a person is a useful indicator of physical identity. Stature estimation leads to a positive identification of the living or when only cephalo-facial are brought under examination. The current study dealt with developing regression equation for stature estimation from cephalo-facial dimensions and to find out the correlation among body height with each cephalo-facial dimensions of Gujarati people. This leads to positive identification of the living or cadaver. Eight cephalo-facial dimensions of 901 Gujarati (676 male and 225 female) namely maximum head length, maximum head breadth, bizygomatic breadth, bigonial diameter, morphological facial length, physiognomic facial length, and total cephalo-facial height and biocular breadth along with body height was measured. It was marked that the mean stature and cephalo-facial measurements of males were significantly higher than that of females. The correlation coefficient (r) of all cephalo-facial dimensions were less than 0.5 which means stature estimation from cephalo-facial dimensions is not reliable. Multiple regression equations are more reliable than linear regression equations.

Key Words: Physical Anthropology; Cephalo-facial dimensions; Stature estimation; Gujarati population

Introduction:

Personal identification of an individual is an important aspect of Forensic science. In the case of living individuals it is based on certain morphological characteristics unique to that individual. In case of skeletal remains it is rather more complicated and requires exhaustive examination of the skeletal remains recovered from the scene of crime.

A Forensic anthropologist would attempt to answer the following key questions relating to origin, age, sex, stature and race after examining the recovered body. In India where crimes, murders, accidents, kidnapping, missing person are at peak, the investigative measures and techniques should be tough enough to bring culprits to the book.

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Through the anthropometric dimensions, it is possible to study body proportions, size and shape of man in formulating standards which will be useful in defence forces. Stature estimation is the principal element in Forensic case studies. Formulas derived from the relevant sample provide most accurate and precise inference.

Various researchers have worked on stature estimation from different body parts of diverse ethnic groups. Bhatnagar et al [1] studied left and right hands separately on Punjabi males. Abdel-Malek et al [2] took two somatometric measurements of the hands on Egyptian subjects. Jason et al [3] estimated stature from the length of cervical, thoracic, lumbar, thoraco-lumbar and cervico-thoraco-lumbar segments of the spine.

Krishan and Sharma [4] conducted a study on the bilateral asymmetry and estimation of stature from arm length and its segments on a Punjabi population. Duyar and Pelin [5] established relationship between tibial length and stature. Ozaslan et al [6] conducted study on the estimation of stature from seven somatometric measurements of the lower.

These equations are based on measurements of different bones which are population specific and should be applied consequently. It becomes difficult to estimate stature when only cephalo-facial is brought for the examination. Regression equations for

stature estimation from cephalo-facial dimensions using non-radiological method on Gujarati population of Gujarat are not documented in any Forensic literature.

To estimate stature, measurements of maximum head length, maximum head breadth, bizygomatic breadth, bigonial diameter, morphological facial length, physiognomic facial length, and total cephalo-facial height and biocular breadth are measured of 901 Gujarati subjects whose age range between 20 to 50 years. The present research was hence undertaken to study the correlation of stature with cephalo-facial measurements and to derive formulas for determining stature.

Material and Methods:

A randomly selected sample of 901 Gujarati subjects whose age range falls within 21 to 50 years were presented for data collection and analysis. Gujarati subjects were born, bred and live in Ahmedabad district of Gujarat state. It is the seventh largest metropolitan area of India.

The stature and eight cephalo-facial measurements viz., maximum head length, maximum head breadth, bizygomatic breadth, bigonial diameter, morphological facial length, physiognomic facial length, total cephalo-facial height and biocular breadth were measured directly using standard anthropometric instruments. Cephalo-facial dimensions are taken by spreading calliper in centimetres according to the landmarks, techniques and procedures recommended by authors Singh and Bhasin.

The anatomical landmarks were identified keeping the head in Frankfurt Horizontal plane. The measurements were taken after obtaining informed consent from the volunteers. All the subjects were healthy and free from cephalic deformity.

The landmarks selected for facial dimensions were glabella, opisthocranion, nasion, gnathion, zygomatic, gonion, euryon, trichion and ectocanthion.

i. **Height Vertex or Stature:** It measures the vertical distance from vertex to floor, where vertex is the highest point on the head when the head is held in Frankfurt Horizontal (FH) plane. The subject was asked to position with standiometer in the median sagittal plane. The subject should stand erect, feet parallel to each other with barefoot and heels to touch the wall. The horizontal length was then measured in centimetres.

Precautions were taken not to exert pressure as that may affect the contact measurement. The height is highly sensitive to fatigue and even up to 3 cms of diurnal differences have been recorded in it in the same subjects (Tanner, 1964).

ii. **Maximum Head Length (g-op):** It measures the straight distance between glabella (g) and opisthocranion (op) i.e., the most protruding point on the dorsal surface of the head in the mid-sagittal plane.

iii. **Maximum Head Breadth (eu-eu):** It measures the straight distance between the two eurya (eu).

iv. **Breadth of Bizygomatic Arch (zy-zy):** Direct distance between the two most lateral points on the zygomatic arches (zy-zy)

v. **Bigonial Breadth (go-go):** It measures the straight distance between the two gonia (go), rounded postero-inferior corner of the mandible between ramus and the body.

vi. **External Biocular Breadth (ec-ec):** It measures the straight distance between the two external canthi (ectocanthion) i.e., outer corners of the eye.

vii. **Total Head Height (v-gn):** It measures the projective distance between vertex (v) and gnathion (gn).

viii. **Physiognomic Facial Height (tr-gn):** It measures the straight distance between trichion (tr) and gnathion (gn).

ix. **Morphological Facial Height (n-gn):** It measures the straight distance between nasion (n) and gnathion (gn).

The data collected were recorded and subjected to statistical analysis by SPSS Version 20.0. Thereafter, a hypothetical regression equation was formulated using the regression coefficients as follows:

S = a + bx

where, s = stature i.e. the dependent variable.

x = any cephalo-facial measurement i.e. the independent variable.

a = the regression coefficient of dependent variable.

b = the regression coefficient of independent variable.

The regression formulae were calculated separately by using computerized regression analysis of the parameters with stature to derive the regression coefficients ‘a’ and ‘b’. The appropriate values of constants ‘a’ and ‘b’ were then substituted in the standard equation of regression. Standard Error of Estimate (SEE) was calculated for each and every regression equation.

Results:

Statistical analysis was presented in tabular form as means, standard deviations, minimum and maximum value of stature and

cephalo-facial anthropometric measurements namely maximum head length, maximum head breadth, bizygomatic breadth, bigonial diameter, morphological facial length, physiognomic facial length, total cephalo-facial height and biocular breadth of adult Gujarati. (Table 1)

In the sample of 901 Gujarati, the mean values were found to be greater in males than the females. Table 2 displays Karl Pearson's correlation coefficients between stature and various cephalo-facial anthropometic measurements in adult Gujarati.

Discussion:

Facial assessment by metrical methods is currently performed in different fields such as plastic and orthodontic surgery and diagnosis for cephalo-facial anomalies, medico-legal aspects and in Forensic science. However, very few studies have proposed facial analysis for forensic purpose. In cases where only fragmentary body parts are recovered, it becomes difficult to establish identity. In such cases, identification of stature and ethnic group becomes important to establish identity. In this study attempt has been made to determine stature of Gujarati people from eight cephalo-facial measurements.

The study revealed the mean value of all facial measurements in Gujarati people to be comparatively lower in females than males. The mean stature of Gujarati male was 164.3 cm and female was 150.56 cm. Our study showed that when sex is unidentified all the facial measurements except morphological facial length was found to show positive significance (p-value<0.05) with stature. (Table 2)

The result indicated that using either of the cephalo-facial dimensions and putting the values in linear regression equation, stature can be known when sex is unidentified. Bigonial diameter gives significant model for stature determination in male and female.

Other cephalo-facial measurements namely, maximum head length, maximum head breadth, bizygomatic breadth, morphological facial length, physiognomic facial length, total cephalo-facial height and biocular breadth shows weak and statistically insignificant relation with stature as p-value>0.05.

The correlation coefficients (r) of cephalo-facial measurements are less than 0.5 in all the cases. As the correlation coefficients (r) are considered to be significant only above 0.5, the cephalo-facial dimensions are not very good predictors for estimating stature in Gujarati population. However it must be kept in mind that precise prediction of stature from cephalo-facial dimensions may be unattainable and there would always be an SEE. Multivariate regression for stature estimation can be used when all the facial measurements are available. When sex is unknown, stature can be identified precisely using multivariate regression equations.

Many authors have derived formulas for stature estimation from cephalo-facial measurements on various ethnic groups. Mahesh Kumar et al. [7] worked on Haryanvi adults and reported that the most reliable cephalo-facial measurements to estimate stature using regression analysis among males is morphological facial length (r=1.39) and in female is maximum head length (r=1.037). Kewal Krishnan et al [8] noted that horizontal head circumference (r=0.781) show good reliability and applicability for estimation of stature in male Gujjars of North India.

A. K. Agnihotri et al [9] studied stature estimation in Indo-Mauritian by using facial measurements where horizontal head circumference (r=0.494), nasal breadth (r=0.380) and morphological facial length (r=0.328) predicts stature among males and among females physiognomic facial length (r=0.382), bizygomatic breadth (r=0.276) and horizontal head circumference (r=0.375). Patil and Mody [10] showed somewhat higher standard errors for most of the variables except head length which showed high degree of reliability (SEE= 3.71) in estimating stature.

Daisy Sahni [11] found low correlation coefficients and suggested the correlations of facial measurements with stature to be very poor. S. Nath et al [12] revealed that Jatavs males shows greater multiplication factor for nasal height, head breadth, and ear length while female exhibit greater multiplication factor for nasal breadth and head length.

The results of the present study can be compared with the similar available studies on different population group of the world. The comparison and differences obtained establish the fact that different Indian population shows variation in the morphology of different population group of India. It is emphasized that all the measurements exhibit correlation when sex is unknown and hence any of the cephalo-facial can estimate stature of Gujarati people. Moreover, stature can be satisfactorily estimated for medico-legal and forensic purpose using multiple regression equations.

Conclusion:

From the present study, it can be concluded that like other parts of body, cephalo-facial dimensions can also be used for

estimating stature when sex is unknown. The facial measurement does not give good reliability and applicability to estimate stature in the sample of Gujarati origin, though the models are significant. Estimation of stature from cephalo-facial measurements is an additional approach when practical samples like extremities and other body parts are not available for examination.

Therefore, it can be concluded that, like other parts of the human body, the cephalo-facial dimensions can also be used for estimation of stature with less accuracy rate when cephalo-facial remains are brought for forensic examination. While applying linear regression formulae, one should keep in mind that these are population specific; these cannot be used on other populations of the world.

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Table 1

Descriptive Statistics for Stature and Cephalo-Facial Measurements in Gujarati (n=901)

Variables	Sex	N	Mini	Maxi	Mean	S.D	S.E Mean	t	Sig. (2-tailed)
g-op	Both	901	13.6	21.4	17.34	1.72	0.05	14.967	0.00
	Male	676	14.0	21.4	17.79	1.52	0.05		
	Female	225	13.6	18.8	16.01	1.6	0.1		
eu-eu	Both	901	9.6	19.0	13.39	1.63	0.05	11.404	0.00
	Male	676	10.1	19.6	13.72	1.52	0.05		
	Female	225	9.6	18.6	12.38	1.54	0.1		
zy-zy	Both	901	9.0	16.8	12.65	1.68	0.05	14.258	0.00
	Male	676	9.8	16.8	13.07	1.54	0.05		
	Female	225	9.0	14.5	11.4	1.46	0.09		
go-go	Both	901	5.9	14.6	9.99	1.66	0.05	13.689	0.00
	Male	676	6.2	14.6	10.38	1.54	0.05		
	Female	225	5.9	11.5	8.79	1.42	0.09		
tr-gn	Both	901	12.0	21.5	15.99	1.72	0.05	13.464	0.00
	Male	676	12.0	20.1	16.4	1.55	0.05		
	Female	225	12.2	21.5	14.76	1.62	0.1		
v-gn	Both	901	10.2	25.3	21.39	1.77	0.05	15.027	0.00
	Male	676	12.5	25.3	21.85	1.48	0.05		
	Female	225	10.2	23.5	20.01	1.88	0.12		
n-gn	Both	901	6.1	12.6	9.52	1.5	0.05	12.219	0.00
	Male	676	6.3	12.6	9.85	1.36	0.05		
	Female	225	6.1	12.0	8.54	1.46	0.09		
ec1-ec2	Both	901	6.4	12.7	9.36	1.59	0.05	9.850	0.00
	Male	676	6.7	12.7	9.65	1.5	0.05		
	Female	225	6.4	11.3	8.5	1.54	0.1		
height	Both	901	135.0	186.5	160.92	9.54	0.31	24.094	0.00
	Male	676	137	186.5	164.3	7.55	0.29		
	Female	225	135	170	150.56	7.11	0.47		

Table 2
Regression Equations for Estimation of Stature (In Cm) From Cephalo Facial Dimensions in Gujarati (N=901)

		r	r^2	Adjusted r	SEE	Equation: Stature=
Both	g-op	0.275*	0.076	0.074	9.182	134.541+1.520(g-op)*±SEE
	eu-eu	0.223*	0.05	0.049	9.308	143.437+1.305(eu-eu)*±SEE
	zy-zy	0.260*	0.067	0.066	9.222	142.317+1.470(zy-zy)*±SEE
	go-go	0.177*	0.031	0.03	9.4	150.804+1.013(go-go)*±SEE
	v-gn	0.277*	0.077	0.076	9.176	129.145+1.485(v-gn)*±SEE
	tr-gn	0.290*	0.084	0.083	9.139	135.263+1.604(tr-gn)*±SEE
	n-gn	0.223	0.05	0.049	9.308	147.413+1.418(n-gn)±SEE
	ec1-ec2	0.190*	0.036	0.035	9.376	150.257+1.138(ec1-ec2)*±SEE
Male	g-op	0.021	0.00	-0.001	7.55	166.224-0.104(g-op)±SEE
	eu-eu	0.014	0.00	-0.001	7.556	165.312-0.069(eu-eu)±SEE
	zy-zy	0.032	0.001	0.00	7.553	166.390-0.155(zy-zy)±SEE
	go-go	0.096*	0.009	0.008	7.522	169.253-0.470(go-go)*±SEE
	v-gn	0.008	0.00	-0.001	7.557	165.241-0.040(v-gn)±SEE
	tr-gn	0.007	0.00	-0.001	7.557	164.937-0.035(tr-gn)±SEE
	n-gn	0.044	0.002	0.00	7.55	166.787-0.245(n-gn)±SEE
	ec1-ec2	0.021	0.00	-0.001	7.555	165.381-0.105(ec1-ec2)±SEE
Female	g-op	0.035	0.001	-0.003	7.122	148.097+0.154(g-op)±SEE
	eu-eu	0.048	0.002	-0.002	7.118	147.854+0.219(u-eu)±SEE
	zy-zy	0.048	0.002	-0.002	7.118	147.925+0.231(zy-zy)±SEE
	go-go	0.193*	0.037	0.033	6.993	159.024-0.962(go-go)*±SEE
	v-gn	0.001	0.00	-0.004	7.126	150.51+0.003(v-gn)±SEE
	tr-gn	0.213	0.046	0.041	6.962	136.807+0.932(tr-gn)±SEE
	n-gn	0.061	0.004	-0.001	7.113	148.032+0.297(n-gn)±SEE
	ec1-ec2	0.034	0.001	-0.003	7.122	149.238+0.156(ec1-ec2)±SEE

*p-value<0.05

Table 3
Multiple Regression Equations for Estimation of Stature (In Cm) From Cephalo-Facial Dimensions in Gujarati (N=901)

Sex	r	r^2	Adjusted r	SEE	Equation: Stature=
Both	0.408*	0.167	0.159	8.751	102.688+1.420(g-op)*-0.234(eu-eu)*+3.697(zy-zy)*-1.620(go-go)*+1.644(tr-gn)*+1.351(v-gn)*-1.447(n-gn)*-3.766(ec1-ec2)
Male	0.174*	0.030	0.019	7.481	153.653-0.83(g-op)+0.345(eu-eu)+0.190(zy-zy)-1.336(go-go)*+0.206(tr-gn)+1.013(v-gn)*-1.267(n-gn)*+0.604(ec1-ec2)
Female	0.584	0.342	0.317	5.87	109.263-0.713(g-op)+0.093(eu-eu)+5.077(zy-zy)*-4.739(go-go)*+2.912(tr-gn)*+1.384(v-gn)*-0.338(n-gn)-4.496(ec1-ec2)*

*p-value<0.05

Original Research Paper

Profile and Analysis of Lightning Victims Brought to MGH, Khammam; Telangana State

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Abstract

When there is discharge of electricity between clouds lightning occurs. This study was aimed to study the profile and analysis of lightning victims and pattern of injuries. Thirty Eight victims of lightning fatalities were identified from emergency Dept. of MGH, Dept. of Forensic Medicine, for a period of 3 years. Middle aged males, married, illiterates from rural region, belongs to low socioeconomic group, Hindu community are the most common victims when working as farmers in the open field afternoon time on Saturdays with peak incidence in monsoon season. The pattern of injuries is noted as burns over body in 36 (94.73%) cases with maximum cases having Lichtenberg figures 26 (68.42%), followed by linear burns 8 (21.05%). Magnetization of the metal worn noted. Maximum cases 34 (89.47%) were brought dead, post-mortem findings were nonspecific, petechial hemorrhage seen in the brain and the spinal cord.

Cardiopulmonary arrest following lightning was most common in 28 (77.77%) cases. High incidence of lightning strikes in this region and requires a more systemic and detailed investigative protocol in lightning related deaths. Such deaths are unpredictable but preventable with better public education, rural health care.

Key Words: Lightning, Victims, Pattern of injuries, Incidence, death

Introduction:

When there is discharge of electricity between clouds lightning occurs, when the charge jumps between cloud and earth, it is called Lightning strike. During thunderstorm the lightning stroke discharges many current peaks varying from 10,000-200,000 Amp occurring in fraction of a second affecting an area of about 30 m distance.

In lightning, the discharge may be from cloud or from cloud to the earth through some object, usually the tallest object in contact with the earth. Cloud to ground lightning accounts for 25% of lightning globally, not distributed evenly around the planet and about 70% of fatalities occurs on land in the tropics where most thunderstorms occurs.

The injuries with or without the burns on the body associated with tearing off of the wearing apparels, may closely resemble those produced by criminal violence.

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But the history of thunderstorm in the locality, effects of lightning with characteristic burns on the body and the vicinity, fusion or magnetization of metallic objects on the body or nearby, will all suggest death due to lightning stroke. Lightning causes human injury by four distinct mechanisms: the direct effect of electric current, burning by superheated air, effects of expanded and repelled air around flash and the sledge hammer blow death by compressed air pushed before the current.

As doubts may be raised of foul play because of bizarre extent, distribution of injuries and torn clothing, the diagnosis of death may be active by carefully considering the history of thunderstorm in the locality, evidence of the effects of lighting in the vicinity of the scene of death, bursting open of the body, tears scorched, imparted smell of singing, boots, belt also burst open, characteristic nature and distribution of burns, which are usually superficial due to very brief duration of flash [1]

An estimated 24,000 people are killed by lightning strikes around the world each year and about 240,000 are injured.

Estimated death rate is 0.3 per 1 lac people per year in developed nations and 6 per 1 lac people per year in developing nations.

In India, according to NCRB lightning fatalities accounted for 2550 (0.7%) in 2011,

2263(0.6%) for 2012 and 2833 (7%) in 2013 respectively. The incidence rate is 0.2. [2]

Aims and Objectives:

- To study and analysis the profile of lightning victims and pattern of injuries
- To study the prevalence of lightning fatalities.
- To determine the various conditions associated with deaths due to lightening

Material and Methods:

The present study was carried out from June 2013 to May 2015 in the Dept. of Forensic Medicine at Mamata Medical College & Hospital, Khammam; Telangana. Proforma specially designed for this purpose was used and filled in each case after examination.

Detailed data collected from victims, relatives accompanied deceased, hospital records, inquest, autopsy reports etc.

Observations and Results:

A total of 38 cases of lightening were recorded during 3 year period of study from2013 -2015 with maximum incidence 16 cases in 2015. Most of the cases occurred during the months of May to September with peak incidence during June– July (76.31%).

Out of total 2262 autopsies done during the study period, 38 victims died due to lightning. The incidence of lightening has increased every year from 2013 10 cases (1.39%) to 2014, 12 cases (1.59%) and 16 cases (2.02%) in 2015.

Maximum number of cases 16 (47.52%) were from 31-40 years age group, followed by 12 cases (31.57%) in 21-30 years, 5 cases (13.15%) in 41-50. The minimum age of the victim is 13 years and maximum was 60 years.

In our study male 30 (78.94%) victims were predominated females 08 (21.05%) and Female: Male is being 26:66. (Table 1)

Majority of victims were from Hindu community 28 (73.68%) followed by Christian 6 (15.78%) and least were from Muslim community 4 (10.52%). In this study Majority of victims 29 (76.31%) were from rural population.

In present study married victims 31 (81.57%) outnumbered unmarried 07 (18.42%). As per educational status, most of the victims were illiterates 20 (52.63%).

Among literates 10 (26.31%), primary education 4 (10.52%), secondary education 2 (5.26%) and intermediate and graduate accounts for one case each. In our study maximum victims belong to low socioeconomic 31(81.57%) group followed by middle class six (15.78%) and one (2.63%) case from high class.

Farmers were top among the occupations, 28 cases (73.68%) followed by laborers 06 (15.78%) and students 03 (7.89%). (Fig. 2)

Maximum lightening cases (94.73%) occurred during June to September months of monsoon and minimum 2 (5.26%) cases are encountered in May. (Fig. 3)

Regarding day of incidents, most cases 18 (50.00%) occurred on Saturday followed by 13 (34.21%) on Sunday and 2 (5.63%) on Wednesday. (Table 2) Most of the cases 24 (63.15%) occurred in the afternoon hours between 12noon and 3 pm. About 10 incidents had occurred in the late afternoon and evening between 3pm and 6pm. (Fig. 6)

Open field is the most vulnerable place for lightning strikes accounting for 27(71.05%) cases. Persons standing beneath a tree or under a shade comprised 9 (23.68%) and 2 (5.26%) cases were recorded near house. (Fig. 1)

In this study maximum cases 34(89.47%) were brought dead and did not receive the treatment, followed by Two cases (5.26%), who died after one day and 2(5.26%) victims were survived after hospitalization. (Table 3) The pattern of injuries were noted as burns over body in 36 (94.73%) cases with maximum cases having arborescent burns or filigree burns 26 (68.42%), followed by linear burns 8(21.05%), surface burns two (5.26%) cases and burns injuries are not seen in two cases. (Fig. 4)

In present study majority of 17(44.73%) victims had burns over the thorax, front and back, followed by both upper limbs 8 (21.05%), front and back of abdomen, both lower limbs 6 (1578%). Face and head are involved in only 2 (5.21%) cases. (Fig. 5) Majority of the burn injuries 26 (68.42%) were superficial burns.

Magnetization of the metal worn noted in 15 (39.47%) cases. Metallic objects marks such as tooth fillings, spectacles, belts, buckles and coins were observed. Singed hair was noted in 18 (47.36%) cases. There was often a smell of singeing or burning of the body and clothing, observed in 12 (34.28%) cases.

We also observed head injury, caused either by the lightning strike itself or by falling to ground in 10 (28.57%) cases in our study. In 16 (42.0%) cases bleeding was noted either from one or both ears. Evidence of blast effect was also found in 11 (31.42%) cases.

Post-mortem findings were nonspecific and majority showed evidence of severe congestion of all internal organs and pulmonary edema was also common. Petechial hemorrhages were seen in the brain and the spinal cord. In present study cardiopulmonary arrest following lightning was most common in

28 (77.77%) cases which leads to immediate death of the victim followed by burns six (16.66%) and one (2.77%) cases each by head injury and pulmonary infarct. (Table 4)

Discussion:

The incidence of lightening has increased from 2013 10 cases (1.39%) to 2015 16 cases (2.02%).This was evident that the incidence of lightening and the fatalities are much higher in this region.

Maximum number of cases 16 (47.52%) were from 31- 40 years age group, followed by 12 cases (31.57%) in 21-30 years, 5 cases (13.15%) in 41-50 and no cases at both extremes of the age. These were consistent with other author's findings. [2, 5] This was due to fact that adults are involved in outdoor activities in spite of bad weather and working class people belong to this age group.

In our study 30 cases (78.94. %) were of males whereas females amounted to 08 [21.05%] and ratio of female to male is being 26:66. Males were involved in outdoor activities and hence more prone for lightening. Similar findings are observed by other studies. [1, 3]

Majority of victims were from Hindu community followed by Christian and least were from Muslim community. These were similar with Indian studies. This could be due to most of the population in India is Hindu community.

Majority of victims (76.31%) were from rural population and (23.68%) cases were from urban population. These are consistent with other studies. [4, 5] This might be due to victims were working at open field even during high risk period of lightening; primary occupation is agriculture which is rain dependent.

In present study married victims (81.57%) outnumbered unmarried **(**18.42%). [3, 6] The married population actively involves in work for earning of money for maintainace of their families. As per educational status, most of the victims were illiterates and literates include literates (26.31%), primary education (10.52%), secondary education (5.26%) and graduate, consistent with other authors. [1, 4]

This is due to the lack of education there are mainly depending on agriculture based woks for source of income. Majority victims were belongs to low socioeconomic group followed by medium and one case from high class. [1, 4]

This could be explained that the low socioeconomic group more exposed for lightning fatalities due to lack of permanent source of income as job, poor living standards, illiteracy, agricultural daily activities in open fields even during thundering.

In our study maximum lightening (94.73%) cases were seen in the rainy season in our region. Minimum (5.26%) cases are occurred during May. [4, 5, 13] The most probable reason might be more reporting of cases during rainfall season.

As per day of incidents, most cases 18[50.00%] occurred on Saturday followed by (34.21%) on Sunday and Wednesday (5.63%). Similar findings occur in other studies also. [4, 12] The most probable reason is that people indulge in more outdoor activities on weekends and holidays. Like other studies in our study also most of the cases occurred in the afternoon between 12-3 pm. [6, 9,11]

This is the time for most of the people engaged in their work more susceptible and also times for most the people to finish their daily work and go back to respective home, hence more susceptible to strike by lightning.

Farmers were top among the occupations [6, 8] because most common outdoor activity carried in our region is farming and they lack proper place to hide during lightening. Open field is the most vulnerable place for lightning strikes accounting for (71.05) cases. Persons standing beneath a tree or under a shade comprised of (23.68%). [8, 9]

The tendency of lightning striking a tall object in an open space and shelter under a tree is by no means safe, particularly if they are carrying or wearing something that may attract lightning. Maximum cases 89.47% were brought dead followed by 5.26% who died after 1 day and 02 were survived after hospitalization. Similar findings were observed by other authors. [8, 9, 13] The reason is after lightening, ventricular arrhythmias are most common effect on the body and this is life threatening condition needs immediate treatment by skilled persons.

We found burns over body in 94.73% cases. These were consistent with authors. [9, 10] A superficial or deep burn marks are the point of discharge from the body to the earth or metal objects may burn the underlying skin or mark the skin due to heat of the electrical arching. The track of the discharge can be traced by these skin burns and damage to the clothing.

The external lesions in lightning mostly take the form of unique arborescent injuries noted in 26 (68.42%) cases. This was due to deposition of copper on the skin as a result of rupture of smaller blood vessels and breaks down of red cells in the skin capillaries along the path of the electric current. [10, 14] The other Pattern of injuries in lightning is linear burns in 21.05% cases.

They are varied from 6-25 mm in width over the victim's body observed. These were found on moist surfaces of the skin, because moist skin offers less resistance than dry skin similar to other studies. [10, 11]

In this study the surface burns were found in 5.26% cases and burns injuries are not seen in 5.26% cases like others. [9, 12] The strike survivors 5.26% were thrown away by the struck of lightning suffered with shock found unconscious condition, after hospitalization recovered with retrograde amnesia. Similar findings were seen in other studies. [10, 12]

In present study 42.10% cases bleeding was noted either from one or both ears. Evidence of blast effect was also found in 31.57% cases. [10, 13] Blast effects observed in the form of tearing of clothing, the effects also observed on the trees showing areas of scorched leaves and vegetation in the vicinity of the scene of death. Metallic objects in the area get fused or become magnetized or nylon underclothing melts and objects at a distance of 100 feet or more struck.

Majority of victims 44.73% found burns over the thorax front & back, right shoulder and right upper limb and least over the face and head consistent with observations of other researchers. [9, 12] This might be due to discharge of high voltage direct electricity bizarre phenomenal presentations of lightning during thundering within the short period.

Majority of the burn injuries 68.42% were superficial burns. [10, 12] This was due to rapid, short period exposure of the body to lightning. Magnetization of the metal was seen 39.47% cases. [12, 13]

Metal objects may burn the underlying skin mark due to heat of electrical arcing which is true burns. This is due to high voltage of direct current and was a usual finding in lightening. Metallic objects marks seen on such as tooth fillings, spectacles, belts, buckles, wrist watches, metal hooks or zip and coins are observed.

Singed hair was noted in 47.36% cases and the clothing got burnt or torn wide apart, observed in 47.36% cases. These were similar to authors. [11, 12]We found head injury, caused either by the lightning strike itself or by falling to ground was observed in 31.57% cases. This was consistent with studies by others. [10, 12]

Post-mortem findings were nonspecific, showed evidence of severe congestion of all internal organs. [13, 14] Cardio-pulmonary arrest following lightning was most common in 77.77% cases, leads to immediate death of the victim followed by burns 16.66% and 2.77% each one by head injury and pulmonary infarct. Similar findings were observed by other studies. [15, 16]

The initial response of lightning stroke is paralysis of the vital centers, especially respiratory centers, resulting in apnea, ventricular fibrillation or cardiac arrest. Cardiac arrhythmias are very common with lightning strokes.

Conclusion:

The incidence of lightening and the fatalities are much higher in this region. Males, Married, Hindu community from rural area belonging to low socioeconomic, illiterate, encounter during rainy reason with peak incidence during June–July farmers at open field, shelter under tree are vulnerable circumstances. Cardiopulmonary arrest following lightning was most common cause of death.

These cases are Unpredictable but preventable with proper precautions and with better public education, arrange lightening protection devices, awareness of common people.

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Table 1: Age & Gender wise Distribution of Victims

Age grps (Yrs.)	Males	Females	Total (%)
0-10	0	0	0(00)
11-20	1	0	1(2.63)
21-30	11	3	14(36.84)
31-40	16	5	21(47.52)
41-50	1	0	1(2.63)
Total	30	8	0(100)

Table 2: According to Days in Week

Day	Cases	%
Monday	0	00
Tuesday	0	00
Wednesday	2	5.63
Thurs day	0	00
Friday	0	00
Saturday	18	50.00
Sunday	13	34.21

Table 3: Survival Period

Survival period	Cases	%
Brought dead	34	89.47
<1 hour	2	5.26
1-24 hours	2	5.26
>24hours	0	00
Total	38	100

Table 4: Cause of Death in Lightning

Cause	Cases	%
Cardio-pulmonary arrest	28	77.77
Burns	6	16.66
Head injury	1	2.77
Pulmonary infarct	1	2.77
Total	36	

Fig. 1: Place of Incidence

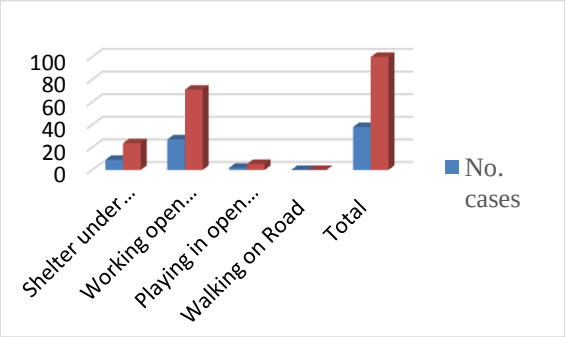


Fig. 2: Occupation wise Distribution

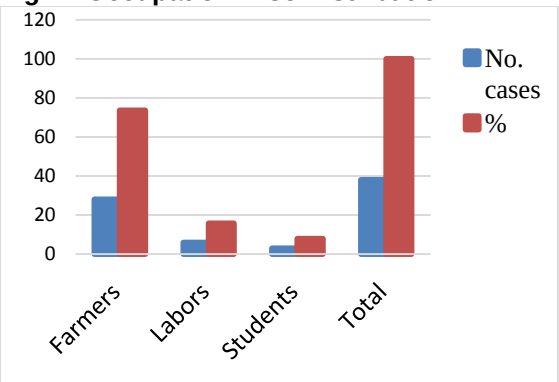


Fig. 3: Month Wise Incidence of Lightning Victims

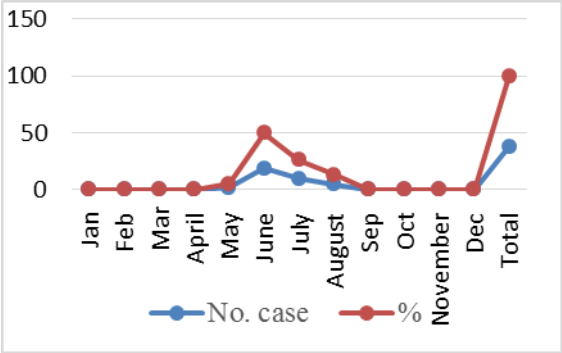


Fig. 4: Pattern Distribution of Injuries in Lightning

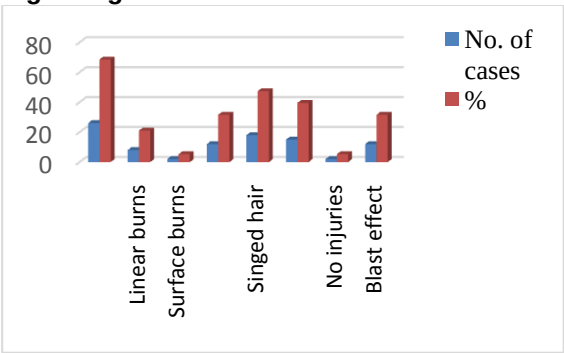


Fig. 5: Surface Burn Injuries in Victims

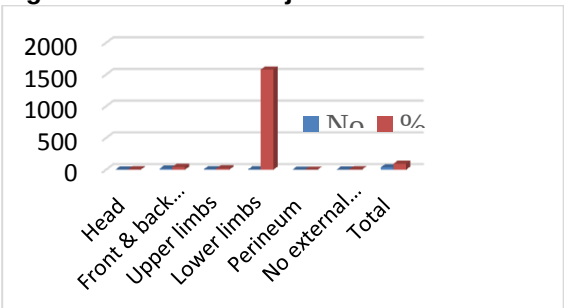
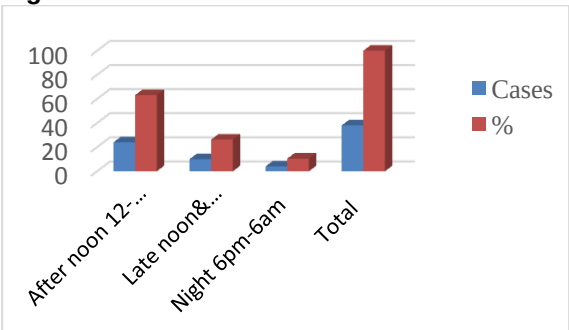


Fig. 6: Time of Incidence



Original Research Paper

Application of Software Tool for Sex Determination from Calcification Pattern of Rib Cartilage in Digital Radiographs

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Abstract

Sexual dimorphism can be studied by observing calcification pattern of rib cartilage, which is gender specific and have peculiar changes those occur at various ages. Various studies have been carried out in past for identifying specific gender from calcification pattern of rib cartilages. Present study was conducted at GCS Medical College, Hospital & RC, Ahmedabad, comprising of total 2291 digital radiographs of chest region (1240 males, 1051 females) of subjects of known age ranging from one day to 92 years. These radiographs were in "jpg format" and observed with "Microsoft Office Picture Manager 2007" by two methods- method I & method-II. Certain technical applications were incorporated in method-II to know the accuracy of computer software in interpretation of digital radiographs for gender determination. After analyzing and applying suitable statistical tests it was concluded that use of computer software for observing calcification of costal cartilages can yield better accuracy in determination of gender. To the best of our belief and knowledge such type of study is hardly reported in bio-medical journals.

Key Words: Calcification; Microsoft Office Picture Manager; Rib cartilage; Sexual dimorphism

Introduction:

Sex determination in clinical Forensic Medicine is not routinely used as from the external/ physical examination it can be easily established. Radiographs of chest region are always not easy to established the sex if mammary shadow is not present like in mass disaster, fragmented body. [1]

So preparing a good data base from living subjects by observing calcification pattern of rib cartilage on radiographs proves to be useful. Various studies also have been undertaken in past to observe patterns of calcification at rib cartilages, which are reported to be useful, convenient and sex specific. [2]

Present study was carried out to evaluate specific pattern of calcification for identification of sex with the help of computer software (Microsoft office picture manager 2007).

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Aims and Objectives:

1. To observe the pattern of calcification at the costo-chondral junction in both sexes in digital radiographs
2. To correlate the average age of appearance of sex specific calcification pattern of rib cartilage;
3. To compare the findings of present study with different studies &
4. To evaluate accuracy of two different methods i.e. without and with incorporation of computer software) in above context.

Materials and Methods:

Present retrospective cross-sectional study was undertaken after approval by Ethics committee of GCSMCH & RC, Ahmedabad. Soft copy of digital radiographs of chest region collected in "jpg format" (taken for non-research diagnostic purpose) available in Department of Radio diagnosis, GCSMCH & RC Ahmedabad from 1-02-12 to 30-04-12 were considered for the purpose of study.

In this study we included Subjects of known sex and age and excluded all Subjects with history of trauma to chest region, congenital abnormality and any disease affecting thoracic region. Samples include patients residing in Ahmedabad city. However, it cannot be considered as geographical population because specific duration of habitat could not be established with absolute certainty.

After blinding digital radiographs were observed by two methods:

- **Method I:** Pattern of calcification at costo-chondral junction of 2nd ,3rd, 4th ribs on both sides in both sexes in digital radiograph of 3520 (W) X 4280 (H) pixel and 14% zoom in was observed in Microsoft Office Picture Manager software 2007, and results were tabulated.
- **Method II:** Digital radiographs observed by method I were cropped and resized to 150% using Microsoft Office Picture Manager software 2007 that lead to 6426 (W) X 5220 (H) size of the images and observed in 10-20% zoom in, which makes any digital image more informative even for small area of interest in question.

After unblinding the data, radiographs were categorized into age groups and suitable statistical tests were applied by using SPSS software version 15.0. Calcification at costo-chondral junction was classified mainly into four patterns as mentioned in the study done by Olga Rejtarova et al. [3]

Type I – Peripheral Pattern (**P**): characterized by calcification of the inferior and superior Costal-cartilage margin. (Fig. 1)

Type II a – Central Lingual Pattern (**Cl**): characterized by pyramidal-shaped central tongues of calcification beginning in the fossae costarum. (Fig. 3)

II b- Central Globular Pattern (**Cg**); characterized by centrally-placed, smoothly contoured globules of calcification

II C – Central Lingual and Globular Pattern (**Clg**)

Type III – Mixed (Peripheral and Central) Pattern (Fig. 2)

Type IV – Indifferent Pattern: Incipient calcification without differentiation into sex specific pattern

Observations and Results:

Out of total 2291 radiographs of known age and sex in the present study, 54.12% (n=1240) were males and 45.88% (n=1051) were females. Maximum number of subjects 17.58% (n=403) belonged to age group 31-40 years as compared to rest. (Table 1)

In present study cases of age range 21-60 years outnumbered other age groups. In age group 21-30 years, out of 160 radiographs of male, calcification was observed in 50 radiographs by method I; while the number increased to 86 by method II. In age group 31-40 years, out of 213 radiographs of male, calcification was observed in 153 radiographs by method I; while the number increased to 186 by method II. In age group 41-50 years, out of 183 radiographs of male, calcification was observed in 158 radiographs by method I; while the number increased to 183 by method II. In age group 51-60 years, out of 197 radiographs of male, calcification was observed in 191 radiographs by method I; while the number increased to 197 by method II. (Table 2)

In other age groups very little or no increase in number of radiographs showing calcification was observed by method II. For comparison of radiographs showing calcification by method I and by method II, Chi-square test was applied. It was found that calcification observed by method I and by method II was significantly different ($p<0.05$) in age group 21-60 yrs. Below the age of 20 years and above 91 years, no statistically significant difference was found ($p>0.05$). (Table-2)

In case of female cases of age range 21-50 years outnumbered other age groups. In age group 21-30 years, out of 136 radiographs of female, calcification was observed in 55 radiographs by method I; while the number increased to 117 by method II.

In age group 31-40 years, out of 190 radiographs of female, calcification was observed in 164 radiographs by method I; while the number increased to 190 by method II. In age group 41-50 years, out of 213 radiographs of female, calcification was observed 193 radiographs by method I; while the number increased to 213 by method II. In other age groups very little or no increase in number of radiographs showing calcification was observed by method II. (Table 3)

For comparison of radiographs showing calcification by method I and by method II, Chi-square test was applied. It was found that calcification observed by method I and by method II was significantly different ($p<0.05$) in age group 11-50 years. Below the age of 10 years and above 51 years, no statistically significant difference was found ($p>0.05$). (Table 3) In our study Type I number of digital radiographs showed calcification by Method II were more as compared to Method I in age group 11 to 70 years.

In age group 1 day -10 years and more than 71 years number of radiographs observed by two methods were same.

In Type II number of digital radiographs showed calcification by Method II were more as compared to Method I in the age group 11 to 50 years. Age group 1 day -10 years, 71-80 years and age above 90 years showed equal number of radiographs by two methods. Age group 51-

60 years, 61-70 years and 81-90 years showed less number of cases by Method II.

In Type III number of digital radiographs showed calcification by Method II were more as compared to Method I in age group 21 to 70 years. In age group 1 day -20 years and age more than 71 years number of radiographs observed by two methods was same. In Type IV number of digital radiographs observed by Method II was more or equal to Method I, except in age group 11-20 years which showed less number of cases by Method II. (Table 4)

In this study males showed Type I calcification pattern (Fig. 1) predominantly (61.5%) followed by Type III (Mixed) pattern (Fig. 2] (19.7%) while females primarily showed Type II calcification pattern (89.2%) followed by Type IV pattern (Indifferent). On applying Chi-square test, *p*-value was <0.0001. (Table 5)

Discussion:

It is noteworthy that the sample size of present study is more than two times the other studies. [3-5] Study by Rejtarová O et al [3] comprised of 1044 radiographs, Navani et al [4] comprised of 1000 radiographs and Khatri et al [5] comprised of 1000 radiographs.

Present study also includes radiographs of age less than 10 years which were not included in previous two studies. [3, 4]

Furthermore present study incorporated application of a computer soft-ware [Microsoft Office Picture Manager 2007], which none of the authors [3-5] used or mentioned about in previous studies. It is obvious from table-2 and table-3 that the "hypothesis of no difference" in both sexes by two different methods is rejected; meaning thereby there is significant difference ($p<0.05$) in calcification observed by method I and method II. Number of radiographs showing calcification by method II in the present study 1738 (75.86%) is quite higher than observed by Rejtarová O et al [3] 538 radiographs (51.53%).

However, Navani et al [4] reported calcification in 776 radiographs (77.60%), which is just higher than the present study.

It was probably because Navani et al [4] did not include age group up to 10 years whereas present study included 217 radiographs (9.47%) of same age group and none of them showed calcification (calcification least likely in this age group). If age group 1 day- 10 years in present study is excluded from calculation, it becomes (83.79%), which comes out to be more than that of Navani et al. [4]

On evaluation of the differences between method I and II as per table- 2 and 3; it is evident that in age groups 11-60 years in both sexes, 218 more radiographs (15.39%) showed calcification by method II as compared to method I. This increase in number manifests in all the patterns of calcification such as in Type I (474 subjects by method I to 545 in method II), Type II (774 to 885), Type III (191 to 211) and in Type IV showed 76 to 97 cases.

In present study in age group 51-70 yrs, the number of subjects showing Type II calcification pattern by method II were less as compared to method I, this is probably due to shifting of cases from Type II to Type I when observed by method II.

On analysis it is evident that only 2 female subjects detected in Type I pattern of calcification by method II. (Table 6) Thus it can be safely inferred that observing digital radiographs as compared to non-digital one for sex determination is more accurate. Furthermore a digital radiograph observed with computer software application in the present study is either at par or has yielded better results than other methods.

Comparison of findings of present study by method II with previous studies showed that all three studies individually and collectively show Type I as male and Type II as female pattern of calcification. (Table 7)

Number of cases of male subjects showing Type I pattern calcification was less than others. This variation can be explained by three possibilities:

- Sample population in all three studies belongs to different geographical region and the sample size is also different.
- Samples in other studies were non digital radiographs, whereas in the present study.
- Samples were digital radiographs; yielding better visualization and hence better interpretation.

In present study radiographs of male showing Type III pattern were much higher as compared to others, meaning thereby that method II is better in differentiating Type I from Type III pattern in radiographs of male. In the present study, radiographs of Type IV pattern in both genders were fewer as compared to other two studies, implying that method II is better in excluding the Indifferent pattern.

Conclusion:

It is safe to conclude that different patterns of calcification at rib cartilage observed in digital radiographs are sex specific. That is to say male subjects predominantly show Type I pattern and female subjects predominantly show Type II pattern. Calcification at rib cartilage

starts at the age of 21 years in both sexes and increases with age.

Distribution of sex specific patterns of calcification in various age groups was consistent with observations in previous studies. Method II more accurately differentiate Type I (male) pattern of calcification of rib cartilage.

Observing patterns of calcification at rib cartilage of 2nd, 3rd, 4th ribs on both sides in both sex in digital radiographs in Microsoft Office Picture Manager 2007 after cropping and resizing the image to 150% [that leads to size of image 6426 (W) X 5220 (H) and observing in 10 -20% zoom in yields better results as compared to observing original images.

Hence incorporation of such useful software or any other similar suitable software technique for sex determination in medico-legal cases or even for research purposes seems to be useful.

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Fig.1: Typical Peripheral Pattern (Type-I) of Calcification [male aged 58 year] by Method II

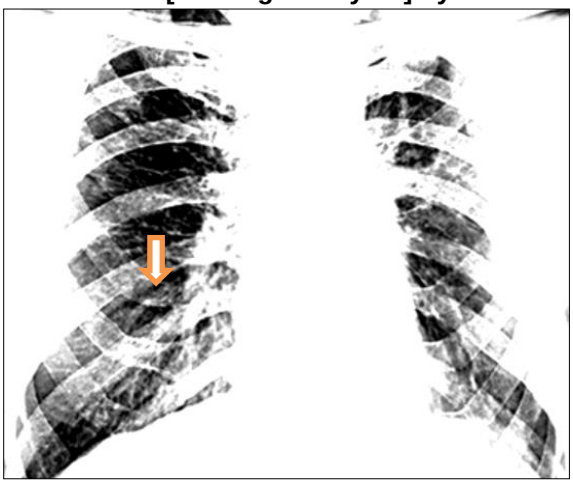

Fig. 2: Mixed Pattern Calcification (Type III= Type I+ Type II) Swiss cheese Pattern [Male Aged 66yrs] By Method II

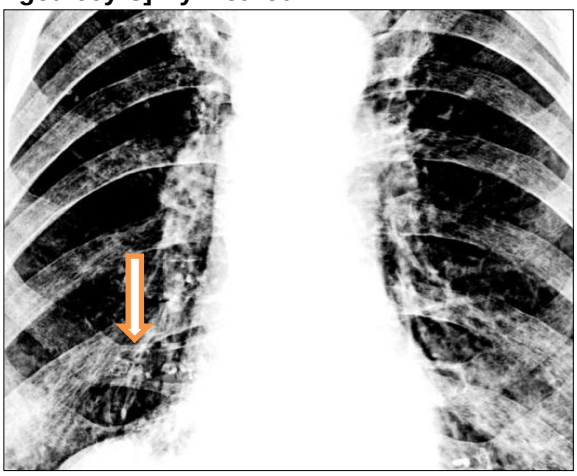

Fig. 3: Central lingual Pattern (Type-II a) of Calcification [Female aged 65 years] by Method II

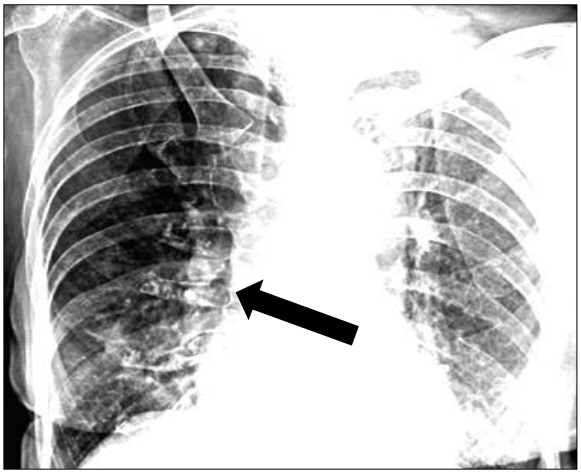

Fig. 4: Crab Claw Pattern (Type-II A) Calcification [Female Aged 70 Years] By Method II

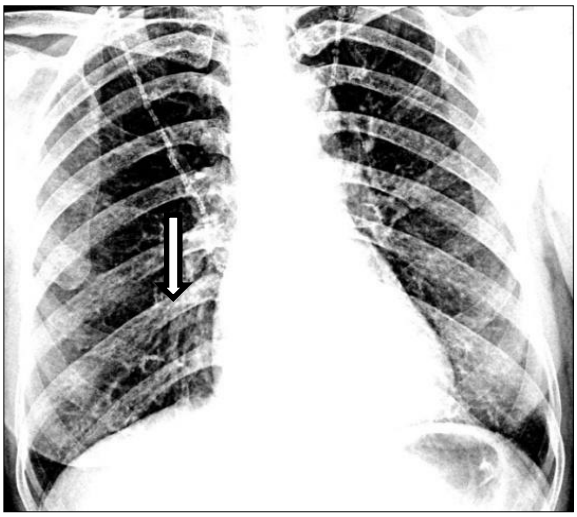

Table 1: Age and Gender Wise Distribution of Subjects

Age grps (Yrs)	Male (%)	Female (%)	Total (%)
1 day-10 yrs	136 (5.94)	81 (3.53)	217 (9.47)
11-20	126 (5.49)	124 (5.41)	250 (10.90)
21-30	160 (6.98)	136 (5.93)	296 (12.91)
31-40	213 (9.29)	190 (8.29)	403 (17.58)
41-50	183 (7.99)	213 (9.29)	396 (17.28)
51-60	197 (8.60)	140 (6.11)	337 (14.71)
61-70	147 (6.42)	121 (5.28)	268 (11.70)
71-80	66 (2.89)	39 (1.70)	105 (4.59)
81-90	11 (0.48)	07 (0.30)	18 (0.78)
>91	01 (0.43)	00	01 (0.44)
Total	1240 (54.12)	1051 (45.87)	2291 (100)

Table 2: Male Subjects Showing Calcification in Method I and Method II

Age grps (Yrs)	Calcification in males			
	Male	Method I (%)	Method II (%)	*p*- value
1 day-10 yrs	136	00	00	0
11-20	126	01 (0.79)	06 (4.76)	>0.05
21-30	160	50 (31.25)	86 (53.75)	<0.05
31-40	213	153 (71.83)	186 (87.32)	<0.05
41-50	183	158 (86.33)	183 (100)	<0.05
51-60	197	191 (96.95)	197 (100)	<0.05
61-70	147	147 (100)	147 (100)	>0.05
71-80	66	66 (100)	66 (100)	>0.05
81-90	11	11 (100)	11 (100)	>0.05
>91	01	01 (100)	01 (100)	>0.05
Total	**1240**	**778 (62.73)**	**883 (71.20)**	**<0.05**

Table 3: Female Subjects Showing Calcification in Method I and Method II

Age grps (Yrs)	Female	Calcification in females		
		Method I (%)	Method II (%)	*p*- value
1 day-10 yrs	81	00	00	0
11-20 yrs	124	15 (12.09)	28 (22.58)	<0.05
21-30 yrs	136	58 (42.64)	117 (86.02)	<0.05
31-40 yrs	190	164 (86.31)	190 (100)	<0.05
41-50 yrs	213	193 (90.61)	213 (100)	<0.05
51-60 yrs	140	140 (100)	140 (100)	>0.05
61-70 yrs	121	121 (100)	121 (100)	>0.05
71-80 yrs	39	39 (100)	39 (100)	>0.05
81-90 yrs	07	07 (100)	07 (100)	>0.05
>91 yrs	00	00	00	0
Total	**1051**	**737 (70.11)**	**855 (81.35)**	**<0.05**

Table 4
Comparison of Calcification Patterns in Both Sexes by Two Different Methods of Observation

Age grps(Yrs)	Type I		Type II		Type III		Type IV	
	Method I	Method II	Method I	Method II	Method I	Method II	Method I	Method II
1day-10yrs(217)	00(0.00)	00(0.00)	00(0.0)	00(0.0)	00(0.0)	00(0.0)	00(0.00)	00(0.00)
11-20 (250)	0(0.0)	04(1.60)	12(6.40)	29(11.6)	00(0.0)	00(0.0)	04(1.60)	01(0.40)
21-30 (296)	33(11.14)	64(21.62)	53(17.90)	113(38.17)	07(2.36)	11(3.71)	15(5.06)	15(5.06)
31-40 (403)	88(21.83)	102(25.31)	184(45.65)	205(50.86)	39(9.67)	45(11.16)	06(1.48)	24(5.95)
41-50 (396)	100(25.25)	109(27.52)	201(50.75)	223(56.31)	35(8.83)	45(11.36)	15(3.78)	19(4.79)
51-60 (337)	143(42.43)	154(45.69)	144(42.72)	139(41.24)	30(8.90)	30(8.90)	14(4.15)	14(4.15)
61-70 (268)	85 (31.71)	87(32.46)	131(48.88)	128(47.76)	39(14.55)	39(14.55)	13(4.85)	14(5.22)
71-80 (105)	22 (20.95)	22(20.95)	40(38.09)	40(38.09)	35(33.33)	35(33.3)	08(7.61)	08(7.61)
81-90 (18)	03 (16.66)	03(16.66)	9(50.00)	8(44.44)	05(27.77)	05(27.77)	01(5.55)	02(11.11)
> 90 (01)	00 (0.00)	00(0.0)	00(0.00)	00(0.0)	01(100)	01(100)	00(0.00)	00(0.0)
Total (2291)	474	545	774	885	191	211	76	97

Table 5: Gender Wise Distribution of Different Patterns of Calcification by Method II

Gender	Type I (%)	Type II (%)	Type III (%)	Type IV (%)	Total (%)	*p*- value (Chi-square test)
Male	543(61.5)	122(13.8)	174(19.7)	44(4.98)	883(100)	p<0.0001
Female	02(0.2)	763(89.2)	37(4.3)	53(6.2)	855(100)	p<0.0001

Table 6: Gender Wise Comparison of Different Patterns of Calcification by Method I and Method II

	Method I		Method II	
Pattern	**Male**	**Female**	**Male**	**Female**
Type I (%)	470 (60.41)	4 (0.54)	543(61.5)	02(0.2)
Type II (%)	126 (16.19)	648 (87.92)	122(13.8)	763(89.2)
Type III (%)	151 (19.40)	40 (5.42)	174(19.7)	37(4.3)
Type IV (%)	31 (3.98)	45 (6.10)	44(4.98)	53(6.2)
Total (%)	778 (100)	737 (100)	883(100)	855(100)

Table 7:Comparison of Distribution of Patterns of Calcification with Previous Studies

Study	Type I		Type II		Type III		Type IV	
	Male	Female	Male	Female	Male	Female	Male	Female
Present study- Method II	61.49%	0.23%	13.81%	89.24%	19.70%	4.33%	4.98%	6.19%
Rejtarová O et al [3]	92.91%	0.38%	0%	77.30%	1.49%	8.84%	5.59%	13.46%
Navani S et al[4]	83.33%	4.21%	6.56%	82.36%	0%	0.78%	10.10%	12.63%

Original Research Paper

An Overview of Custodial Deaths in Pune Six years Retrospective Study

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Abstract

Numbers of deaths in custody are increasing every year. It is important to carry out research studies in this field. In this six year retrospective study, all cases of custodial deaths brought for post-mortem examination during year 2008 to year 2013 at Forensic Medicine department of B.J.G. Medical College, Pune were analyzed to study mortality pattern. Total 118 cases were studied which showed male preponderance with 107 males and 11 females. Out of 118 cases 109 died in jail and 09 deaths occurred in police custody. There were 96 cases of natural deaths, 18 cases of unnatural deaths and in 04 cases manner of death was undetermined. Out of natural deaths maximum cases died of respiratory diseases (42), of which maximum cases (22) were of pulmonary tuberculosis. Suicide was the most common unnatural manner of death. Major reasons behind custodial deaths were mainly unawareness and carelessness on the part of custodial authorities.

Key Words: Custodial deaths, Human rights, Tuberculosis, Suicide, Unnatural death

Introduction:

Any death in police custody is a serious matter causing public disquiet. Custodial deaths have become a major human right issue in world including India. [1] According to prison statistics of India by National Crime Records Bureau, total 1597 custodial deaths occurred in year 2013 as compared to 1332 in year 2011 and 1471 deaths in year 2012. [2-4] This shows that total number of deaths in custody has been increasing continuously.

Most of the times such deaths are considered as unnatural because the person in the custody is solely dependent on the custodial authorities for all of his/her constitutional rights including access to health care. On the contrary it is found that majority of deaths in custody are natural. [5] Hence post-mortem examination of custodial deaths requires prior organisation, planning and meticulous approach to put pause on all the rumours and to give best possible opinion regarding cause and manner of death.

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National Human Rights Commission of India has hence laid down strict guidelines to be followed after custodial deaths. It is found that major reasons behind custodial deaths are mainly unawareness and carelessness on the part of custodial authorities on the health status of the inmates and poor condition of the cells. [5]

On the other hand unnatural deaths though less common as compared to natural deaths are equally important because they lead to public and media speculations against custodial authorities. [1]

From previous studies it is clear that many of these deaths are premature deaths and can be prevented with proper care and treatment. However knowledge and data regarding such deaths is important to focus attention on prison medical services and to facilitate the implementation of preventive programs. [6] Number of studies has been carried out on custodial death by various international agencies and authors of western countries, but only few studies have been done in India till date. [5] More and more studies in this field are required in future.

Hence we have conducted this study to highlight issues relating to deaths in custody.

Material and Method:

The present study is a six year retrospective study. The study was conducted at department of Forensic Medicine and Toxicology, B.J. Government Medical College, Pune. Data was collected from records of

custody deaths that were brought for post-mortem examination during year 2008 to year 2013. The data was then analyzed for age, sex, cause of death, manner of death, pre-existing illness and place of death.

Observations and Results:

Total 118 cases were studied in this six year retrospective study. (Fig. 1) This Study showed male preponderance with 107 males and 11 females. (Fig. 2) Out of 118 cases 109 died in jail and 09 deaths occurred in police custody. (Fig. 3)

Maximum cases of males (20) were from age group of 31-35 years and of females (04) were from more than 61 years age group. (Fig. 4) Maximum age of male studied was 79 years and female was 76 years.

With respect to manner of death, 96 cases were natural deaths, 18 cases were of unnatural deaths and in 04 cases manner of death was undetermined. (Fig 5)

Out of natural deaths maximum cases died of respiratory diseases (42), of which maximum cases (22) were of pulmonary tuberculosis. (Table 1) Suicide was the most common unnatural manner of death with 10 cases, followed by accidental deaths consisting 06 cases and homicidal being the least common with 02 cases. (Table 2)

Out of 118 cases 16 cases were HIV positive. As far as pulmonary tuberculosis is concerned 11 out of 22 cases i.e. 50% cases were associated with HIV infection.

Discussion:

Death occurring in some form of custodial detention is commonly known as death in custody, such as police cell or prison. It should also include deaths resulting from police or prison officers attempting to detain a criminal or a person escaping or attempting to escape from police custody or prison. [7]

In this study we have retrospectively analyzed all cases of custodial deaths which came to department of Forensic Medicine for post-mortem examination during the period 2008 to 2013. Study showed male preponderance with 107 male cases (91%). This finding was consistent with other studies conducted previously. [6, 8-12]

With respect to manner of death out of 118 cases maximum cases (97) were of natural deaths. Other researchers also found that natural deaths are more common than unnatural deaths. [5, 6, 9, 13, 14] But some workers reported that unnatural suicidal deaths are more prevalent. [1, 10, 15-17]

Among the natural deaths most of the deaths were due to respiratory system involvement with pulmonary tuberculosis being commonest. This finding was supported by various researchers. [6, 13, 18] However Wobeser et al [17] and Frueshwald et al [19] found that majority of deaths were due to Cardio-vascular diseases.

In our study out of 118 cases 16 cases (13.5%) were HIV positive. As far as pulmonary tuberculosis was concerned 11 out of 22 cases i.e. 50%. Bardale et al [6] found that 14.08% cases were associated with HIV in his study.

From above observation it was clear that prisoners constitute high risk group for acquisition of tubercular infections. This is attributed to overcrowding, closed living conditions, insufficient ventilation, poor living conditions and poor nutrition. [20]

According to prison statistics India by National Crime Record Bureau 2013 there are total 1391 prisons across India, having authorised capacity of 3, 47, 859.

On the contrary Indian prisons are overcrowded with 4, 11, 992 prison inmates, exceeding the authorised capacity having occupancy rate of 118.4%. [2] In present study suicide was the most common unnatural manner of death with 10 cases, followed by accidental deaths consisting 06 cases and homicidal being the least common with two cases.

The present study is in line with that of Bansal et al [13] who found that suicide is the most common unnatural manner of death, however they found, fall from height as the cause in most of suicidal cases as opposed to hanging in present study. Hanging was also found to be most common method of suicide in custody by Agnihotri et al. [1]

This study showed two cases of homicides with cause of death as shock due to peritonitis in case of blunt injuries in one case and asphyxia due to ligature strangulation in another case. According to study by Bansal et al [13] majority of homicidal deaths were due to trauma. They also reported one case of homicidal burns in judicial custody.

All these cases be it natural deaths or unnatural deaths show some sort of carelessness and disrespect for human life on the part of authorities.

Authorities are not aware about any history related to health of inmates and they take action only when the condition deteriorates and the inmates ultimately succumb to death. [5]

Conclusion and Suggestions:

There should be responsibility on the part of custodial authorities and the public to regularly review causes and rates of death among people in police custody and to look for the preventive measures. It is also evident that deaths occurring in custody are mostly natural ones; where previous history of medical, surgical and psychiatric illness is present but authorities are unaware of those facts. Hence we recommend following suggestions in addition to suggestions of previous studies:

1. Complete pre arrest medical check-up as per NHRC guidelines. This must include screening of diseases like HIV, HBV, Tuberculosis, Diabetes, Hypertension and previous psychiatric illness.
2. Custodial authorities should maintain proper registers regarding health issues of each inmate.
3. A surveillance team of qualified persons under the supervision of collector/ executive magistrate consisting of physician, surgeon, medico legal expert, and food inspector should be appointed to regularly inspect health care facilities, accommodation facilities and quality of food supplied.
4. Closed circuit television cameras (CCTV) should be installed in all cells and police lockups to have the check on the activities of inmates and custodial authorities.
5. Timely education and training program should be organised by custodial authorities with the help of nearest government medical college to address the health issues of jail inmates and to increase health awareness. This should also include health check up by medical professionals.
6. Awareness cum training programs should be undertaken by NHRC to make prison inmates aware about human rights.
7. Appreciating the problem of overcrowding of jail inmates, it is needed to increase number of jails to accommodate extra burden.

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Fig. 1: Year wise Distribution of Cases

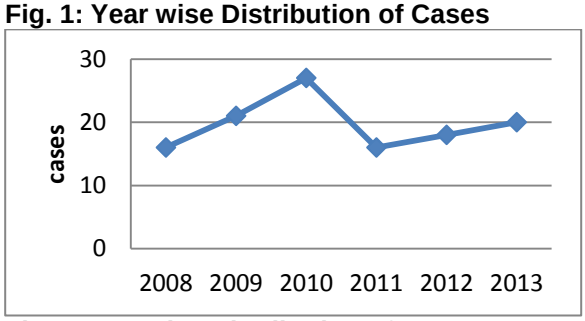

Fig. 2: Sex wise Distribution of Cases

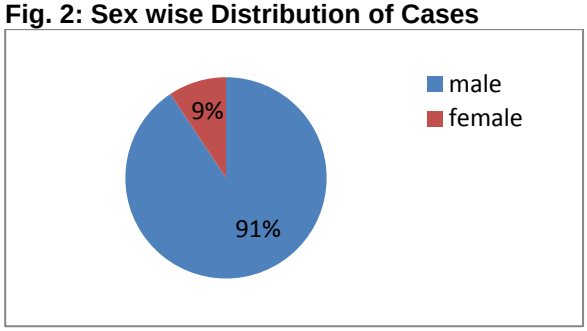

Fig. 3: Custody wise Distribution of Cases

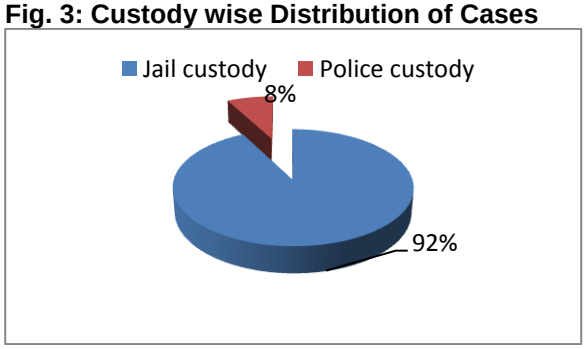

Fig. 4: Age and Sex wise Distribution of Cases

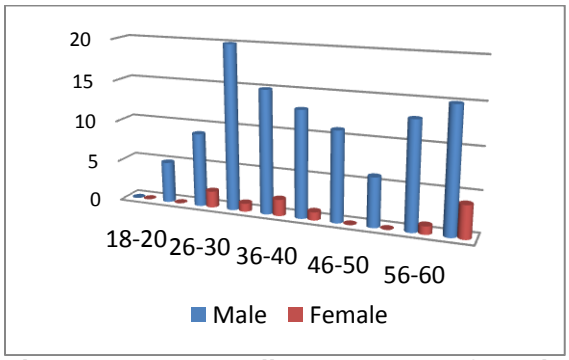

Fig. 5: Cases According to Manner of Death

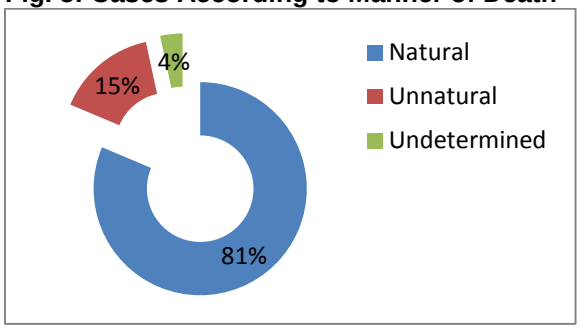

Table 1: Distribution of Cases of Natural Deaths

S.N.	System Involved	Cases
01	Central nervous system	03
02	Cardiovascular system	26
03	Respiratory system	42
04	Gastrointestinal system	02
05	Genitourinary system	03
06	Multi-systemic involvement	14
07	Septicaemia	02
08	Malaria	01
09	Diabetic ketoacidosis	01
10	Carcinoma	02

Table 2: Distribution of Cases of Unnatural Deaths

Manner of death	Cause of death	Cases
Suicidal	Hanging	06
	Poisoning	02
	Cut throat injury	01
Accidental	Head injury	04
	Multiple injuries	01
	Intraperitoneal haemorrhage due to laceration of mesentery of small intestine.	01
Homicidal	Shock due to peritonitis in case of blunt injuries	01
	Asphyxia due to ligature strangulation	01

Original Research Paper

The Study of CNS Manifestations in Aluminium Phosphide Poisoning

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Abstract

With rapid development in the field of science & technology and green revolution in the agricultural sector, the problem of acute aluminium phosphide poisoning leading to morbidity and mortality is spreading like a wild fire. Different disciplines of medical science are working on various aspects both from treatment as well as preventive point of view. Aluminium Phosphide is a very toxic, cheap, ideal suicidal and lethal protoplasmic poison involving all generations and organ systems of the body. Although its incidence was unknown before 1980 but now it has surpassed every other poisoning in India especially in the northern states and has created havoc with the human lives. Our study showed that males (1.94:1) are the major sufferer with high mortality rate (76%). The freshness of tablet and lack of specific antidote are directly related to its poor prognosis. Major CNS manifestations are dizziness (52%) and headache (44%). Loss of consciousness is only the terminal event and sufficient time is available to record the dying declaration. Magnesium sulphate has some role in its management.

Key Words: Aluminium Phosphide Poisoning, CNS Manifestations, Sensorium of the Patient

Introduction:

Aluminium phosphide, is in use as solid fumigant pesticide since the 1940s, has all the properties of an ideal fumigant such as cheap, cost effective, highly effective even with single application, handy, easy to transport, peculiar smell and lethal to the target species.

It is available as 3gms tablet and on coming in contact with water or hydrochloric acid (HCl) in stomach liberates inflammable, colourless phosphine gas having garlic or stale fish like pungent smell due to added impurities.

Less than 500 mg of an unexposed pellet of aluminium phosphide is fatal for an adult (usual being 150 - 500 mg for a 70 kg individual) and the fatal Period is one hour to four days but majority die within twenty-four hours. [1-4]

Mechanism of Action:

The exact mechanism of action is still not clear. It was assumed that aluminium phosphide produces non-competitive inhibition of cytochrome oxidase (a respiratory chain enzyme of mitochondria).

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Thus it will lead to diffuse cellular hypoxia and therefore acts as a protoplasmic poison. In a study by Nakakita et al [5] phosphine was found to be a potent inhibitor of ADP uncoupler and ion stimulated respiration but the exact target site was not detected. Price and Dance [6] heavily poisoned three species of stored beetles with phosphine and found that there was no inhibition of cytochrome system but the insect catalase was inhibited.

Cheufurka et al [7] found that phosphine was a strong inhibitor of mitochondrial respiration in the active state (state 3) than resting state (state 4).

It inhibited the uncoupled site and ion pumping state which could not be reversed by uncouplers suggesting that it is due to a direct effect on electron transport which is an important electro-chemical link between respiration and phosphorylation in mitochondria.

This inhibition is in the Ki range from 1.6 x 10^{-5} to 7.2 X 10^{-5}. It also causes changes in the dichroic spectra of haemoglobin suggesting a valency change in haem accompanied by confirmational changes in the prosthetic group. There is interaction of phosphine with the heam moiety of cytochrome oxidase (cytochrome-c), but it is yet to be determined whether it interacts with cytochrome a or a_3 or both.

After the ingestion of aluminium phosphide, phosphine is liberated in the stomach, which is absorbed into the circulation. Some of the parent compound, i.e. aluminium

phosphide itself, is also absorbed and is metabolised in the liver with a slow release of phosphine, accounting for prolongation of symptoms. The absorbed phosphine is oxidised slowly to oxyacids and excreted in urine as hypophosphite. It is also excreted in significant amount in unchanged form through lungs and can be detected by placing silver nitrate paper in the mouth. Phosphine produces widespread organ damage due to cellular hypoxia produced as a result of its binding to cytochrome oxidase. Acute cardiotoxicity is possibly related to the subcellular trans-membrane exchange of ions (Na, K, Mg and Ca) due to focal myocardial necrosis produced by phosphine. [1, 8]

It is a common concept that every coin has "two sides", a darker and another brighter. The doctors/scientists working in this field are facing the darker side. Doctors attending the court are facing battery of questions such as status of sensorium after its consumption and fitness to make dying declaration etc.

Present work will be a mild attempt to highlight these things.

Aims and Objectives:

The our study was conducted on 50 confirmed cases of aluminium phosphide poisoning admitted to Medicine department, Government Medical College, Amritsar from 01-10-2004 to 15-04-2006 to determine

1. The CNS manifestations.
2. State of sensorium in relation to dying declaration.
3. Relationship of freshness of aluminium phosphide tablets to mortality.

Material & Methods:

The diagnosis of aluminium phosphide poisoning was based on reliable history of ingestion, circumstantial evidences such as the production of the remaining tablets/empty container by the relatives, garlic/decaying fish like odour. Our study consists of 50 cases of aluminium phosphide poisoning which were confirmed by **'silver nitrate filter paper test'** with gastric lavage of the patient. [9, 10]

Results:

In our study of 50 cases males (66%) outnumbered females (34%) with 1.94:1 ratio, more common in married 68% (46% males & 22% females) than non-married 32% (20% males & 12% females) with ratio of 2.1:1 and mostly cases (86%) were of suicidal poisoning. No case of homicidal poisoning was recorded in our study and the mortality rate was 76%.

The minimum period between ingestion of poison and death was observed to be 3 hours 5 minutes and maximum period was 27 hours 50 minutes and mean survival time period was 4 hours 56 minutes in our study. The majority of cases (63.16%) expired within 1-6 hours.

The major CNS manifestations in our study of aluminium phosphide poisoning were dizziness 52% and headache 44%. Convulsions were seen only in 08% patients. (Table1)

Patients were closely monitored for the state of consciousness. (Table 2) In present study 38 patients expired and 12 survived. Out of 38 expired patients two remained conscious till death while maximum cases (44.44%) lost consciousness between 2-4 hrs. and 27.78% cases lost consciousness between 4-6 hrs.

Only 13.89% lost consciousnesses between 0-2 hrs. So majority of cases remained conscious for many hours.

In this study we also observed that 76% of the patients died after ingesting 'fresh' tablets of aluminium phosphide. 24% patients who took 'exposed' tablets survived.

In our study 42 patients were treated with magnesium sulphate but only 12 patients who had taken exposed tablets survived. Out of 12 patients 10 patients had changes in their ECG. These changes were successfully reverted with magnesium sulphate therapy.

Discussion:

Regarding the CNS manifestations and sensorium of individuals in aluminium phosphide poisoning Cases Our study was consistent with the study by Kalra et al [11] where majority of patients were restless throughout the period of hypotension although their sensorium was clear till the end. Our study was also comparable with other studies by Chopra et al [12] and Gupta [13] where only 25% and 24% cases respectively were admitted with altered sensorium.

But our study is not consistent with the findings of Khosla [14] in which 40% cases were admitted in delirious state and expired. The possible reasons for this difference could be due to difference in number of patients studied, dose and freshness of the tablet, early admission to the hospital. So unconsciousness is only the terminal event and literature on shock clearly indicates that sensorium remaining clear in all forms of shock till the terminal stage.

In present study a direct positive correlation between the freshness of aluminium phosphide tablets consumed and mortality rate was found. Our findings are similar to Chopra et al [12] who observed that the only factor which predicted a poor prognosis was the ingestion of 'unexposed' tablets.

Chugh et al [15] also reported that patients with history of ingestion of fresh

aluminium phosphide compound had florid clinical symptoms and high mortality rate (80%). It is clear from various studies that exposed tablets are less potent than unexposed tablets because the atmospheric moisture reacts with aluminium phosphide to release phosphine, thus decreasing the toxicity of the tablet.

In our study 42 patients got magnesium sulphate therapy but only 12 patients who had taken exposed tablets survived. Out of 12 patients 10 patients had changes in their ECG. These changes were successfully reverted with magnesium sulphate therapy, consistent with Chugh et al study. [16] The loading of magnesium sulphate dose schedule significantly brought down the mortality rate irrespective of the dose consumed.

So it was suggested that hypomagnesaemia might be responsible for high mortality of patients of aluminium phosphide poisoning and its correction has beneficial effect on management and ultimate favourable outcome of the illness.

Siwach et al [17] studied 30 non survivors of aluminium phosphide poisoning and similar number of age and sex matched controls. Magnesium content was estimated in different organs. It was observed that magnesium content was not significantly different between controls and patients who were not given magnesium sulphate. Rather magnesium levels were significantly high in patients who got treated with magnesium sulphate.

So hypomagnesaemia treated with magnesium sulphate therapy suggested by various workers does not really exist.

Conclusion:

Aluminium phosphide is a protoplasmic deadly poison. Mortality rate is directly proportional to freshness of the tablet. Loss of consciousness is the terminal event and sufficient time is available to record the dying declaration. Lack of specific antidote is the biggest lacuna in its management.

Magnesium sulphate has some role in the management of acute poisoning. Carelessness in storage could lead to accidental exposure and immediate first aid can be life-saving.

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Table 1: CNS Manifestations in Aluminium Phosphide Poisoning

CNS manifestations	Cases	Percentage
Headache	22	44%
Convulsions	04	08%
Dizziness	26	52%

Table 2: Time Elapsed between Loss of Consciousness and Intake of Poison

Time elapsed between loss of consciousness and intake of poison	Cases (%)
0-2 hrs	05 (13.9)
+2-4hrs	16(44.4)
+4-6hrs	10(27.8)
+6-8hrs	02(5.6)
More than 8hrs	03(8.3)
Total	36(100)

Original Research Paper

Clinical Teaching in Forensic Medicine: Need of the Hour

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Abstract

Forensic Medicine is a medical specialty that is practiced at the interface with the law. Keeping in view the increasing incidences of allegations against health professionals it is necessary to impart practical training to medical graduates in various Medico-legal cases to make them well oriented with the procedures & proper documentation. Total 138 students of 2nd M.B.B.S of J.N.MC participated in this study. The exercise of Examination & certification of an Injury was given to the student. Students were informed about this exercise. Bedside teaching students were exposed to examination to interpret the injuries present. The impact of the clinical exposure on the students was carried out through structured questionnaire. The student's feedback was taken in the form of Pre & Post-test. This feedback evaluation was used to assess the significance of this newer teaching methodology. Statistically significant results were observed from the response given by the students to each structured question. It is need of the hour to reframe the under graduate curriculum and introduce clinical posting for them in the subject of Forensic Medicine for making a competent medical graduates to handle the cases of Medico legal importance.

Key Words: Bedside Examination, Demonstration, teaching methodology, Reframe curriculum

Introduction:

In the last two decades, medical education has drawn from a range of disciplines to introduce new teaching and assessment methods and approaches to educational intervention. Teaching and learning methods in medical education have much in common with those in other health and social care professions. It is time to ensure that teachers and curriculum developers have appropriate educational skills and knowledge. [1]

Teaching and learning approaches are designed to ensure that students acquire appropriate scientific and clinical knowledge; so that they acquire practical, procedural and communication skills or competencies needed to practice medicine, and that they develop professional attitudes and demonstrate proper behavioural approach to the practice of medicine. [2] Clinical teaching traditionally involves patients as the pillar of all learning and teaching events whether this is at the bedside, in the clinic or in the operating theatre.

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Care needs to be taken to ensure that patients and their caregivers are fully informed about this activity and their active participation should be taken in such teaching modalities. [3]

Clinical teachers have a range of teaching and learning methods currently available to them; teachers need to plan academics carefully for learners so that optimum learning can take place with minimum disturbance to patient care. [2]

Keeping in mind the increasing medico-legal problems in practising medicine it is time to introduce clinical Forensic Medicine to make Medical Graduates competent in dealing with Medico-legal cases. Hence this study is carried out to evaluate the need of clinics and its importance for proper documentation & certification of Medico legal cases in the subject of Forensic Medicine.

Material & Methods:

The study was carried out by active participation of the Students of IVth semester M.B.B.S. studying in Jawaharlal Nehru Medical College Sawangi (M) Wardha. It was Experimental & open labelled study.

It was taken to improve awareness & identify the cases of Medico legal importance among Medical graduates. Total 138 students participated in this project. The students were divided into small groups of 20-25, however 10-12 per group would have been ideal.

Each group was subjected to clinical teaching on patients admitted in the ward with

history of wound for examination & certification of injury. The group was accompanied by the faculty in Forensic Medicine.

The students voluntarily participated in this study prior to the clinics after explaining the importance of the study to them. A Medico-legal case for examination of wound for certifying the injury was taught to the students during routine class room teaching.

The same students were then taken to the indoor wing of the Department of Surgery & Orthopaedics, Acharya Vinobha Bhave Rural Hospital; for examination & certification of injuries received by patient through clinical teaching on the patient. The consent of the respective Head of the Department was taken prior to taking the students to the clinics.

Interactive teaching of students with the patient at the centre was carried out. Assessment of the understanding of Student's for examination & certification of Medico legal case was carried out by the pre- & post-test evaluation (Semi quantitative) methods.

The overall feedback of the teaching method was taken. The significance of the study was carried out by applying the χ^2 test & finding the p-value for each response of the students for the structured questionnaire given to the students prior to & after the exposure to clinics & Bedside teaching. The analysis of the overall feedback of this teaching activity was carried out by putting questions as annexed-2 and their response noted in 5 point scale.

This study will help to impart knowledge of legal procedures and to properly interpret findings for handling cases of Medico legal importance in the Medical graduates to make them competent for proper documentation & certifying Medico legal cases.

Observations and Results:

All the students' responses to the question were submitted to $\chi 2$-test and the significance of the response was determined by p-value. The p-value for the questions was found to be significant if it was < 0.05 which was found to be significant in all the responses given by the students proving the significance of this study. (Table 1 & Graph 1) The overall response with Z-value is 13.56. (Table 2 & Graph 2) The analysis of the overall feedback of the activity was graded as satisfactory & Excellent by the students. as shown in Table 3.

Discussion:

Osler (1905) quotes "The student begins with the patient, continues with the patient and ends his studies with the patient, using books and lectures as tools as means to an end". [4]

Students subjected to the regular curriculum have restricted information about the vast variety of cases faced by the practising doctors. [5]Hippocrates (460-370 BC) was not only a teacher but also an itinerant practitioner. The first two principles of his Hippocratic method are-Observe all and Study the patient rather than the disease, giving the importance of clinical teaching. [1]

Through clinical exposure, students had the opportunity to examine the patient, interpret the findings & document cases of medico legal importance in a proper way. Students are able to identify specific cases and provide adequate certification of the Medico-legal case.

Bed side teaching or Clinics has the advantage of group discussions, close intellectual understanding between the student and teacher, sharing of observation and coming to a common conclusion. [6, 7] Clinical teaching in the wards forms the backbone of Medical education of the Medical graduates. For better understanding of the Medico legal problems arising in practising medicine in the society, it is necessary that the undergraduates should be exposed to clinics or bedside teaching. [8,9]

The implementation of Clinical Forensic Medicine teaching will give an opportunity to teach students medico-legal aspect in an efficient way which will definitely improve the medico legal examination and medico-legal report writing as suggested by Khandekar et al. [10,11] As students become more dispersed and mobile and medical schools increasingly need to ensure they produce doctors who are safe, competent practitioners who can practice professionally in a range of contexts, teaching, learning and assessment methods need to adapt to reflect the demands of patients and healthcare systems. [2, 12] Clinical postings for Medical graduates in Forensic Medicine will help them to be competent in identifying and handling the cases of Medico-legal importance.

Conclusion:

Clinical teaching will definitely improve the quality of medico-legal work in medical graduates as it is seen from the response & feedback given by the students.

Exercise like examination & certification of wound, certification of age, certification of impotence can be taught in clinics. The curriculum of MBBS may be reframed and few clinics can be added in current teaching Time Table. Clinical posting for Undergraduate students in Forensic Medicine be introduced in Medical colleges, especially during fourth or Fifth Semester of second M.B.B.S. Casualty posting

for Interns, which is at present optional, should be made compulsory.

This programme if implemented will provide the core for the development of a high quality of Medico-legal services.

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Table 1: Pre- test & Post- test % to correct response, χ2 value & p-value

Response	Pre Test %	Post Test %	χ2-value	p-value
Q.1	58.7	73.2	16.04	0.003
Q.2	60.9	83.3	24.51	p<0.0001
Q.3	26.81	42.8	10.10	0.03
Q.4	63.0	87.0	21.94	0.0002
Q.5	63.0	78.3	13.73	0.0082
Q.6	38.4	62.3	19.96	0.0005
Q.7	42.0	52.2	11.79	0.019
Q.8	23.2	34.8	22.33	0.0002
Q.9	42.0	80.4	49.72	p<0.0001
Q.10	5.8	68.1	121.4	p<0.0001

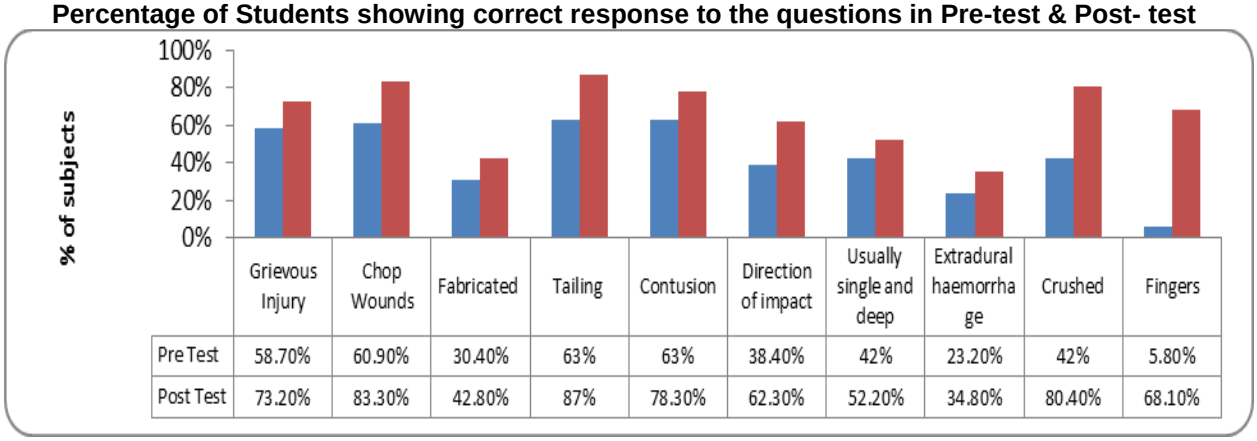
Table 3: Satisfactory Response for the Overall Feedback of the Study

Question	Students %	
	F	%
1. Were you sufficiently briefed by the teachers about the role of learner & modality of learning inClinics	110	79.71
2. Was the teacher available & of help to your batch during Clinics when required?	114	82.60
3a. Do you think the teaching in clinics was successful in generating interest	110	79.71
Q 3.b: Do you think the teaching in clinics was successful in better understanding	116	84.05
Q 3.c: Do you think the teaching in clinics was successful in improving interpretation skill	112	81.15
Q 3.d: Do you think the teaching in clinics was successful in fulfilling teaching Objectives.	121	87.68
Q 4: Do you think learning through clinics is better as compared to traditional classroom teaching	115	83.33
Q 5: Do you think clinics improves your communication skill	114	82.60
Mean	**114**	**82.60**

Table 2
Comparison of Overall Score at Pre and Post Test

	Mean	N	SD	Mean Difference	Z-value	p-value
Pre Test	4.25	138	1.74	2.55±2.20	13.56	0.000S,p<0.05
Post Test	6.80	138	1.32			

Graph 1
Percentage of Students showing correct response to the questions in Pre-test & Post- test



Original Research Paper

Trend of Male Poisoning at North Karnataka from 2008-2013

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Abstract

Acute poisoning is an imperative medical emergency moreover one of the leading causes of death. It affects uniformly all countries, religions, communities moreover all ages and income groups. The aim of the study was to find the commonest age group among male victims and choice of poisoning in North Karnataka. This study was accomplished at KLE University's J. N. Medical College, Poison Detection Center, Belgaum, North Karnataka, during the period of 29 September 2008 to 28 February 2013. Total 682 cases of poisoning were registered in our study period. All the poisoning cases were screened and investigated. The commonest age group affected among males was between 21 to 30 years. This study serves as pilot project for more detailed retrospective and prospective studies in the future. Organophosphorus compounds were the most generally abused essence.

Key Words: Bromodilone, Male, North Karnataka, Organophosphorus, Poisoning

Introduction:

Every day approximately 700 deaths have been reported due to poisoning around the world. [1, 2] Incidence of poisoning, as reported is 13-fold higher in developing countries than in highly industrialized nation.

According to WHO (1999) more than three million poisoning cases have been reported out of which 251,881 deaths occur worldwide annually, of which, 99% of fatal poisoning occur in developing countries, predominantly among farmers due to various kinds of poisons, including poisonous toxins from natural products handled. [3]

The cause, pattern, results of poisoning in particular community depend on a variety of factors such as easy availability of particular poison, the sophistication of the populace, the stress of environment and the quality of medical care. [2] In South East Asia pesticide ingestion is endemic [4] whereas in Pakistan, urban population is mostly exposed to house hold chemicals. [5]

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Pesticides were manufactured for the protection of crops from pests but now the days they are one of the most important tool of poisoning and causing significant morbidity and mortality. Although plenty of data is available regarding the pattern of poisoning in India, there is few information regarding common age group of male and profile of poisoning especially from northern Karnataka.

An information about the magnitude of poisoning cases not only help in early diagnosis and treatment but also can help in evaluating old and introducing improved preventive measures. Considering the background, the present study aimed to analyze the common age group of male involved and choice of poisoning.

Material and Methods:

This study was carried out from 29 September 2008 to 28 February 2013. During this period total 682 cases of poisoning were registered in Poison Detection Center, Forensic Medicine & Toxicology, J.N. Medical College, and KLE's Dr. Prabhakar Kore Hospital & MRC, Belgaum, Karnataka, India.

All poisoning cases were screened by color test & thin layer chromatography and further confirmed by UV Spectrophotometer as well as enzymatic analysis.

The various agents involved in poisoning cases were categorized under the heading of pesticides, drugs, alcohol & others.

Pesticides mainly comprised of Organophosphorus compound, Bromodilone, Pyrethyroid and other. Drugs encompassed mainly were sedative/ antidepressant. Alcohol cases were mostly due to consumption of

ethanol and phenol usually in combination with primary compound. Indigenously designed data collection forms were used to obtain data including the demographic origin of patients, age and gender as well as poison involved.

Result:

During the year 2008-2013, total 682 cases of acute poisoning were recorded among which 363 cases were males. The majority of the poisoning cases were in the age group of 21-30 years. (Table 1)

In our study majority cases of poisoning was due to pesticide, among which 68% cases were due to Organophosphorus compound, followed by 20.69% drugs mainly sedative and few cases of alcohol poisoning. (Table 2)

Discussion:

According to the WHO, every year along with three million acute poisoning cases 2,20,000 deaths has been registered. [3]

Majority of fatal poisoning cases has been registered from developing countries. We conducted this study to know the pattern of poisoning in male subjects at Belgaum region during the study period i.e. from 29 September 2008 to 28 February 2013. In this study we, observed that out of 368 cases 270 (73.36%) cases of poisoning were due to pesticides followed by drugs (54) and alcoholic compounds (39). In that 221 were solely due to Organophosphorus compound followed by Bromodilone, which itself is quite big in number.

Like other studies [6-8] this study also reveals the similar trend that pesticides are predominating over the other poisons. This may be due to green revolution and industrialization; they are used as household items of the agriculturists. [9]

Mortality rate due to poisoning is increasing every year in developing countries. Many studies reported the mortality rate between 11- 34%. Other studies also reported more than double male mortality rate compare to female mortality. [1, 6-8, 10-12]

This male predominance also indicates that males are more exposed to stress associated with occupational hazards, liability and competition which not only increases the mental stress but also has deleterious effect on physical health as well.

When it becomes difficult to overcome from stress, subjects go under depression. Sometimes takes wrong steps like suicide by consuming poison. Maximum poisoning cases (37.5%) had been reported in this study were basically from young age group(21-30 years) followed by 20.65% in age group 31-40 years. Other studies also reported the similar pattern. [8, 10, 11, 13-15] This can be explained on the basis that age group of 21-30 years are most experimental in life. At this particular period of life, the youngsters are keen to take risk and have high expectation from life which sometimes doesn't fulfill their requirements. This leads them into depression.

The majority of the poisoning cases were in the age group of 21-30 years. The medical drugs involved as poisoning tools are benzodiazepine, diazepam and Paracetamol. Use of insecticide (Organophosphorus) as one of the commonest tool of poisoning and in age group 21-30years, are the striking feature of this study. Every year approximately 1000,000 population died due to poisoning only. [16]

Compare to other unnatural death like RTA injuries, burns, snake bite and assaults, this itself is quite big number. [17] The figures collected from other unnatural causes of mortality showed positive or negative variation but death rate due to poisoning is increasing every year. Mortality due to poisoning is one of the leading problems of developing countries.

According to WHO; every year 99% of fatal poisoning out of 251,881 occur in developing countries. [2] The country like India, where insecticides/ pesticides are easy available and accessible due to agricultural economy could be the strong reason of its use as poisoning tool. In the North Karnataka, use of Organophosphorus as pesticide in agricultural field is very common practice and may be the reason of common poisoning tool also.

In Jawaharlal Nehru Medical College and KLE's Dr. P. K. Hospital and MRC, where study was undertaken has well established Poison Detection Center which not only helps in identification and treatment of poison but also provide the information on poisoning. It is one of the well-established and qualified tertiary care hospitals in this zone of Karnataka, but highly possibility is that most of the poisoning cases might not registered here.

Hence, this study may not represent the true epidemiology of poisoning cases in this part of Karnataka but it definitely indicates the poisoning problem in this zone. These data also reflect the success and failure of much government or Non-government organization (NGO) intervention on poisoning. In country like India, efforts from government and private sector have been made but still not sufficient.

Poisoning is a preventable and we can reduce the death rate due to poisoning. We have to develop effective preventable strategies and should keep keen observation on their

applications. In north Karnataka pesticide poisoning is the commonest problem which can be reduced by mass awareness, strict control on its use, sales and storages and legislation.

Government and private sector combindly can establish Poison Information Centers (PIC) especially on poison prone zones.

These Poison Information Centers will provide identification of unknown poisoning, general information and guidance for treatment of such cases. Development of interpersonal relationship through proper counseling can also reduce the mortality due to poisoning drastically. All these strategies and efforts may increase some economical load on government but it will save plenty of valuable life.

Limitation of Study:

Number of patients in this study is very small nevertheless it may be taken as an initial step to conduct more studies about the comparative role of acute Organophosphorus poisoning in male.

Conclusion:

This study provides update information on epidemiology of acute poisoning among Male populace in north Karnataka, India.

Organophosphorus, followed by antidepressant drug (Benzodiazepine) was commonest cause of mortality in our study. Most important in the management in order to have a good outcome is rapid transport to hospital, early diagnosis and complete atropinization.

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Table 2: Types & Patterns of Poisoning

Type of Poison	Pattern of poisoning		Cases	Total
Pesticide	Organophosphorus		221	270
	Bromodilone		22	
	Pyrethyroid		14	
	Carbamates		13	
Drugs	Sedatives	Diazepam	17	54
		Benzodiazepine	33	
	Paracetamol		04	
Alcohol	Phenol		15	39
	Ethanol		24	
Poisonous herb	Dhatura		05	05
Grand Total				368

Table 1
Frequency and Causative Agent in Poisoning Cases

Age grps (Yrs)	Frequency	Insecticide	Sedatives	Drug Paracetamol	Bromodilone	Alcoholic group	Dhatura
0-10	12	08	02	01	---	01	---
11-20	70	50	07	01	05	05	02
21-30	138	95	18	01	11	13	---
31-40	76	49	10	---	06	10	01
41-50	30	16	07	---	----	05	02
51-60	28	22	02	01	----	03	---
61-70	10	07	01	---	----	02	---
71-80	04	01	03	----	---	---	---
Total	368	248	50	04	22	39	05

Original Research Paper

Correlation of Upper Facial and Lower Facial Height in Garhwali Population of Uttarakhand

[1]P Hatwal, [2] DK Atal, [3] S Das

Abstract

Craniofacial anthropometry, as an important part of anthropology, is used to determine the morphological characteristics of head and face. It is particularly important in planning and evaluation for facial reconstructive surgeries. Facial measurements depend on various factors, such as gender, race and ethnicity, climate, socio-economic, nutritional and genetic. The study group included 100 males and 100 females, between 18-45years belonging to the Garhwal region of Uttarakhand. Subjects with cranio-facial diseases and abnormalities, growth related disorders and history of facial trauma / reconstruction surgery were excluded from the study group. The bisexual variation of upper and lower face height was observed. The mean values of Upper, Lower and Total facial heights were greater in males. However, from statistical analysis it was also observed that the coefficient of determination was low (0.04). So, further study in relation with other racial groups and with increased number of subjects is suggested.

Key Words: Upper Facial Height, Lower Facial Height, Garhwali, Anthropometry, Identification

Introduction:

Anthropometry has been utilized for Forensic purposes especially in the identification of individuals. Facial anthropometric features are used for facial reconstruction, especially in cases where DNA cannot be obtained. In facial reconstruction various parameters are used to develop an image to compare with the life size photograph. Very few studies have been conducted to determine various parameters for facial reconstruction.

Baral et al conducted an anthropometric study of facial height on 857 subjects in the Sunsari district of Nepal. [2] They reported statistically significant differences of upper and lower facial height proportions among the different racial groups. They also concluded that the facial height proportion between male and female were insignificant. [2] No such study has been done in this region. The present study aims to examine the differences in facial height proportions i.e. Upper facial and Lower facial heights in Garhwali population of Uttarakhand and to determine whether there is any significant ratio in male and female.

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Materials and Methods:

The study was conducted as a part of a Short Term Research Project at the Himalayan Institute of Medical Sciences. The study group was comprised of 200 subjects (100 male and 100 female), aged between 18 to 45 years, and belonging to the Garhwal region of Uttarakhand.

The study was done over a period of 3 months. Children below 18 years and adults above 45 years, cranio-facial diseases and abnormalities, growth related disorders and history of facial trauma / reconstruction surgery were excluded from the study.

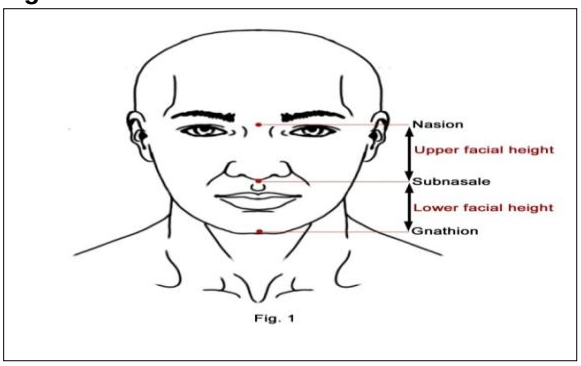
Prior clearance was obtained from the Institutional Ethics Committee. The subjects were examined after taking informed consent.

The anterior aspect of face , from above downwards, consists of frontal region, cheek and lower jaw with some important surface landmarks including glabella, nasion, zygoma, subnasale, Gnathion, etc. as described below.

- **Glabella**: It is a small horizontal ridge, is present between the superciliary arches. [3]
- **Nasion:** Below the glabella the nasal bones meet the frontal bone in a small depression at the root of nose [3] or the point on the root of nose where the mid-sagittal plane cuts the naso-frontal suture. [2]
- **Subnasale:** The point at which the nasal septum merges with the upper cutaneous lip in the mid-sagittal plane.[2]
- **Gnathion:** The lowest point on the lower border of the mandible in the mid-sagittal plane.[2]

- **Upper facial height (UFH) =** Distance between nasion and subnasale. [2]
- **Lower facial height (LFH) =** Distance between subnasale and Gnathion. [2]

Fig. 1:



The upper and lower facial heights were measured in all the subjects and the data was used to determine the range, the mean and standard deviation. The data was statistically analysed to determine any significant correlation between upper and lower facial heights.

The 'p' value was calculated to study sexual dimorphism in upper facial and lower facial heights. The 'p' value of <0.04 was considered statistically significant.

Observations and Results:

In this study the bisexual variation of upper and lower face heights was observed. The mean values of Upper, Lower and Total facial heights were greater in males.

The maximum values for Upper, Lower and Total facial Heights in males were greater in comparison to female. (Table 1 & 2)

It is also evident from this study that the relationship between upper and lower face height is significant. (Table 1 & 2) However, from statistical analysis it is also observed that the coefficient of determination is low (0.04).

Discussion:

Baral et al and Hussain A Obaidi studies showed that there is no significant difference in facial height proportions between males and females in different population group (p > 0.05). [2, 4] However, Omotoso et al observed 'sexual dimorphism' in all the dimensions of face and nose, the males having higher mean values than the females. The result also showed that in all the studied dimensions there is increase in mean values from lower to higher age groups. [5] Jeremic et al observed that males have significantly higher values of morphological facial height, facial breadth and total facial index compared to the tested females p (<0.001). [1]

The current study is in agreement with Omotoso et al and confirmed the bisexual variation of upper and lower face height. The mean values of Upper, Lower and Total facial height were greater in males.

In addition, the minimum and maximum values for Upper, Lower and Total facial Heights in males were greater in comparison to females. Baral et al found statistically significant differences of the UFH and LFH proportions among the different racial groups. [2]

Hussain A Obaidi also observed that there was certain variation in facial height among dentoskeletal groups. [4] Folaranmi et al had conducted a study to measure anterior facial height of school children in Nigeria. Total 100 subjects (60 females and 40 males); aged 12-15 yrs were radio-graphed.

They observed that the proportion of Anterior Lower Facial Height (ALFH) to anterior Total Facial Height (ATFH) is 56%. [6] The current study is limited to Garhwali population, however, relationship between upper and lower face height is significant. Moreover, from statistical analysis it is also observed that the coefficient of determination is low (0.04).

Hence, further study in relation with other racial groups and with increased number of subjects is suggested.

Conclusions:

The bisexual variation of upper and lower face height was observed. The relationship between upper and lower face height is also significant but from statistical analysis the coefficient of determination is low.

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Table 1: Mean and Range of Upper Facial Height and Lower Facial Height in Males

	UFH (mm)	LFH (mm)	TFH (mm)
Mean	48.051	57.344	105.395
Range	40.12 - 56.42	45.22 – 70.12	92.34 – 118.54

Table 2: Mean and Range of Upper Facial Height and Lower Facial Height in Females

	UFH (mm)	LFH (mm)	TFH (mm)
Mean	45.864	54.8	100.664
Range	37.22 – 54.12	43.42 –65.22	88.34 –113.74

Original Research Paper

Correlation between Skeletal Age and Dental Age in Living Individuals

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Abstract

The age determination of living individuals of unknown chronological age, has assumed a very strong role in juvenile crimes in India. Many cases are being referred by courts for age determination of such 'juveniles in conflict with law', in which the most important cut off age is 18 years. Age estimation of unknown chronological age is a big challenge for law enforcement agents which have become more important due to ever increasing incidences of heinous crimes committed by juveniles. We present a review of correlation of skeletal age measured by X-rays of various joints and dental age measured by OPG (Orthopantograms) of a population of 150 cases of age estimation cases sent to our hospital by various courts of law at Delhi, capital city of India. The result was subjected to statistical analysis by using Pairwise Pearson's correlation (0.885) which suggests highly significant correlation. The result shows statistically highly significant correlation between the said parameters.

Key Words: skeletal age, dental age, Pearson correlation coefficient

Introduction:

The age determination of living individuals of unknown chronological age, has assumed a very strong role in juvenile crimes in India as well as internationally. Many cases are being referred by courts for age determination of such 'juveniles in conflict with law', in which the most important cut off age is 18 years.

The most frequent methods involved in age determination of living individuals in India are skeletal age and dental age. Skeletal age is determined by series of radiographs of hand-wrist, pelvis, shoulder etc., whereas dental age is determined by eruption pattern of teeth and formative stages as depicted on OPG radiograph. Both dental and skeletal ages are affected by various factors like genetic, environmental, diet, and race.

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Most common method used for dental age determination is based on maturity score developed by Chaillet and Demirjian in 2004 in French population. [1] India-specific regression formulas were developed by Asith Acharya (2011), which gave better age estimates for Indian population (mean absolute error, MAE=0.87 years) than the original formulas (MAE=1.29 years). [2]

The study done by Garamendi et al found that when either of skeletal age or dental age is used alone to estimate age, then neither of them provides optimal accuracy. But combination of these methods represented a significant increase in the efficacy of the prediction that a subject was under the 18-year-old age limit or not. [3] When a combination of two methods is used, it is important to find out the correlation between the two methods. The accuracy of age estimation will not be optimal if the results of two methods are not closely related to each other.

Till date, to best of author's knowledge, the correlation between dental age based on India-specific regression formulas and skeletal age has not been examined.

The present study aims to examine the correlation between Dental ages based on India specific regression formulas of Demirjian's method and skeletal ages as derived from radiographs of various bones.

Materials and Methods:

Retrospective records of age estimation cases were retrieved from Department of Forensic Medicine & Toxicology, VMMC & Safdarjung Hospital New Delhi. This department received cases for age determination which is referred by various courts commonly Juvenile Justice Boards & other trial courts.

The skeletal ages in these cases was based on the radiographs of various joints reported by Department of Radio diagnosis. OPG x-rays of all the cases were taken and examined by Dental specialist. Dental age was based on Demirjian's and Chaillet method, calculated on basis of India-specific regression formulas developed by Acharya. [2]

Initially, records of 150 cases were retrieved. Out of 150, the cases in which third molars were absent were excluded from present study. Finally 132 cases were considered for finding the correlation. The reports of skeletal age, which were given in form of range, were converted into mean skeletal age.

Results:

Skeletal age from x-ray examination and dental age from OPG x-rays were recordedfor all 150 cases. The result (Table I) was subjected to statistical analysis by using Pairwise Pearson's correlation using software STATA Version12.0. The Pearson correlation efficient of this study was 0.885, suggest highly significant correlation.

Discussion and Conclusion:

The estimation of age in living individuals of unknown chronological age has implicit legal importance in view of increasing juvenile crimes. Juvenile Justice (Care and Protection of Children) Act, 2000, has made it mandatory that age estimation boards should include Dentist and Radiologist, which further underlines the importance of finding the correlation between skeletal and dental ages.

Photo 1: OPG of a 16 year old boy

Photo 2: OPG of a 15 year old boy

Photo 3: OPG of an 11-12 year old boy

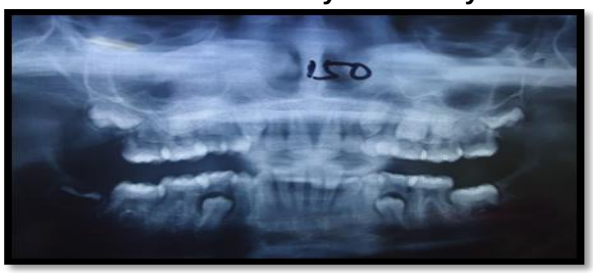

Photo 4: OPG of a 16 year old boy

Various studies have examined the correlation between dental age and skeletal age. Sukhia and Fida [4] determined the correlation among chronologic age, skeletal maturity, and dental age, and concluded that skeletal maturity and dental age are significantly correlated.

Another study investigated the relationships between the stages of calcification of various teeth and skeletal maturity stages among Turkish subjects based on hand wrist radiographs. [5] This study also established a high correlation between the two.

But these studies were done in other countries and the correlation data in Indian population is not available. So the present study attempts to establish the correlation between dental age based on India-specific regression formulas and skeletal age in mixed Indian population. The accuracy of India specific regression formulas based on Chaillet and Demirjian 8-teeth method in prediction of age has been evaluated by some investigators.

These India specific regression formulas were developed by Acharya, and he concluded that it gave better age estimates for Indian population (mean absolute error, MAE=0.87 years) than the original formulas (MAE=1.29 years). [2] Kumar and Gopal also tested the reliability of India specific formulae and concluded that age estimation using this method narrows down the error rate to just over one year making this method reliable. [6]

In our study the correlation is highly significant. This indicates that age as estimated by Demirjian's method is closely related to the skeletal age as estimated on basis of various radiographs. As this study was done on living

individuals of unknown chronological age, it was not possible to establish the correlation with chronologic age. Based on the results of this study, we can suggest that combination of these two methods should be used for more accurate estimation of age in living individuals.

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Table 1: Correlation between Skeletal and Dental Age of Subjects 1-50

S.N.	Skeletal age (mean)	Dental Age (mean)
1	17.5	17
2	18.5	18
3	>20	> 19.5
4	>20	> 19.5
5	>20	> 19.5
6	15	15
7	15	15
8	>20	18.6
9	15	16
10	20	NA
11	17.5	NA
12	21	17.5
13	18	>19.5
14	18.5	17.5
15	17	16.8
16	>20	18
17	13	16
18	17	16.5
19	21	>19.5
20	19	18
21	19	18.5
22	17	17.5
23	10	10.5
24	17	18
25	19	19
26	19	17
27	17	17.5
28	20	21
29	15	16.5
30	15	16
31	30	>21
32	10	9.5
33	30	>19.5
34	21	>19.5
35	17	18
36	10	10
37	21	18
38	19	18.5
39	19	>20.5
40	17	17
41	19	>19.5
42	>20	>19.5
43	17	19
44	21	>19.5
45	15	17
46	21	>19.5
47	21	21
48	19	NA
49	17.5	17
50	19.5	19

Table 2: Correlation between Skeletal and Dental Age of Subjects 51-98

S.N	Skeletal age (mean)	Dental Age (mean)
51	17.5	NA
52	17.5	17
53	17.5	17.5
54	17.5	18
55	17.5	NA
56	17.5	18
57	13	13
58	13	15
59	13	11
60	12.5	11
61	14.5	15
62	17.5	17
63	19	19
64	17	NA
65	16.5	16
66	15.5	NA
67	13	16
68	15	NA
69	13	16
70	7.5	9
71	16.5	15
72	15	15
73	16	17
74	15	16
75	21	19
76	13	15
77	15	17
78	7.5	10
79	7.5	10
80	15	16
81	15	17
82	17	NA
83	17.5	19
84	7.5	11
85	15	16
86	20	>19.5
87	19	>20
88	21	18
89	12.5	14.5
90	13	14
91	12.5	15
92	19	18
93	18.5	>20
94	17.5	17.5
95	13	14.5
96	21	18
97	21	19.5
98	19	18.5

Table 3: Correlation between Skeletal and Dental Age of Subjects 99-150

S.N	Skeletal age (mean)	Dental Age (mean)
99	21	>21
100	15	NA
111	17.5	17
112	20	>21
113	17	16.5
114	10.5	14.5
115	17	17.5
116	7	10
117	13	15.5
118	13	15.5
119	15	15.5
120	13	15.5
121	15.5	17.5
122	13	15.5
123	19	18
124	20.5	NA
125	17.5	18.5
126	13	15.5
127	17.5	NA
128	15.5	16.5
129	13	16.5
130	15.5	17.5
131	18.5	19.5
132	17.5	17.5
133	21	>19.5
134	16	16-17
135	10	11-12
136	6	8-9
137	15.5	15-16
138	15.5	NA
139	7.5	8-9
140	10	9-11
141	12.5	11-12
142	17	NA
143	15	17
144	17	17-18
145	17	17-18
146	17	17-18
147	18	19-20
148	17	16-17
149	17	NA
150	13	11-12

Original Research Paper

Age Determination by Development of Third Molar Teeth with Rongengraphic Skeletal Relationship of Iliac Crest and Ischial Tuberosity in Bikaner City

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Abstract

The aging and identification of victim is either accident, or crime has acquired new substance during the last few years with increasing resource to dental data. Details of eruptions and dentition, of extractions or prosthetic work and of artificial dentures provide precise dental features which can reflect as sound a basis for identifying a dead body as the more traditional finger prints. The history of predevelopment time of radiology indicates that scientist used to estimate age by means of macerating bones, to go for naked eye examination for determination of time of appearance or time of fusion of bony centres, which has a limit for getting a statistical data's and these methods are applicable only dead persons or autopsy specimens This study is attempt to highlight the age determined by development of third molar teeth with skeletal relationship of iliac crest & ischial tuberosity in pelvic region by x-rays in Bikaner city.

Key Words: Eruption, Third Molar, Iliac Crest, Ischial Tuberosity, Nolla's Stage

Introduction:

The history of predevelopment time of radiology indicates that scientist used to estimate age by means of macerating bones, to go for naked eye examination for determination of time of appearance or time of fusion of bony centres, which has a limit for getting a statistical data's and these methods are applicable only dead persons or autopsy specimens. [1]

After the development of radiological methods it became easier to examining the appearance and union of epiphysis of different joints. The aging and identification of victim is either accident, or crime has acquired new substance during the last few years with increasing resource to dental data. Details of eruptions and dentition, of extractions or prosthetic work and of artificial dentures provide precise dental features which can reflect as sound a basis for identifying a dead body as the more traditional finger prints. [2]

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There are three periods in life, each differing in relation to tooth development. The first period is from utero to the time of eruption of the first tooth. The second phase is from age of eruption of the first tooth to about 12 years, the third follows when almost all permanent teeth are already present in the mouth. [2]

Nolla studied on the development of the teeth using x-rays in both sex and he found that dental development starts early in girls as compared to boys. [2]

Schour and Massler [3] stated that the age of calcification in teeth are distinct process and may not correspond to those of chronological age.

Logan and kronfeld [4] observed that the crown of lower third molar completely develops between the ages of 12 to 16 years. But further they observed that the root of this tooth is completed at the age of 18 to 25 years.

Gustafson [5] proposed a unique method of age estimation based on certain regressive changes in the hard tissues of teeth like attrition, secondary dentine, root translucency and cementum apposition.

Miles [6] did a studied on extracted third molar and radiographs of contemporary teeth and concluded that the root of the third molars are nearly completed & apical canals are beginning to close at 18 years. By the 20 years the apical canals are usually closed and seen with naked eye, in 22 years the apical canals are

not only closed but in radiograph they appear more constricted than at an early age.

Delitz [7] studied on Australians population by intra oral periapical radiograph of third molars in different age groups and concluded that completion of crown formation and beginning of root formation of lower third molar occurs before the age of 19 years.

Root formation equal in height to that of the crown usually occurs between the ages of 15-18 years. Complete formation of tooth with convergent root canals at the apex never occurs before the age of 19 years.

This study is an attempt to highlight the age determined by development of third molar teeth with skeletal relationship of iliac crest and ischial tuberosity in pelvic region by X-rays in Bikaner city.

Materials and Methods:

The randomized controlled trial study was conducted in the Department of Forensic Medicine & Toxicology, Radio-diagnosis and Dental Department in P.B.M hospital, Bikaner, Rajasthan. Total 300 cases (135 girls and 165 boys) of both sexes, bearing age group between 13- 24 years were included in this study.

The candidate were chosen from different schools, colleges and outdoor in P.B.M hospital, in Bikaner city. Only those cases were selected whose exact date of birth was verified by the school /college authority subjects residing for more than 10 years in Bikaner city were included in the study.

The subjects for the study were divided into various age groups. The dental examination of the subjects were done with the aid of mirror, probe and counting of teeth were recorded by palmer's notation. The intra-oral periapical radiograph of upper and lower third molar teeth of all subjects were taken and observed regarding various stages by Nolla's stages of development of teeth.

After clinical examination, the observations about fusion of epiphysis iliac crest and ischial tuberosity in pelvic region were recorded and analysed.

Observations and Results:

In this study we observed that at 13-14years to 16-17 years group in boys and girls there was no fusion of epiphysis of Iliac crest and eruption of third molar in mandible and maxilla in radiograph.

Age Group of 17-18 years showed that out of total 26 boys and 19 girls only four girls and nine boys showed the fusion of epiphysis in Iliac Crest and 8 stages of development of third molar in both arches.

In 18-19 years to 23-24 years group almost all boys and girls except 18-19 years group (only 12 girls & 14 boys) complete fusion of epiphysis in iliac crest and eruption of third molar was seen. (Table 1)

Present study showed that in boys and girls of 13-14years to 17-18 years age group there were no fusion of epiphysis of Ischial Tuberosity. But eruption of third molar was seen in only 17-18 years group in mandible and maxilla in radiograph.

In 18-19 years age group out of total boys (18) and girls (15) only three girls and four boys showed the fusion of epiphysis in Ischial Tuberosity and 8stages of development of third molar in both arches.

In 19-20 years to 23-24 years group almost all boys and girls except (only 9 girls & 11 boys of 19-20 years group) showed complete fusion of epiphysis in Ischial Tuberosity and eruption of third molar. (Table 2)

Discussion:

Present study included 300 cases out of which 165 were boys & 135 were girls. Observation of present study indicates the third molar eruptions were seen in age group of 17-18 years. The findings of eruptions of third molar are consistent with observations described in of Modi's textbook [8] but not consistent with observation of Powell [9] who while working as police surgeon of Bombay give the upper limit 14 years for third molar teeth in Indian children.

As soon as second molar teeth erupts the space for the third molar teeth start to form and it was seen well marked at the age 16-17 years in most of cases in present study.

Third molar teeth in mandible have reflected earlier eruption in comparison to maxilla. The tipoff crown of third molar tooth was seen in most of the cases and the finding were consistent with Schranz [10] but not consistent with Koski et al [11] who concluded that molars do not cut the gums until they have almost reached the occlusal level.

Our findings were also similar to Adler study in which he observed that eruption is not bilaterally symmetrical. [12]

These finding were not inconsistent with observations of Schranz. [10] In our study both males and females in group 13-14 years to almost 17-18 years group showed no fusion of epiphyseal in iliac Crest and Ischial Tuberosity in pelvis region.

Majority of cases 19-20 years to 23-24 years showed fusion of epiphysis in iliac Crest and Ischial Tuberosity. The present study findings were close to other studies. [13-16]

Conclusion:

The developmental stage of third molar teeth was not showed significantly difference between girls and boys. Only third molar teeth eruption should not be sufficient criteria of estimation of age. The most important aspect of dental age estimation for the Forensic Odontologist to remember is that he or she should not be restricted to only one age estimation technique but should apply the different techniques available and perform repetitive measurements and calculations in order to establish maximum reproducibility.

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Table 1
Fusion of Iliac Crest & Dental Stages of Development (Nolla's Stages)

Age grps (yrs)	Cases		Fusion of Iliac Crest		Development stages of Third molar			
	Girls	Boys	Girls	Boys	Mandibular		Maxillary	
					Girls	Boys	Girls	Boys
13-14	10	13	-	-	-	-	-	-
14-15	11	13	-	-	-	-	-	-
15-16	9	12	-	-	-	-	-	-
16-17	14	16	-	-	-	-	-	-
17-18	19	26	4	9	8	8	8	8
18-19	15	18	12	14	8	8	8	8
19-20	17	15	17	15	9	9	9	9
20-21	16	19	16	19	9	9	9	9
21-22	11	14	11	14	10	10	10	10
22-23	8	11	8	11	10	10	10	10
23-24	5	8	5	8	10	10	10	10

Table 2
Fusion of Ischial Tuberosity & Dental Stages of Development (Nolla's Stages)

Age group (yrs)	Cases		Fusion of Ischial Tuberosity		Development stages of Third molar			
	Girls	Boys	Girls	Boys	Mandibular		Maxillary	
					Girls	Boys	Girls	Boys
13-14	10	13	-	-	-	-	-	-
14-15	11	13	-	-	-	-	-	-
15-16	9	12	-	-	-	-	-	-
16-17	14	16	-	-	-	-	-	-
17-18	19	26	-	-	8	8	8	8
18-19	15	18	3	4	8	8	8	8
19-20	17	15	9	11	9	9	9	9
20-21	16	19	16	19	9	9	9	9
21-22	11	14	11	14	10	10	10	10
22-23	8	11	8	11	10	-	10	-
23-24	5	8	5	8	10	-	10	-

Original Research Paper

Digital Analysis of Lip Prints for Personal Identification: A Cross Sectional Study in South Indian Population

[1]Deepa Jatti, [2]Pooja Rastogi

Abstract

Personal identification plays a pivotal role in identifying unknown persons both dead and alive. Cheiloscopy deals with examination of system of furrows on the red part of human lips. The present study was undertaken to classify lip prints, study their variations, determine the most common pattern in the study population, and evaluate differences in lip prints between males and females.Lip prints of 150 individuals, were obtained using lipstick and adhesive tape. The lip prints were scanned and analysed using Adobe® Photoshop® software 7and classified according to Tsuchihashi classification.All the lip prints showed different patterns. Patterns of lip prints occurred in various combinations. The patterns were similar between males and females. Type II was the most common followed by Type I.Although Lip prints have been found frequently at crime scenes its use is still in the budding stage. It is suggested to institute a record of lip prints for all individuals in a certain locality, hoping to be a reference in civil litigations and criminal cases.

KeyWords: Cheiloscopy, Personal identification, Lip prints, Forensic odontology, Digital analysis

Introduction:

Personal identification plays a pivotal role in identifying unknown persons both dead and alive. They are used in cases of execution, suicide, calamities, missing person inquiries and criminal investigation. [1] Dental, fingerprint and DNA comparisons are the most common techniques used. From the perspective of Forensic odontology various tools used are bite marks; lip prints and teeth in crime scenes. [2]

The finger print patterns are typical and permanent and hence considered as a tool for identification. Due to the new trends in crime detection techniques, the criminals are taking sufficient precautions like the use of gloves.

In such circumstances, the identification of criminals using fingerprint analysis fails to establish a positive identity. Thus investigators can rely on adjuvant technique such as cheiloscopy as supportive evidence. Lip prints are considered unique to an individual and analogous to fingerprints. [3]

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Lip prints are the normal lines and furrows in the form of wrinkles and grooves present in the zone of transition of the human lip between the inner labial mucosa and outer skin. [4] Cheiloscopy is a Forensic investigation procedure that deals with identification of humans based on lip traces. [5, 6]

Lip prints were first noted in 1902 by an eminent anthropologist, R. Fischer. It was only in 1932, a French person named Edmond Locard advocated the use of lip prints in personal identification and criminalization. [7] In 1950 Synder was the first person who suggested the idea of using lip print for identification. [8]

In the period from 1968-1971 based upon the research of two Japanese scientists, Y. Tsuchihashi and T. Suzuki it was established that the arrangement of lines on the red part of human lips is individual and unique for each human being. [3, 9]

The significance of Cheiloscopy in personal identification is due to the evidence that, once developed at the 6th month of intrauterine life they are permanent, unchangeable even after death, and unique to each person except in monozygotic twins. [4, 5, 7-10] Lip prints are now considered as important tools of personal identification in crime scenes such as murders, rape and burglaries.

No such study has been carried out in this region of South India. The present study was therefore, undertaken to enlighten on the distinctiveness of the lip prints, to analyse the various lip patterns in different quadrants of the

lip and thereby determine the most common lip patterns and its role in gender identification in the population of Coimbatore.

Material and Methods:

Patients and students reporting to the Dental outpatient department over a period of one month were selected for the study after obtaining informed consent. The approval from the ethical committee of the institution was obtained regarding the study. The study group comprised of 150 patients segregated into 2 groups, (75 males and 75 females) aged between 18 to 70 years.

The study sample included residents of Coimbatore with atleast 2 generations residing here. Lips free of any pathology were included in the study. Patients with conditions like inflammation, trauma, congenital deformity, orthodontic treatment disease or deformity of the lips and hypersensitivity to the lipstick were excluded from the study.

The armamentarium comprised of: Betadine solution, Lakme lip liner, herbal hand cleanser, lipstick applicator brush, Lipstick of a dark, bright colour and non-glossy (Lakme), Scotch Magic™ tape, cellophane tape, White bond paper, scanner and software Adobe Photoshop 7 USA.

The lips of the subjects were first cleaned carefully with betadine solution. The outlines of the lips were marked with a sharp lip liner pencil (Lakme). The tip of the lip liner was later cleansed with a cotton ball dipped in an herbal hand cleanser, (Himalayas) prior to using it on the next person.

Lipstick was applied uniformly to the lips using lipstick applicator brush starting at the midline and moving laterally.

The lipstick was allowed to dry for about 2 minutes after which lip prints were taken in two ways. First, lip prints of each lip were taken separately using scotch Magic™ tape. A thin coat of lipstick was reapplied and a second lip print of both the lips together was taken using cellophane tape. The subjects were advised to avoid movement during the procedure.

These prints were stuck onto white paper in a manner similar to that described by Sivapathasundharam et al. [5] For each patient a new lipstick applicator brush was used.

The lip prints of each individual were scanned using an image scanner set at a resolution of (256 grey shades at a resolution of 300 dpi. They were stored as JPEG (Joint Photographic Experts Group) files for maximum details. The most legible prints of both lips taken together on cellophane tape were cropped and divided into four quadrants.

The lip prints obtained were coded, while noting the name and sex of the respective individuals. At the time of analysis the sex of the print was not disclosed.

Each lip was divided into two quadrants starting from right upper to right lower quadrant [Q1-Q4] using Adobe® Photoshop® 7.0 software. (Fig. 1,2)

The lines and furrows present, their length, branching and combinations were analysed quadrant-wise, denoting the type according to Suzuki's classification, (Fig. 3-6) which is as follows: [2,8]

- **Type I:** Vertical, comprising of complete longitudinal fissures.
- **Type I':** Incomplete longitudinal fissures.
- **Type II:** Branching 'Y' shaped pattern.
- **Type III:** Criss-cross pattern.
- **Type IV:** Reticular, typical chequered pattern, fence like.
- **Type V:** All other patterns.

Each Lip print was compared with other to test the uniqueness of lip prints. Analysis was done by studying the number and position of different patterns in all four quadrants.

Results:

A comprehensive assessment of each lip print revealed its individuality and that each print is distinctive.

All the lip prints showed different patterns. Type II pattern was found to be common among upper and lower lip in both males and females followed by type I. (Table 1 Graph1) Analysis of lip prints in each quadrant was done. Among males type II pattern was most common in quadrants 1-4 having 42%, 55%, 45% and 48% respectively.

This was followed by type I pattern Q 1-4 36%,25%,39% and 30% respectively. Among females type II pattern was most common in quadrants 1-4 having 49%, 42%, 45% and 47% respectively.The least common pattern is reticular pattern type IV 2.85% in males 9% in females. (Table 2 Graph 2)

In the upper lip type I and II patterns are common and in lower lip type III and IV are common. About 85% of the patients have different lip patterns in all the quadrants and 15% of patients have similar lip patterns. (Table 3 Graph3) 10 impressions were spoilt and were not included in the study.

Discussion:

The present study is the first cheiloscopic study describing the lip-print patterns in the population of Coimbatore males

and females. This study was carried out to scrutinise the diverse patterns of lip prints and determine its role in personal identification.The utilisation of lip prints in personal identification in criminal investigations is still in its infancy.

Although very few studies are available on lip prints, a landmark study performed by Suzuki etal and Tsuchihashi [3, 9] gave a new dimension to the study of lip prints. They devised a standard classification which formed the foundation of many studies in the future.

In our study lip print patterns in all 150 subjects were distinct and none of the patterns were identical. This finding was in compliance with results obtained in the similar studies conducted earlier by Tsuchihashi and Suzuki [3, 9] and various other authors [10-15]

Lip print patterns did not simply comprise of one type alone, but appeared as a mixture of varying types. [9]

In this study we found that the most common pattern is the type II, Type III, Type IV and Type I in the descending order. The analysis of lip prints in different quadrants revealed the presence of Type II in all the quadrants followed by Type I. Type III and IV were equally distributed in all the quadrants. (Graph 2)

Type IV was the least common and was similar to the finding by Sivapathasundharam et al. [5] but our findings are in contrast to the study done by Annie Joseph Verghese et al on population of Karnataka. In their study most common type of lip print was Type IV, which is the reticular type of lip print. [16] Our findings are also non consistent with Bhuvan et al, in which type I pattern was the most prominent pattern among Indian and Malaysian males and females for the complete lip. [17]

All the four quadrants showed different patterns in 5% of males and 1% of females. Similar lip print patterns were observed in three quadrants in 20% of males and 211% of females. Similar lip print patterns were observed in two quadrants in 35% of males and 36% of females.

Similarities among all the four quadrants were noticed in 10% of males and 12% of females. (Graph 3) All the lip prints were unique and distinctive. In our study Type II is common in both males and females. Our results are in agreement with those of Rubio and Villalain who did not find significant differences in lip prints based on sex, age or race. [18]

Type III may not be commonest in both males and females as it was reported by others. [5, 8] It was also observed that no two persons had similar lip prints, either the same type or different types. It was further noticed that not even a single person had one particular type of lip print in the upper lip or lower or in both.

Thus the statement of Tsuchihashi [8] is true and can be justified in stating that each of the subjects has his own or her own lip print.

Tsuchihashi Y [9] investigated Lip Prints of 1364 inhabitants of the Metropolitan and rural prefectures of Tokyo, Kanagawa, and Saitama in Japan and revealed that in both sexes Type III was commonest followed in order by Types I, II, IV and V. Sivapathasundharam B, PrakashP.A [5] studied 200 subjects at Chennai and recorded Type III pattern as the predominant one and Type IV as least commonly occurring.

Manipady S [12] studied Lip Prints of 100 subjects studying at Kasturba Medical College and International Centre for Health Sciences, Manipal, 50 each of Indian and Chinese origin, including male and female in the age group of 18-22 years, concludes by stating that the incidence of Type II pattern is the most commonest pattern seen in the studied subjects and that the pattern of distribution is not affected by race or sex.

Molano M.A et al [13] found among 168 dental students from the College of Dentistry of the University of Antioquia, that the Type III pattern (Suzuki Tsuchihashi), is the most common one among the population studied, this finding coincides with the results observed in previous studies done in subjects of a race different than the South American crossbred.

According to Vahanwala S.P., Parekh B.K[11] Type 1 and type 2 were common in the first and second quadrant. Reticular type was least common in 2, 3 and 4 quadrants in males. In first quadrant Type I' was the least common.

In females Type I' was least common in all the quadrants. Hirthet al [14] observed that branched pattern was more frequently present in the upper lip and simple pattern was commonly seen in the lower lip, which was in contrast with that seen in our study.

J. Augustine et al [15] in their study concluded that the most predominant pattern in the entire study population, taking both the upper and lower lips together, was type III (48.2%). This was followed in order by type II (18.92%), type IV (17.44%), type I (11.10%), type I' (2.54%) and type V (1.58%).

RV Prabhu et al [19] found the most predominant pattern to be Type V , Type I, Type II (Type IV (40 lines; 3.61%), Type III (9 lines; 0.81%). They recorded the following types of type V patterns for the first time; Trifurcations, Bridge or 'H' pattern, Horizontal Lines, Cartwheel, Pineapple Skin and Multiple

Branching appearance. No such patterns were found in the current study.

Ball [20] had reported the history of lip prints and importance of its evidence in the courts and the status of lip prints as a source of Forensic evidence. She had also stated that latent lip prints would be available at all crime scenes as the vermilion borders of lips have minor salivary glands and sebaceous glands with the latter being principally present around the edges of the lip associated with hair follicles, sweat glands in between and secreting oils.

It is these secretions and continual moisturizing by the tongue due to occasional sebaceous glands present on the lip to alveolar mucosa, crossing the transitional zone, there are chances for the presence of the latent lip prints on items such as glasses.

Lip prints at crime scenes are rarely mentioned simply due to the fact that, most investigators or crime scene examiners do not look for them. On the numerous occasions when a smear or a smudge is discovered, most crime scene personnel disregard it as being a fingerprint that is unidentifiable.

It is important to note, lip prints left at scenes of a crime are more prevalent than one thinks. Articles such as drinking glasses, letters, cigarette butts, clothing, napkins and even skin may possess lip prints that could eventually lead to the identity of a suspect, victim or a witness of a crime. The method described by Sivapathasundharam et al [5] was selected for this study for the accuracy of details achieved, the ease of obtaining such details and the protection and preservation provided by the adhesive tape to the impression once it was stuck onto the paper.

Two sets of lip prints were useful for confirmation of patterns in cases where details were diminished. The obtained lip prints were scanned. The scanned images could be preserved safely with loss of minimal details, divided into equal parts using the ruler in the software, adjusted for brightness and contrast and magnified as much as necessary for clear visualization of details.

These images could be filed systematically and stored as a database for further use as and when necessary.

According to this finding, it is suggested to institute a record of lip prints for all individuals in a certain locality, hoping to be a reference in civil litigations and criminal cases. This study proved the distinctiveness of lip prints in Coimbatore as no identically similar lip-print patterns appeared in two subjects. (Table 3)

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Table 1: Sex wise distribution of Lip print Patterns

Lip Print Patterns	Males	Females
Type I	32	14
Type I'	5	4
Type II	45	45
Type III	14	26
Type IV	3	9
Type V	0	0

Table 2: Frequency of Lip Print Patterns in Different Quadrants in Relation to Gender

	Q1		Q2		Q3		Q4	
	M	F	M	F	M	F	M	F
Type I	36	9	25	11	39	14	30	18
Type I'	6	4	4	4	4	0	4	1
Type II	42	49	55	42	45	45	48	27
Type III	13	24	15	31	13	27	16	22
Type IV	3	14	1	7	3	10	2	7
Type V	1	0	0	0	1	0	0	0

Table 3: Frequency of Repetition of Lip Print Patterns in Relation to Gender

Lip print repetition	Males	Females
All quadrants same	10	12
Three quadrants same	20	21
Two quadrants same	35	36
No quadrants same	5	1

Fig. 1:Lip Pattern Analysis on Adobe Photoshop Software

Fig. 2:Lip Print Patterns Classified by Suzuki et al

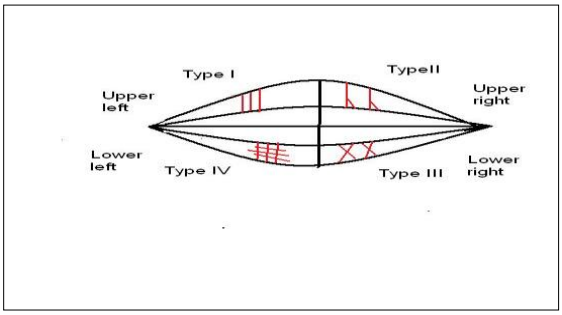


Fig. 3: Type I Lip Pattern

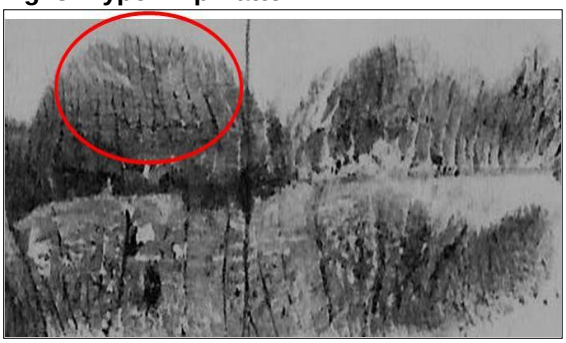


Fig. 4:Type II Lip Pattern

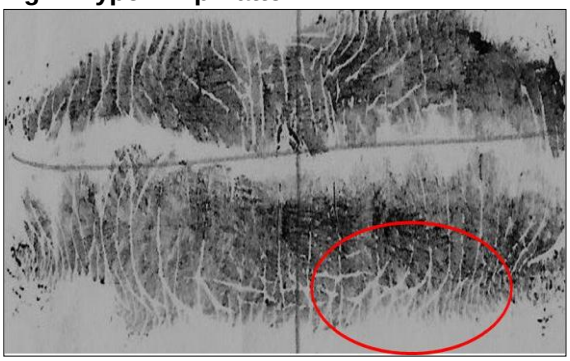


Fig. 5: Type III Lip Pattern

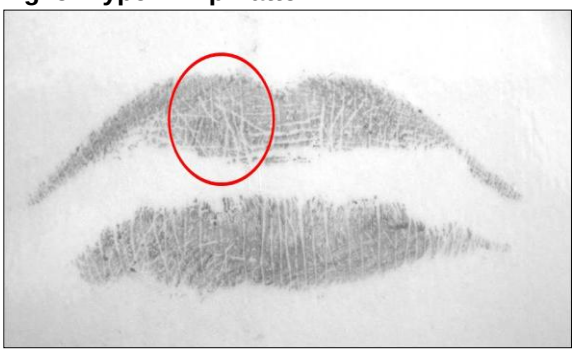
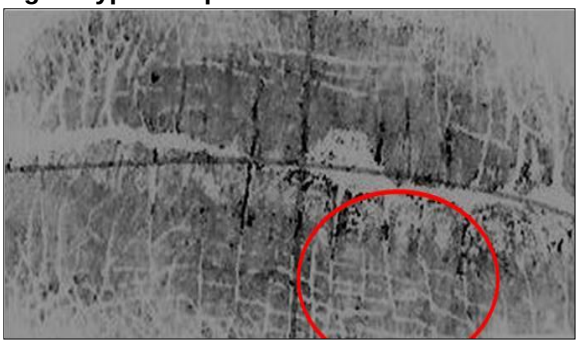


Fig. 6:Type IV Lip Pattern



Review Research Paper

Ethical and Legal Aspects of Required Request for Organ Donation

M. S. Vinay Kumar

Abstract

The demand for organs is ever increasing globally and even after coming out with many innovative measures to deal, the scarcity of organs continues to be of major concern for both developing and developed nations. This is a review research article wherein articles were searched using 'Google' search engine and hard copies available in the library of medical college. The articles were selectively filtered based on full text availability and access to references and a total of 20 articles were reviewed to study various ethical and legal complications arising out of required request for organ donation. Required request though initially seemed to be a very effective measure to overcome the shortage of organs, it has its issues which are highly debatable with respect to conflicts of treating doctor, psychological aspects of family members of patient, economic constraints and rights of donor. It is better to adopt strategies which are widely accepted and are less controversial before going for required request.

Key Words: Required Request, Ethical Issues, Legal Issues, Organ Donation

Introduction:

India is the second most populous country in the world after China with an estimated population of over 1.2 billion but unfortunately when it comes to organ donation it is one of the lower ranked nations with 0.08 donors per million people. Countries like USA and UK have 10-30 donors per million populations where as some of geographically very small nations like Singapore, Belgium and Spain are doing still better having a staggering statistics of 20-40 donors per million populations.

In India every year 5 lakh people die because of non- availability of organs, 2 lakh die from liver disease, 50 thousand from heart disease and over 10 lakh people suffer from corneal blindness. [1-3]

When we look at this disappointing statistics of India where people are dying for the want of organs there is an urgent need to address this issue seriously and look for more options to enhance organ donation even if it means any modifications in the existing legal system.

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This paper is aimed at addressing the shortage of organ donation by discussing the pros and cons and conflicts of required request which at the very outset looks very promising to increase organ donation.

Materials and Methods:

The present study was undertaken from July 2014 to January 2015 at Prathima institute of medical sciences which is located at Karimnagar town of Telangana state. The articles were searched using 'Google' search engine which guided further to selective websites and hard copies available in library.

The articles were filtered based on full text availability; access to references and a total of twenty articles were selected for this review research study. The articles were searched using keywords ethical issues, legal issues, required request and organ donation.

What actually is "Required Request"?

"Required request" or "required referral" is defined as "that it shall be illegal, as well as irresponsible and immoral to disconnect a ventilator from an individual who is declared dead following brain stem testing without first making proper enquiry as to the possibility of that individual's tissues and organs being used for the purposes of transplantation". [4]

In other words it makes mandatory for the hospital personnel to request the families of potential donors to donate organs and tissues. Though it is considered in many countries as a

significant step to overcome the shortage of organ donation and transplantation adequate evidence is certainly lacking to support this law.

Issues of Doctor While Treating the Patient:

Consider a road traffic accident case in which the patient has sustained multiple injuries and has edema of brain. In these circumstances the treating doctor faces a huge dilemma whether to administer intravenous fluids to patient which is considered beneficial for survival of organs like liver, spleen and kidney on one hand and on the other hand the very same IV fluids are detrimental to brain as it further worsens cerebral edema.

At this critical juncture, giving volume replacement therapy favors' organ donation as organs are preserved compromising the function of brain whereas withholding it will favor the preservation of brain at the cost of other organs which in turn does not favor organ donation.

Apart from this physical aspect, the treating doctor also faces the mental challenge as he has to constant shift his views from saving the life of patient to making the patient potential donor which is considered as the toughest part for the doctor to deal with. [5-9]

Issues Regarding Psychological Aspects of Health Professionals and Family Members:

The first and foremost challenge is addressing the attitude of the health professionals as they have shift their thought process from dealing with the living patient who is battling for the survival to brain dead person whose sole purpose of management is only for organ procurement.

Next thing is health professionals dealing with the relatives of the patient. Till then they were giving hope to the family members about the survival of the patient but once the required request is made it automatically causes the relatives to lose hope about the chances of survival of their loved one.

The acceptance of brain death by the family members of the patient is very hard and in numerous instances they struggle to come to terms with it as patient will be still breathing and pulsating apart from having a warm body.

As for as informed consent is concerned, if we are to go by the literal meaning of it which states the patient or the relatives of the patient should be in compos mentis state and should be able to understand the nature of the proposed intervention offered by the health professional which is seriously compromised in these circumstances as family members are emotionally disturbed. This makes required request less valid as it does not fully serve the purpose for which it is meant.

Later on when the relatives recover emotionally they may comprehend better to the concept of require request and may feel they are the soft targets of organ donation. They may even blame the health personnel for coercing them which actually is not the case. [10-13]

Issues Relating to Financial Constraints:

Once require request is made it implies that hospital should possess adequate infrastructure for organ preservation and transplantation. This includes team of transplant surgeons, trained assisting paramedical staff, fully fledged Operation Theater, proper preservation facilities for the donated organ and tissues, immunosuppressive drugs and so on.

All these will definitely put heavy monetary burden on the state. This means required request cannot be made at all centers as it is literally impossible to provide these facilities to all hospitals. This economic burden will certainly hinder the purpose of required request as it cannot be made to all and at every trauma center.

Some hospitals may receive funding from Non-Governmental Organizations or others but even then for this funding to sustain it requires a minimum number of transplants to be made in a single year in that particular center.

This may compel the hospital management and health professionals to convince the family of the deceased to donate organs for the survival of the hospital which again raises serious ethical issues.

Required request law in a sense creates an imbalance in resource allocation of health care delivery system in any nation whether developed or developing. Since a lot of money is spent on preservation of tissues and organs, transplant team etc. the health care of the vulnerable groups of society such as the poor, back classes and those who do not have easy access to health care facilities is severely compromised. [14-20]

Issues Regarding Health Education and Rights of the Donor:

This required request law may suppress the health education programs which aim to motivate the people to donate their organs. Though this request initially seem to increase organ donation rates in the long run there is less chance that it will produce the same result as it cannot replace less debatable methods of organ procurement like voluntary donation.

Another point which attracts a lot of debate is the rights of the donor being completely taken by hospital personnel and family members. How can a doctor make a request to family members of the patient to agree for organ donation? And how can any family member give consent for the same when the patient is still breathing and pulsating? This law if not properly guarded may lead to hastening of the death of the patient.

Conclusion:

Even though required request appears to be very attractive move initially to meet the increasing demand for organs, on the long run it has its inherent pitfalls with regards to doctors treating the patient, psychological aspects of family members of the patient, economic factors and issues of rights of the donor. In culmination it is better to address the shortage of organ donation by implementing strategies which are less controversial and which are ethically and legally less debatable.

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Review Research Paper

Medical Evidence in Dowry Deaths: An Evaluation by Indian Courts

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Abstract

Dowry Death has been one of the most barbaric forms of cruelty inflicted on young brides in the matrimonial home. Over the years, it assumed dangerous proportions calling for immediate legislative changes. Supreme Court judgment dated 11th Oct 2006 held that the demand for dowry or money from the parents of the bride has shown a phenomenal increase in last few years. Cases are frequently coming before the Courts, where the husband or in-laws have gone to the extent of killing the bride if the demand is not met. These crimes are generally committed in complete secrecy inside the house and it becomes very difficult for the prosecution to lead evidence.

Forensic medical evidence has proved to be a crucial area in establishing the fact of 'unnatural' death before the Indian courts. An evaluation of cases indicates that proper scientific evidence has assisted the courts to establish the cause of deaths, while the absence of it has created a dilemma, leading to the acquittal of the accused. The paper emphasizes on the significance and indispensability of Forensic Medical evidence for the purpose of prosecuting an accused for the offence.

Key Words: Dowry, Medical Evidence, Death, Forensic Evidence, Cause of Death

Introduction:

Dowry is one of the persistent evils of Indian society. It has assumed tremendous proportions over the years compelling the Indian Legislature to design stern laws for curtailing the evil. Section 304B IPC, 1860 stands testimony to the fact. It has been invoked in thousands of incidents concerning unnatural deaths of Indian brides in the safety of their matrimonial homes.

In the recent judgment of Supreme Court dated 11th Oct 2006 [10] it was held that the demand for dowry or money from the parents of the bride has shown a phenomenal increase in last few years. Cases are frequently coming before the Courts, where the husband or in-laws have gone to the extent of killing the bride if the demand is not met. These crimes are generally committed in complete secrecy inside the house and it becomes very difficult for the prosecution to lead evidence.

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No member of the family, even if he is a witness of the crime, would come forward to depose against another family member.

The neighbours, whose evidence may be of some assistance, are generally reluctant to depose in Court as they want to keep aloof and do not want to antagonize a neighbour-hood family. The parents or other family members of the bride being away from the scene of commission of crime are not in a position to give direct evidence which may inculpate the real accused except regarding the demand of money or dowry and harassment caused to the bride.

But, it does not mean that a crime committed in secrecy or inside the house should go unpunished. [10]

Forensic evidence has been an innate part of the process, since the 'unnaturalness' of the death has to be established, before a court can proceed with examination of the case for dowry death.

Dowry in Indian Society:

Dowry system is deeply rooted in Hindu culture and is the customary practice of giving gifts in cash and kind by the bride's family to that of the groom. The origin of the practice of dowry may be traced to the Hindu ritual of "Varadakshina" which was associated with "Kanyadaan" in ancient Hindu tradition. Marriage was considered a sacrament and not a contract under Hindu Law, Kanyadaan being essentially the gift which the father of the bride made to the

bridegroom. The presents that were given to the daughter on the occasion of marriage by her relations and friends constituted her "stridhan", i.e., her separate property. Varadakshina was given voluntarily to the groom and there was no compulsion. [1]

The modern practice of dowry has no resemblance to the original concept contained in Hindu Law as it originated in ancient times. In fact it is a manifestation of the political, economic and cultural insignificance of women both in her natal family and in the family in which she enters in marriage.

Having always been considered an economic liability within her natal home, she is considered a temporary visitor until she departs in marriage to her husband's home. Dowry is to compensate the expenses of the new member to the family, even when the woman is educated and has her own job and is not economically dependent on her husband.

Extent of Dowry Death in India:

Nearly 16000 women had been killed in dowry disputes from 1989 to 1991, about 15 a day. Another study reports that every hour and 42 minutes, a newly married woman is burned to death for bringing an insufficient dowry. [2]

According to National Crime Records Bureau, the number of dowry deaths reported in 2010 was 8391 which increased to 8618 in 2011. The number indicated a marginal decrease in 2012 and 2013, at 8233 and 8083 respectively. The country, thus, reports more than 8000 deaths due to dowry every year. [3]

Fighting Dowry through Legislations:

The first noticeable attempt to tackle the problem of dowry was sought by the Hindu Succession Act, 1956 by conferring improved property rights on women, but the evil persisted. In 1961, Dowry Prohibition Act was passed which was the first penal law to ban this practice.

By the latter half of the 70's, it was realized that this law too had not lived up to the expectations and a Parliamentary Committee was appointed to study the law and suggest measures after an empirical survey.

Two of the major lacunas noticed were the phrases 'in consideration of marriage' and 'at or before marriage'.

This vagueness of the legal provisions was accordingly cured by the amendments of 1984 and 1986 respectively, by which 'in consideration of marriage' was replaced by 'in connection with marriage' and the words 'any time after marriage' were added. In 1983, Section 498-A was added to the Penal Code, 1860 which referred to both physical and mental cruelty as cognizable and non-bailable offence.

However, in-spite of all efforts, the menace of bride murder or bride burning continued to rise and Section 304B was incorporated in the Indian Penal Code 1860 to make dowry deaths a specific crime under the law. The legal position, as it stands now, is that in order to establish the offence under Section 304B IPC the prosecution is obliged to prove that the death of a woman is caused by any burns or bodily injury or otherwise than under normal circumstances and such death has occurred within seven years of her marriage and that soon before her death she was subjected to cruelty or harassment by her husband or any relative of her husband. Such harassment and cruelty must be in connection with any demand for dowry.

Once these aspects are established by the prosecution, by virtue of the presumption under Section 113B Evidence Act 1872, the court shall presume that the accused who has subjected the deceased wife to cruelty before her death caused the dowry death in connection with any demand for dowry.

Irrespective of the fact whether such person is directly responsible for the death of the deceased or not, by virtue of the presumption, he is deemed to have committed the dowry death. [4]

Proving Dowry Death:

In order to seek the conviction of an accused for the offence of dowry death, the prosecution is obliged to prove that:

(a) The death of a woman was caused by burns or bodily injury or had occurred otherwise than under normal circumstances;
(b) Such death occurred within seven years of her marriage;
(c) The deceased was subjected to cruelty or harassment by her husband or by any relative of her husband;
(d) Such cruelty or harassment was meted out to the deceased soon before her death.
(e) Such cruelty or harassment was for or in connection with the demand of dowry; and

If all of the above conditions are present, then there is a presumption that the accused has committed the crime of dowry death.

Medical Evidence to Prove Death:

The first component relates to the nature of death of the woman. The term "normal circumstances" apparently refers to natural death. In other words, the expression "otherwise than under normal circumstances" would mean

the death not in usual course but apparently under suspicious circumstances, if not caused by burns or bodily injury. [5] Majority of the dowry deaths occur due to burning, so much so that, dowry death has almost become synonymous to Bride Burning. Other modes generally adopted by the accused may be drowning, hanging, strangulation, poisoning, smothering etc.

Establishing the cause of death and thereby the fact that the death was not in normal circumstances is crucial to proceed with a charge of dowry death. In many situations, the deaths are shrouded in mystery, or the bodies are merely disposed of without medical examination. Ascertaining the exact cause of death and whether the same is accidental, suicidal or homicidal in nature is the responsibility of the forensic medical expert.

In case where the death is merely accidental, no charge under Section 304B may be sustained; but in situations where suicidal or homicidal deaths are involved, the accused may be held liable for the death of the married woman. It is important that the investigation lays adequate emphasis on deciphering the cause and circumstances relating to death with the assistance of forensic experts.

The following may be indicated as important points in this regard.

Common causes of Dowry Death:

(a) Death due to Burning
(b) Death due to Drowning
(c) Death due to Asphyxia
(d) Death due to Poisoning

Death due to Burning:

- Nature of death
- If burn injuries, ascertain the time and date
- Depth/ extent of burn.
- Whether the victim was admitted in the hospital or not.
- Presence of any smell of kerosene oil or any other inflammable substance.
- Whether the burn is ante-mortem or post-mortem.
- Any associated illness.

Death due to Drowning:

- Condition of clothes.
- Presence of froth at mouth and nostrils.
- Condition of eyes and tongue.
- Cadaveric spasm -presence of mud and weeds; decomposition.
- Cyanosis
- Cutis anserine
- Injury marks on the body
- Rigor mortis and Post-mortem staining.

Death due to Asphyxia:

- External evidence of compression, such as ligature marks, bruises, nail marks or any other injury around the neck.
- Condition of eyes, tongue, external orifices and dribbling of saliva.
- Cyanosis and petechial hemorrhage.
- Evidence of struggle.
- Differences in ante mortem and post mortem hanging.

Death due to Poisoning:

- Smell from mouth.
- Condition of eyes, teeth, tongue, nails, etc.
- Presence of froth at mouth.
- Cyanosis or any other colour change
- Contents of stomach etc.

Evaluation of Medical Evidence by Courts:

In several cases before the courts in India, medical reports and expert testimonies have helped to ascertain the culpability of the accused in cases of dowry deaths.

Case Law on death due to Injury not Burn Injury:

In *Prem Kanwar vs. State of Rajasthan [6]*, the woman allegedly died due to burning and the father stated that the accused used to harass and torture her for dowry. The medical evidence stated that the whole body was burnt, including the hairs of the deceased, the outer portion of the skull had come out and the bones of the skull of the deceased were broken. The doctor opined that the deceased died because of burns was well established, but her skull bones were already broken and therefore, she had been killed before being burnt. The Supreme Court safely relied on the evidence to uphold the guilt of the accused which the court stated clearly showed the greed of the accused in persistently harassing and beating the woman for dowry.

In *State of Karnataka vs. M.V. Manjunathegowda & Anr. [7]*, in a case of dowry death, the husband put up the plea that the wife had met a suicidal death when she slipped into the well while going to fetch water. The court rubbished the claim of the husband stating that the medical evidence indicated injuries on the skull and the right side of the occipital region fractured into five fragments. The doctor opined that the death was homicidal due to shock and haemorrhage as a result of head injury and they were sufficient in ordinary course of nature to cause death. Coupled with this evidence, the court found evidence on record to indicate that soon before her death she was subjected to

cruelty or harassment in connection with the demand of dowry by her husband. The court accordingly convicted the accused under Section 304B IPC.

In yet another case before the Karnataka High Court [8], Mahadevamma died an untimely death. At the time of marriage, there was an agreement for Rs.20000 and 6 tolas of gold as dowry to be given in two instalments.

The woman lived for some time in the matrimonial home and a child was born to them.

However, her in-laws kept on the persistent demand for money for construction of house, twenty days after which she died. One of the contentious issues before the court was with regard the cause of death.

The defense put the argument that the woman had epilepsy and she fell from stairs thereby and sustained injuries, resulting in death. The court relied on the medical expert opinion that the tongue was protruding, severe red congestion was present around the neck and chest had small superficial abrasions.

On dissection, the medical expert found contusion present on the left temporal region with hematoma. The brain matter was shrunken and liquefied. The thorax region was intact, congested, Thyroid cartilage was broken. He opined that the death was due to asphyxia as a result of hanging.

Further medical clarification was sought which established that the death was one of homicide on account of the presence of injury on the left temporal region. There was no evidence with regard to the defense contention that the deceased was suffering from epilepsy.

This evidence established the complicity of the accused in the death of the woman, and even though a demand for dowry could not be established, the court held the accused liable for offences of abetment and cruelty.

Case Law on Death due to Head Injury not Drowning:

In *Deen Dayal vs. State of U.P*. [9], the body of a married woman was recovered from inside a well. The contention of the husband and his family members was that the death was accidental on account of falling down into the well. The prosecution held the story that the dead body had been thrown into the well as there were unfulfilled demands of dowry. The medical evidence in the case established that death was caused due to coma resulting from head injury. Such injuries, the doctor stated, were possibly caused by some blunt weapon. He found no water in the lungs or the wind pipe.

He further said that that if there was water in the well then those injuries couldn't possibly have been caused (by falling down into it). In cross-examination, he said that both the injuries could be caused by dashing against two different projections.

Under persistent cross-examination, he further said that as a result of falling from a high place with face downward, one injury could possibly be caused while the other could be caused by dashing against some stone. The Court held that the medical evidence negatived the story of the defence, more so, since the well was a kuccha well, was half covered by wooden planks and there was water in the well.

Therefore, the court opined, that there was no doubt that her body was dumped into the well when she was dying or already dead. The Supreme Court confirmed conviction of the accused for the offence of dowry death.

Case Law on Death due to Asphyxia not Snake Bite:

Similarly, where the death was stated to be snake bite, but the medical evidence clearly established that she had died due to asphyxia as a result of compression of neck and the general and specific chemical testing did not reveal any poison, the court upheld the order of conviction of the accused. [10]

Case Law on Recording of Dying Declaration:

In *Rajeev Kumar vs. State of Haryana [11]*, dying declaration was recorded which stated that the husband of the deceased used to taunt her for inadequate dowry and being fed up with such conduct, she sprinkled kerosene on herself and set herself ablaze.

The defense questioned the dying declaration on the ground that her larynx and trachea had been affected by burns and it was impossible for her to have made any statement. Medical opinion was sought on the issue. While the recording of the dying declaration had been certified by a doctor who stated that she was fit to make a statement, in post mortem it was found that the larynx and trachea were charred.

However, the doctor clarified that when the larynx and tracheae are charred, the person cannot speak, but when the larynx and tracheae are in the process of being charred, the person can speak. Another medical opinion was brought in which stated that if the vocal cord of the larynx is charred, such person may be able to speak but it may not be very clear.

The Court held that there was no inconsistency in the statements; rather the medical evidence along with the ocular evidence

established the fact that the woman had made a dying declaration regarding torture in the hands of her husband. [9]

Case Law on Non-Examination of Doctor during Trial and FSL Report:

In *Chhotan Sao vs. State of Bihar [12]*, the apex court questioned the scanty medical report and the non-examination of the medical expert to set aside the conviction of the accused for the offence of dowry death. The case related to the death on one Babita who, it was alleged was beaten up and forced to consume poison which resulted in her death.

The deceased had also complained of the harassment faced in the hands of the accused due to demand for more money coupled with threats to kill in case of non-fulfillment. Based on the evidence of witnesses and other materials on record, the trial court as well as the High Court convicted the accused for the offence. In appeal, the Supreme Court held that a disturbing feature of the case was that the doctor who had conducted the post-mortem had not been examined.

The trial court noting merely mentioned that the viscera had been sent for chemical analysis but no report received till then; and no apparent injury external or internal had been found on post mortem examination.

Accordingly the court concluded that the fact recorded by the courts below that Babita died an unnatural death was not based on any legal material on record. “The non-examination of the doctor who conducted the post-mortem coupled with the failure to produce the Forensic Laboratory Report regarding the examination of viscera of the deceased leaves a gaping hole in the case of the prosecution regarding the nature of the death of Babita Devi.” The Court accordingly acquitted the accused of all charges. [12]

Conclusion:

As has been emphasized long ago [13], the importance of medical testimony in elucidating and fixing the character and extent of crime and the degree of its punishment, is very properly becoming every year more apparent and better understood.

Medical evidence has demonstrated that without it, many of the most startling and dangerous crimes would go undiscovered and unpunished. The same stands true for the barbaric offence of dowry death.

Dowry is a serious menace to the society and it is important that the evil of dowry is tackled in the most effective manner.

The successful prosecution and conviction of accused demands that effective forensic evidence is adduced whereby the cause of death and related issues can be well established before the Court of Law.

Medical evidence plays a crucial role in determination of guilt or otherwise of the accused and it is imperative that the Criminal Justice System lays increased emphasis on expert opinion for effective and efficient dispensation of justice.

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Review Research Paper

Medico-Legal Cases Need a More Professional Approach

Suraj Sundaragiri

Abstract

As far as medico-legal services are concerned, many of us have seen medico-legal examinations conducted and certifications undersigned by any MBBS doctor or gynecologist or dermatologist etc., who are not specialized in medico-legal work. As per statistics, about 80 per cent of medico-legal work is done by non-forensic doctors, flooding the Department of Forensic Medicine and Toxicology in teaching hospitals with second/expert opinion, due to non-specialized medico-legal knowledge of other doctors. When a Forensic Medicine specialist is available to do the core work he is trained in, there is no point in a non-forensic doctor, who is not well versed with various aspects of forensic medicine to authorize his work by giving opinions or reports or presenting evidence in the court of law. Therefore, all medico-legal services in area or district hospitals must be mandated by doctors with specialization in MD Forensic Medicine & Toxicology. Provision of District Forensic Medicine specialists will also cater to the need and will help in guiding both police and judiciary.

Key Words: Medico-legal services, Forensic Medicine Specialists, Posts in District Hospitals

Introduction:

As far as medico-legal services are concerned, many of us have seen medico-legal examinations conducted and certifications undersigned by any MBBS doctor/gynecologist/dermatologist/etc., who are not specialized in medico-legal work.

As per statistics, about 80 per cent of medico-legal work is done by non-forensic doctors, flooding the Department of Forensic Medicine and Toxicology in teaching hospitals with second/expert opinion, due to non-specialized medico-legal knowledge of other doctors. When a Forensic Medicine specialist is available to do the core work he is trained in, there is no point in a non-forensic doctor, who is not well versed with various aspects of Forensic Medicine to authorize his work by giving opinions or reports or presenting evidence in the court of law.

In India, except in those hospitals attached to medical colleges, medico-legal services are usually offered not by Forensic Medicine doctors, but by MBBS doctors who lack experience in such work.

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Therefore, there is a possibility that the medical evidence is not properly presented in court resulting in delaying of reports (and justice delayed is justice denied). [1] The benefit will be for criminals who can get more acquittals due to poor quality of medico-legal services by MBBS/ non-forensic specialists in the country. [2]

The medico-legal services in our country are at an all-time low. This has reflected time and also a non-forensic medical practitioner finds himself in trouble, when he goes to court of law to depose. A larger negative impact is on the society, when an offender is not convicted due to lack of proper medico-legal investigation. [3]

Working at Primary Health Centers (PHC), Community Health Centre (CHC), Area and District Hospitals involves lot of application of forensic knowledge in day-to-day practice of medico-legal cases, especially in conducting medico-legal autopsy.

From day one while on duty medical officer has to perform autopsy, alcohol case examination, sexual offence cases, injury reports, age estimation etc. Every new medical officer joining health services lacks basic knowledge in handling medico-legal cases and issuing of various medico-legal certificates.

These doctors are not facing any problem regarding clinical specialties, but they are afraid when it comes to medico legal cases. When any medical officer encounters a medico legal case, he panics and tries to contact specialists in Forensic Medicine and Toxicology.

Many medical officers are going on long and unauthorized leave whenever they are summoned by court in any medico-legal case because they are being harassed by defense lawyers due to their inadequate medico-legal knowledge, further hindering not only the court judgments, but also their routine medical services to patients.

Discussion:

The police generally conduct all preliminary enquiries relating to offences affecting the human body. The Medical Practitioner is liable to be called upon to give evidence as a Medical Jurist.

It is consequentially advisable that he should learn to look at medico-legal standpoint upon such of his case as may possibly become the subject matter of judicial investigation.

He should know carefully everything which is likely to be of medico legal importance, and also be aware of the fact that medical evidence is not substantive one but usually opinion evidence, which has great corroborative value. The reliability, completeness and objective investigation of the Forensic Medicine expert facilitate formation of definite opinion by the Court. [4]

The Madras High Court has shown its concern in following words: “This Court is much desirous and concerned of expressing that the branch of science of Forensic Medicine is an effective scientific method, which plays a vital role in assisting the Justice Delivery System to render justice to the society, in the administration of Criminal Justice.

In order to make this particular subject more viable, more teeth have to be provided by the legislature and the authorities concerned, to make it trendsetting. The service rendered by the Forensic Medicine experts in this regard is unique and deserves admiration, but the real state of affairs remain that medico legal cases are handled in this country by the non-forensic experts and none could be blamed in this regard. [4]

There is need for implementation of recommendations of the Survey Committee Report on medico-legal practices in India 1964, along with various recommendations of the Central Medico-legal Advisory Committee made from time to time since its inception in 1956. The Committee during its first session in 1956 considered the suggestion of the Ministry of Home Affairs, Government of India, to create a special cadre of medico-legal officers.

However, the Committee recommended that each State should give advance medico-legal training to at least one officer in each district and in important cities and towns and such an officer should undertake the specialized medico-legal work himself and also co-ordinate all general medico-legal work by other Government medical officers in his jurisdiction resulting in creation of specialist Forensic Medicine and Toxicology department throughout the country. [5]

“Finding out the cause of death in suspicious cases lies in the hands of skilled medical personnel’’, said Lalrokhuma Pachau, Director General and Inspector General of Police, Karnataka. [6] In the Public Interest Litigation (PIL) in the Nagpur Bench of Bombay High Court, it was highlighted, how the poor quality of Forensic medical post-mortem examination results in “inadequate, illegible, incomplete, loose and lackadaisical, not reliable” postmortem records.

Such records are stumbling block in the administration of Criminal Justice System and are leading to travesty of justice and serious violation of human rights goes on with impunity, the PIL claimed. [7]

Allahabad high Court has also valued the second opinion by the Forensic Medicine expert being more justified, medico-legally significant and well drafted than the first opinion of chief medical officer with MBBS qualification.

It opined Forensic Medicine experts should be posted at district headquarters and Civil Hospital level. Opinion of the doctor as expert witness has been given very much importance by the judges. Forensic Medicine Experts protect the fundamental rights of victim as well as that of the accused.

It observed that “further, the disturbing trend of non-forensic specialist doctors becoming too careless and often willing tools, ever ready to rubber stamp the opinions of I.O. without application of their independent knowledge appears to have been again highlighted before the court”.

An opinion erroneously, collusively or dishonestly given by the doctor, who examines a victim, can have far reaching consequences. [8]

The main reason for poor medico-legal work disposal is the absence of Forensic Medicine experts at district level. It is well known that presently majority of work is being disposed of by MBBS doctors who are not well versed with various aspects of Forensic Medicine.

Therefore mandatory creation of two posts of District Medico-legal Experts/Doctors with justification as (M.D Forensic Medicine) will lead in improving the quality of work was suggested in a meeting at Directorate General of

Health Services, Government of India, New Delhi which was circulated to Principal Secretary of Health in all states of the country. [9]

The police officials of Telangana questioned under right to information act regarding the quality of the medico-legal services of MBBS doctors and their opinion regarding the necessity of creation of post of forensic medicine specialists in district headquarter hospital also demanded the creation of the posts. [10]

Conclusion:

In district hospitals, as there are no separate medico-legal departments, the medical officers without proper training in forensic medicine or non-forensic specialists perform post-mortem and other medico legal works along with their routine duties, against their will.

Majority of clinicians are not willing to do medico legal works for the amount of cases they need to attend court in due course.

This is also one of the reasons for leaving government jobs by obstetricians, pediatricians, anesthesiologists etc. after certain period of time due to medico-legal cases and their fear of attending court which directly affects medical services of the State. Recruiting Forensic Medicine specialists in district hospitals will create a referral medico-legal centre for PHCs, CHCs and area hospitals and will take off the excess burden on the clinicians.

Provision of District Forensic Medicine specialists will cater to the need and will help in guiding both police and judiciary. The advantages, being provision of medical clarification or guidance to the police officials in collecting evidence and understanding the circumstance of death by visiting crime scene, will definitely leads to reduction of the travel and time burden of police officials by providing accessibility in their jurisdiction.

It will reduce the damage of the specimen in chain of custody due to prolonged and improper preservation such as viscera in suspicious deaths, hyoid bone and thyroid cartilage in asphyxia deaths etc. and also no further sending of documents and evidences for expert or second opinions from your jurisdiction to far tertiary teaching hospitals.

Therefore, all medico-legal services i.e. examinations and certifications in area or district hospitals must be conducted by doctor with specialization in MD Forensic Medicine & Toxicology which can be fulfilled by mandatory creation of two forensic medicine specialist posts (as one will be busy in attending spot autopsies or court of law to give evidence) improves the quality of medico-legal services in our country.

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Case Report

Violent Sexual Homicide: An Unusual Case Report

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Abstract

Violent crimes against women with sexual overtones have always been perpetuated despite being considered one of the lowliest of acts. Recently there is an upsurge seen in these types of inhuman instances. This reflects an abnormal feudal psychosocial behavior, the underlying reasons being many and not completely explained. We present a case of sexual homicide where an unclothed female body was recovered from a river. Autopsy conducted the next day revealed a young female body with multiple injuries all over the body including bite marks, gross genital mutilation and fatal cranio- cerebral injuries. The alleged accused examined the day after showed numerous scratch abrasions on his body. We intent to discuss the psychosocial and behavioral problems arising out of illicit sexual relationship and hope it serves as a warning to the society of its possible fatal outcome. Finally the Forensic pathologist should do their duty meticulously to preserve every piece of evidence and give a scientific opinion to help the law to carry out justice against such monstrous act.

Key Words: Sexual assault; Homicide; bite marks; Genital mutilation

Introduction:

Violent crimes against women with sexual overtones have always been perpetuated despite being considered one of the lowliest of acts. Recently there is an upsurge seen in these types of inhuman instances.

Though sexual crimes against women are entities commonly dealt with in day to day Forensic practice, however homicides after sexual violence are occasionally met with.

This type of heinous crime reflects an abnormal feudal psychosocial behavior, the underlying reasons being many and not completely explained. Though rape is regarded as the most brutal and abominable crime in all civilized countries but it is the fastest growing crime against woman in our country.

There is one rape every 30 minutes. According to National Crime record bureau, Rate of crime committed against women in 2012 is 41.7. [1] Again killing of the victim after various sexual assaults reflects the abnormal psychology of criminal mind which plans to conceal the crime.

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Sexual homicide is defined by Ressler, Burgess and Douglas's criteria as Evidence or observations that indicate the murder was sexual in nature are-Victim attire or lack of attire, exposure of the sexual parts of the victim's body, Sexual positioning of the victim's body, insertion of foreign objects into victim's body cavities, evidence of sexual intercourse; oral, vaginal or anal, evidence of substitute sexual activity, interest, or sadistic fantasy. [2]

We intent to discuss here a case of sexual homicide where there is sexual assault, mutilation, killing and attempt to dispose of the dead body resulting out of such an emotional and psychological conflict in the mind of accused.

Case History:

An unclothed female body was recovered from the river Mahanadi, near a village of Cuttack District of Odisha. The dead body was identified by her father; she was missing from her home the previous evening.

He alleged that her daughter was gang raped and murdered. On police investigation her clothes were found near the river bank which was suspected as the scene of crime. The next day the body was brought to the mortuary of S.C.B. Medical College and Hospital for autopsy.

Autopsy Findings:

The dead body was of a female aged about 25-30 years found in advance stage of decomposition with distension of whole body, protrusion of tongue, softening of eyeball, post mortem peeling of cuticles, marbling, Purging.

The body was soiled with mud. Scalp hairs were easily pluck able and fly eggs were deposited.

External Injuries:

1. Abrasion with surrounding contusion were present over left side of face(temple), left cheek, over back and front of both knees.
2. Contusions were present over medial aspect of left breast, third web space of finger of right hand.
3. Bite marks in the form of interrupted abraded contusion circular in shape, 3cm in diameter, were present over outer quadrant of right breast, medial aspect including areola of right breast and over right cheek. (Fig. 1)
4. Small lacerations were present over right cheek and upper lip.
5. A 'U' shaped Laceration was present over labia majora and perineum. (Fig. 2)
6. There was post-mortem distension and prolapse of small intestinal loops through the wound of perineum.

Internal Examination:

Under surface of scalp was contused over left fronto-temporal region and anterior fibres of temporalis were contused. A linear fracture of left temporal bone was present which extends downward in the base of skull in the left ACF and crosses to right in the middle cranial fossa. Blood tinged brain matter was coming out mostly from anterior and middle cranial fossa.

Neck structures and Trachea were intact, Heart, lungs were Intact and softened. Stomach was Intact, contained semi digested food materials about 100ml, and mucosa was intact. Liver, spleen, kidneys were intact.

There was a tear in the pelvic cavity behind the post vaginal wall. Contusion of size 2cmx2cm was present over left side posterior aspect of pelvic cavity. (Fig. 3) Uterus was intact, empty, non-gravid, left side broad ligament is contused.

Chemical analysis of viscera was found negative, Blood sample, Vaginal, Perineal swab, Nail clippings, Scalp hairs were preserved for analysis. The cause of death was due to "**cranio-cerebral injuries. The genital injury could have been due to forceful insertion of hard and blunt object."**

History Given by the Suspected Accused:

As per his statement he had affair with the deceased since last 2 years and they had physical relation. Suspecting, her love affair with someone else, he got angry. On the day of incident, he got drunk, called the victim to the river bank, had physical relation with her after that they quarreled and some altercation took place which resulted in death of the victim lady. There after he threw her body into the river water to dispose of the body in order to conceal the crime. The examination of the accused revealed multiple number of nails scratch abrasion on right side of neck, right arm and right forearm which are the signs of tussle and resistance by the victim.

Discussion and Conclusion:

This type of violent sexual homicide where a woman is raped, beaten and finally killed by her known lover is a rare instance in our locality. Rape is a crime against basic human rights and also violates one of the fundamental rights i.e. the right to life contained in Article 21.

According to Chikkara and Kodan, Rape is the fastest growing crime against woman in the country. There is 700% rise since 1971. Other known people are the major offenders, 75.1%. [3] In this case, there are evidences of injuries which are sexual in nature and there is also evidence of gross genital mutilation due to insertion of foreign body. (Fig. 2)

But cause of death is from other injuries and not directly from sex act. The crime is performed by the known person / acquaintance, therefore in order to avoid identification of the perpetrator, the victim was silenced by merciless killing and body was secretly disposed of.

The mutilations and destruction of identity may be done due to anger, suspicion, jealousy and also to prevent identification of the victim and to make it difficult to know the cause of death. A similar case was reported by Choudhary et al where a 25 year old female unclothed body was sexually assaulted and autopsy revealed found with crushed head and multiple injuries on her body and a wine bottle inside vagina, the upper part of the body was burnt post mortem to mask the identity. [4]

Such homicidal behavior may be the outcome of variable factors including abnormal psychological attitude like-Sexual jealousy, punishing for being unfaithful, alcohol and drug addiction, depression, erectile dysfunction, education, mental health problems in childhood, sadistic attitude and extremes can lead to lust murder and necrophilia.

As per Harris 2004, Jealousy is one of the top three reasons for non-accidental homicides. [5] Sexual jealousy can lead to male aggression and possessiveness is stated by Denisiuk. [6] It is based on a sexual partner's suspected or imminent sexual infidelity.

Expression may vary from anger and violent aggression to fear, grief, and depression.

Here accused psychology points towards sexual jealousy, infidelity, possessiveness, alcoholic intoxication and depression.

A study by Rajs et al showed during the 30 years period, 1961-1990, a total of 22 deaths with criminal mutilation / dismemberment of human body were registered in Sweden. They described mutilation in three categories as defensive, offensive (lust murder) and necromaniac mutilation. The characteristic of the mutilations were diverse.

In case of murder committed in association with sexual deviation, wounding is usually limited to breasts and sexual organs. [7] In our case also there are bite marks in breasts (Fig.1) and injury to genitalia. (Fig. 2)

As per Webb DA et al, assailants in sexual attacks including sexual homicide, rape and child sexual abuse, often bite their victims as an expression of dominance, rage and animalistic behavior. [8]

According to Michelle et al strangulation was the method of killing in 68.8% of sexual homicide [9] which is different in our case. Hence involvement in such affairs, cheating, addictions, abnormal psychology, disturbed personality may lead to dead end.

Therefore this case of illicit sexual relationship throw some light on the cruel aspect of humans and hope it serve as a warning to the society of the possible fatal outcome.

Finally the Forensic pathologist should do their duty meticulously to preserve every piece of evidence and give a scientific opinion to help the law to carry out justice against such monstrous act.

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Fig.1: Bite Marks over Breast

Fig. 2: Genital Mutilation

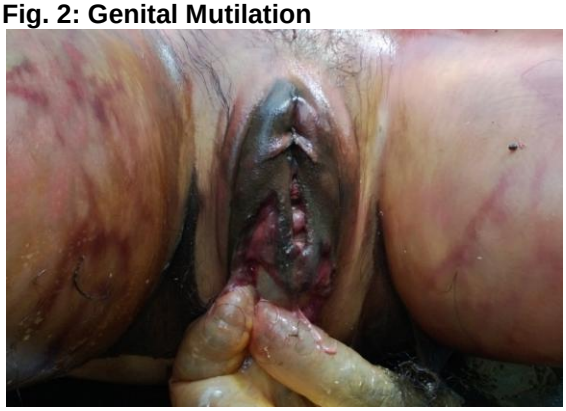
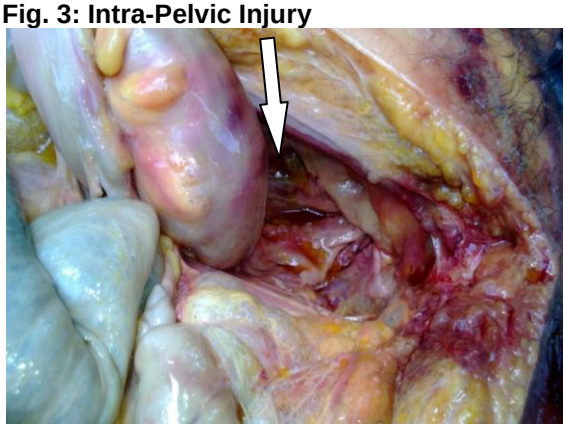


Fig. 3: Intra-Pelvic Injury



Case Report

Infant with Congenital Anomalies: Born To Die?

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Abstract

Forensic investigation of foetuses, stillbirths and new-borns and their differential diagnosis often present many difficulties. In practice all cases of abandoned new-borns deaths are reported to the police, who ask for a post-mortem examination because only this can establish the viability of the infant and the cause and manner of death in such cases. In this paper, a gruesome killing of an infant with congenital anomalies viz. polydactyly, bilateral cleft lip and palate and low set ears, is presented. The infant was killed by an **act of commission** using a sharp cutting weapon, and the motive behind the crime in all possibility was to get rid of a malformed child by the parents. In the present world, modern medical science can do wonders and there is possibility of a child with congenital anomalies growing up as a normal human being. The present case emphasizes the importance of spread of awareness to the general public, especially those in remote areas, so that such primitive and gruesome crimes are not committed in the future.

Key Words: Congenital anomalies, Parents, Infanticide, Crime, New-born

Introduction:

The Medico-Legal Encyclopaedia states that the term 'infanticide' is often taken to mean the killing of any young child, but should be reserved for the meaning implicit in the Infanticide Act 1938, that is the killing of a child under the age of 12 months by its mother, by 'wilful act or omission' during a period of mental disturbance. [1] It has been practised since time immemorial by various civilizations including the Greek and the Roman. [2]

Reasons of infanticide are social taboo surrounding a baby born out of wedlock, economic reasons, sex selection, getting rid of deformed babies, child sacrifice to supernatural forces, etc. [3] In this paper, we presented a case of gruesome killing of an infant with congenital anomalies.

Case Report:

On the 12th April 2013, the body of an infant was brought for post-mortem examination to a tertiary health care teaching institute in Imphal. As per the history, the body of the infant was found abandoned at a paddy field of a remote village in Manipur.

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Autopsy Findings:

The body was found inside a blue carry-bag, which was wrapped by a green plastic sheet. (Fig 1) A white thread was tied at the wrist with a small pouch containing a few rice grains. The length of the baby was 51 cm, and weight was 2 kg.

Rigor mortis had passed off and putrefactive changes were present, with maggots crawling on the body.

Umbilical stump had fallen off (healing). Multiple congenital anomalies in the form of polydactyly (6 digits on both hands and feet), bilateral cleft lip and palate and low set ears were seen. (Fig 2 & 3)

External injuries consisted of a chop wound on the left side of the face, vertically placed, 12cm x 0.5cm x cavity deep.

Another chop wound on the right side of the nose (extending from nose to chin) 5.5cm x 0.5cm x muscle deep and two lacerated wounds, one at back of the head (occipital area) and the other on the nape of the neck, 2.5cm x 1cm x scalp and 3cm x 1.5cm x scalp respectively.

A chop wound was also present on the right lower part of the abdomen extending up to the perineum of size 10cm x1cm x cavity with extrusion of the intestines. (Fig 2 & 3)

Internally, a cut fracture of the frontal bone was seen along with a corresponding cut on the meninges. Brain was liquefied and reddish brown in colour.

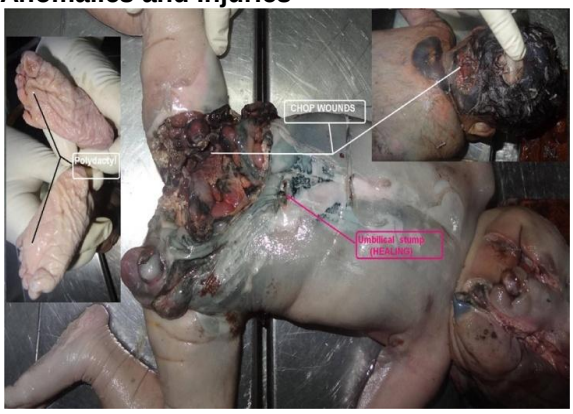
The left maxilla was fractured and the stomach was empty. Intestines were cut at

multiple sites. Both the testes were present in the scrotum.

Fig. 1: Body Found Inside a Blue Carry Bag Wrapped by a Plastic Sheet

Fig. 2: Congenital Anomalies and Injuries Observed on the Body

Fig. 3: Healing Umbilical Stump, Congenital Anomalies and Injuries



The cause of the death was found to be the Injury to the brain with fracture of the skull produced by a moderately heavy sharp- cutting weapon, and the nature of death was homicidal.

Discussion:

Roman and certain other ancient cultures regarded the birth of a deformed baby as a bad omen and babies born with even a minor defect viz. a cleft palate, harelip or missing finger were put to death. [4] In India, **"Bringing up a daughter is like watering a neighbour's plant"**- a common expression. [5]

Hence, female infanticide is more common than the killing of male offspring in this country. Poverty, ignorance of family planning, cost of dowry, etc. have been reported as the possible causes for this crime. [6]

Commonly employed methods of infanticide are divided into Acts of commission and Acts of omission. [7] Acts of commission include suffocation by the hand or a cloth, strangulation, blows on the head, or dashing the child against the wall, drowning by putting it in the privy or in a bucket of water, burning, twisting of neck, stabbing, poison etc. Sometimes, clandestine stabbing by a long needle or pin into the spine, fontanels, eye or nose are also practiced. [8]

Acts of omission are failure to tie the umbilical cord after birth, failure to protect the child from exposure to heat or cold, failure to supply proper food or to clear air–passages, etc.

Neglect, defined as the failure of a care-giver to adequately provide safety, food, clothing, shelter, protection, medical care and supervision for a child, is a relatively uncommon but important cause of child mortality. [9]

Hypothermia among new-borns is considered an important contributor to neonatal morbidity and mortality. They are more prone to develop hypothermia because of large surface area per unit of body weight. [10]

Out of the acts of commission, the common methods usually employed are suffocation, strangulation, blows on the head, or dashing the child against the wall or drowning. [5]In our case, the victim was a male infant killed by an act of commission; and the method employed for killing was an uncommon one.

The motive behind the crime in all possibility was to get rid of a malformed child by the parents.

In some remote areas, killing of a malformed baby with mutilation of its body parts by **a "Louri thangjou"-** a moderately heavy sharp cutting weapon is traditionally practised by parents in order to avoid rebirth of a baby with such malformations in future.

Conclusion:

In the present world, modern medical science can do wonders and there is possibility of a child with congenital anomalies growing up as a normal human being.

The present case emphasizes the importance of spread of awareness to the general public, especially those in remote areas,

so that such gruesome crimes are not committed in the future.

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Case Report

Autopsy Findings and Histopathological Corroboration in A Case of Death due to Hornet Bite

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Abstract

We present a rare case of death due to hornet bite in an adult 64 years old patient who died within 6 hours of admission. There were bites on multiple sites and histopathology of Kidney showed acute tubular necrosis. Liver shows fatty changes periportal fibrosis and portal inflammation. Lungs show intra-alveolar exudation, alveolar wall destruction and inflammatory infiltrates. Heart showed deposition of lipofuschin and brain showed focal oedema with dilatation of vessels. These accidents can occur in places of cohabitation of hornets with humans. People who are allergic to wasp venom are also allergic to hornet stings. In severe cases, allergic individuals may go into anaphylactic shock and die unless treated promptly. Clinical criteria for fatal cases can be formulated from this case and especially susceptible individuals like elderly with co morbid conditions and children should be treated early and extensively to avoid fatal complications.

Key Words: Hornet bite, Fatal, Histopathological corroboration, Allergy, Inflammation

Introduction:

Hornets are the largest eusocial wasps; some species can reach up to 5.5 cm (2.2 in) in length. The true hornets make up the genus Vespa and are distinguished from other vespines by the width of the vertex (part of the head behind the eyes), which is proportionally larger in ***Vespa*** and by the anteriorly rounded gasters (the section of the abdomen behind the wasp waist).

The best known species is the European hornet (Vespa crabro), about 2–3.5 cm in length, widely distributed throughout Europe, Russia, North America and Northeast Asia.

Hornets have stings used to kill prey and defend hives. Hornet stings are more painful to humans than typical wasp stings because hornet venom contains a large amount (pkp, 5%) of acetylcholine. Individual hornets can sting multiple times.

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Unlike honey bees, hornets and wasps do not die after stinging because their stingers are not barbed and are not pulled out of their bodies.The toxicity of hornet stings varies according to hornet species; some deliver just a typical insect sting, while others are among the most venomous known insects. Single hornet stings are not in themselves fatal, except sometimes to allergic victims. Multiple stings by non-European hornets may be fatal because of highly toxic species-specific components of their venom. The stings of the Asian giant hornet (*Vespa mandarinia japonica*) are the most venomous known.

Stinging insects are members of the Order Hymenoptera of class Insecta. In most instances, insect stings are only followed by allergic reactions but sometimes intravascular haemolysis, rhabdomyolysis, thrombocytopenia [9], acute tubular necrosis, acute hepatic injury [9, 10], and myocardial infarction [11] have been reported.

Their venom is a concentrated mixture of complicated active components, such as melittin, apamine, phospholipases, hyaluronidase, acid phosphatase, histamine, and kinin. These have direct and indirect haemolytic effects, neurotoxic and vasoactive properties, which can cause intravascular haemolysis and rhabdomyolysis [4]

Case History:

A 64 years old male was brought for autopsy to the police morgue of Burdwan

Medical College with history of hornet bite. Multiple punctured wounds each measuring 2mm x 2 mm with evidence of blackening induration and oedema of surrounding skin was noticed over following areas of body.

The areas involved were Dorsum of right hand 2x1 inches, Malar area of left side of face 2.5x1 inches, Anterior aspect of left forearm 1.5x1 inches, Posterior aspect of left arm 2x0.5 inches, Dorsum of phalanges of Right index finger 0.8x0.4 inches, Anterior aspect of right leg 2x1.6 inches and Dorsum of right foot 1.4x1inches.

Autopsy Findings:

Huge extravasations of blood and serous fluid were found in underlying areas. Organs were congested all over. Pleura and pericardium show pin point haemorrhages on both sides. Liver showed pin point haemorrhages on under surface of liver.

Kidney showed slight cortico-medullary haemorrhages on both sides. Considering all probable factors Time since death was between 12-36 hours prior to date and time of PM examination.

Histopathological Findings:

On histopathology and haematoxylin eosin staining the tissues under high power (40X) magnification showed following changes. Kidney showed acute tubular necrosis, hyalinisation of glomerular capillary and focal glomeruloscerosis. (Fig. 1 & 2)

Liver showed fatty changes periportal fibrosis and portal inflammation. Lungs showed intra-alveolar exudation, alveolar wall destruction and inflammatory infiltrates. (Fig. 3) Heart showed dilated blood vessels and lipofuschin pigment. Brain showed mild focal oedema and dilated thin walled blood vessels. (Fig. 5)

Discussion:

A death of this nature is sudden and occurs unexpectedly in places where there is cohabitation of humans and hornets. Disturbed hornets are extremely aggressive which can result in fatal consequences from which the victims cannot escape. Hornets are numerous in Indian subcontinent.

They form nests close to human dwellings where there is a constant conflict with humans which may result in immense human suffering and even leads to fatalities.

Therefore, utmost priority should be given to recognize hornet stings as an important public health issue and to improve management strategies in hospitals like giving early recognition of symptoms thereby reducing the number of deaths.

Thorough knowledge about possible complications of hornet stings, understanding of venom effects on body homeostasis and testing of different therapeutic regimens that would reverse the deranged physiological processes in the body. In this case study, the patient had similar macroscopic and histopathological findings suggesting an initiation of the same pathophysiological process as a result of envenoming that has progressed to a fatal outcome. In previously reported cases acute pulmonary oedema had been the dominant one detected both clinically and histopathologically that had contributed to their death within a short hospital stay. It is thus obvious that the development of pulmonary oedema can take place in a few hours in the patient.

Our case shows histopathological changes of lungs However, fluid shift as a result of immediate anaphylaxis or anaphylactoid reaction starts very early leading to the development of acute pulmonary oedema followed by a cascade of events such as prolonged hypoxemia, metabolic acidosis and cardiac dysfunction. During the early hours, onset of acute pulmonary oedema was not obvious clinically and detected later in advanced stages when the damage was irreparable.

The immune mechanisms causing the histamine-releasing action of Hymenoptera stings are either Type 1 hypersensitivity that operates through immunoglobulin E-mediated mast cell degranulation leading to anaphylaxis or anaphylactoid reaction where immunoglobulins are not involved [3, 5] or, occasionally, delayed reactions due to Type III hypersensitivity immune response that could cause Arthus reaction and serum sickness.

It is apparent that deaths happening a few hours or days later could be due to different problems which are unpredictable.

Other than lungs and kidneys, other organs did not show significant histopathological changes in these patients. On microscopic examination the myocardium and coronary arteries were normal and what caused the cardiac arrest was not ascertained.

In our case hemosiderin deposition was seen in myocardial muscle fibres. Lessons learnt reiterate that immediate recognition of anaphylaxis, early use of adrenaline, inhaled beta agonist and other measures are crucial for a successful outcome. [12]

Therefore, the positive impact of adrenaline administration in the early stage of Hymenoptera envenoming is clear irrespective of either anaphylactic or anaphylactoid reaction.

Testing for immunological mechanisms is beyond our scope.

In fatal cases one might find insufficient monitoring, missing the onset of organ dysfunctions, delays in early intensive care and organ support and inappropriate therapeutic decisions and medications. Lack of standard management protocols of Hymenoptera envenoming is a global problem which has an amplified effect on victims in resource-poor countries. Therefore, increased vigilance is needed from the time of stinging to detect all the complications and to institute proper management to increase the chances of survival of the victim.

The severity of envenoming and the late complications are related to the number of stings as shown in these cases, but sometimes a single sting could be fatal in a sensitised individual. Hymenoptera stings and envenoming needs more global attention as it appears to be a neglected problem now. [16-18]

Previously various case reports of acute renal failure in patients with Hymenoptera stings have been documented. Initially it was attributed only to tubular necrosis (ATN) either due to shock or pigment nephropathy due to intravascular haemolysis or rhabdomyolysis. [5-7, 12] Three of the five patients with hornet bite (V. orientalis) and renal failure reported by Sakhuja et al had histopathological evidence of ATN. [5] Mejia et al also reported five cases of acute renal failure following African bee stings. [12]

Post-mortem renal biopsy done in one of these patients showed dense proteinaceous casts of collecting tubules and ascending loop of Henley (probably due to shock), arterial nephrosclerosis (due to underlying hypertension) and unexplained membranous glomerulonephritis.

Our case also shows similar findings of acute tubular necrosis. Glomeruloscerosis is however probably a result of long standing premorbid condition likes hypertension.

Rhabdomyolysis and ischemia was thought to be the most probable cause of renal lesions. [12] There were reports of renal failure without any evidence of haemolysis and shock earlier but as renal biopsy was not done, the cause could not be ascertained and it was postulated to be due to the direct toxic effect of the venom. [13]

Sakhuja et al had also found that direct toxic effect cannot be directly excluded. Vikrant et al reported three case of acute renal failure following wasp bite but only two had evidence of intravascular haemolysis. [14]

So obviously there are causes other than ischemic/toxic acute tubular necrosis which are responsible for development of acute renal failure in such patients

Conclusion:

This may help to formulate or postulate clinical criteria for diagnosis in fatal cases of hornet bite especially in cases of elderly and children who form the susceptible population at risk. Premorbid conditions like long standing diabetes, liver and renal diseases also show an increased propensity of fatal outcome and early treatment can help to prevent death in allergic individuals with implementation of crucial treatments such as early use of assisted ventilation, organ support, dialysis, and medications such as adrenaline.

Further studies are needed to understand the pathophysiological mechanisms of pulmonary oedema in Hymenoptera envenoming and to find out appropriate preventive treatments.

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Fig. 1: Acute Tubular Necrosis and Focal Glomeruloscerosis in Kidney HE Stain (40X magnification)

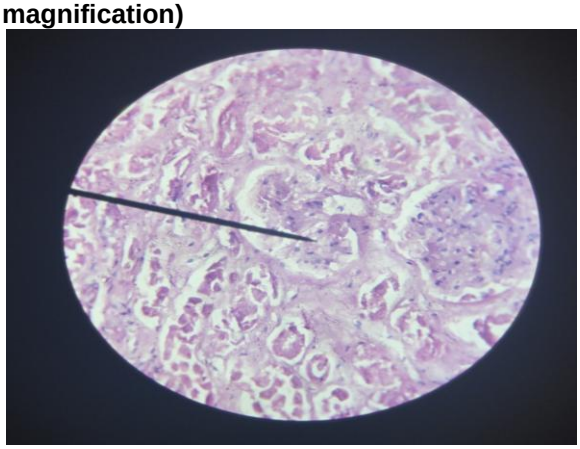


Fig. 2: Peritubular Arterial Wall Thickened and Dilated lumen HE Stain (40X magnification)

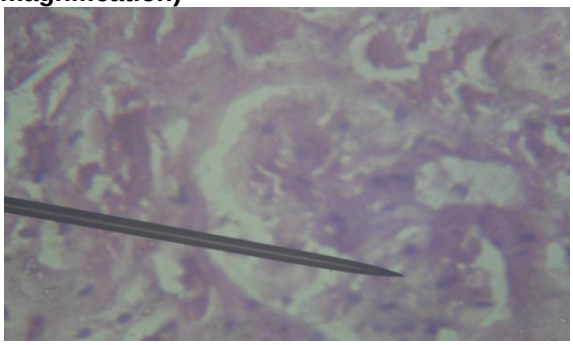


Fig. 3: Lungs Intra-alveolar Exudation, Alveolar wall Destruction and Inflammatory Infiltrates in Lungs HE Stain (40X magnification)

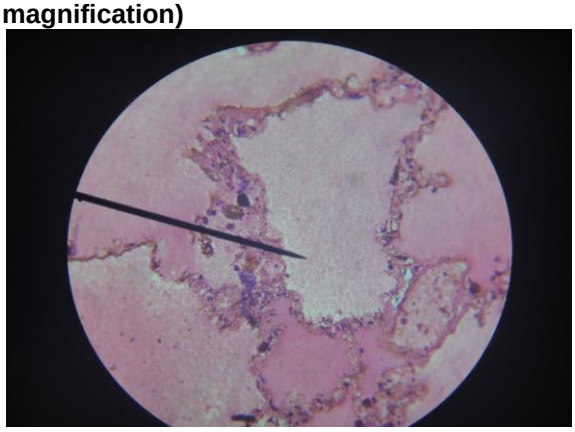


Fig. 4: Intra-alveolar exudation, Alveolar Wall Destruction & Inflammatory Exudate HE Stain (40X magnification)

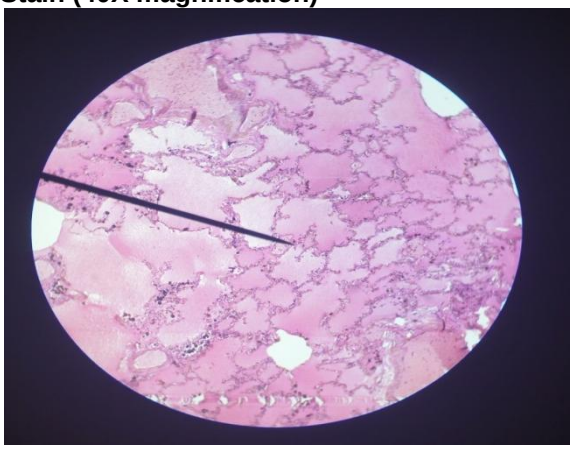
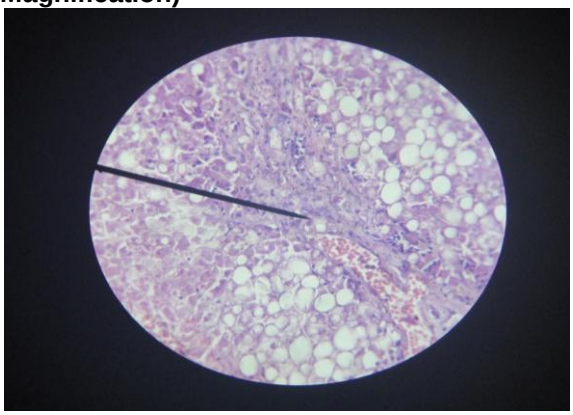


Fig. 5: Focal Dilatation of Thin Walled Blood Vessels of Brain HE Stain (40 X Magnification)



Case Report

The Sternal Foramen: The Possible Forensic Misinterpretation of an Anatomic Abnormality

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Abstract

The sternum is one of the skeleton parts with frequent variation in appearance on images or during autopsy studies. Therefore the knowledge of sternal variations and anomalies is useful so as not to confuse those with pathological conditions and acquired lesions, usually gunshot or stab wounds. Awareness of a sternal foramen is important in acupuncture practice also. Acupuncturists should be aware of congenital sternal foramina to avoid serious heart injury by needle insertion, especially since this area holds a commonly used acupuncture point. Besides this it is important for doctors to have thorough knowledge about sternal anomalies for better diagnosis and treatment. Here we discuss one case brought for autopsy in the Department of Forensic Medicine PGIMS, Rohtak. We observed in this case a sternum with a large oval foramen in lower one third of the body which could have mislead to the diagnosis of a firearm/stab wound in a skeletonized remains of a body.

Key Words: Sternum, Foramen, Autopsy, Skeletonized Remains

Introduction:

The adult sternum has three components i.e. manubrium (Prosternum), the body of sternum (Mesosternum) and xiphoid process (Metasternum). [1] The sternum is formed from bilateral mesenchymatous condensations, sternal plates, which begin in ventrolaterally region of body wall.

These plates undergo chondrification, move ventrally towards each other from both sides, and they eventually fuse together across the midline in a craniocaudal direction.

This chondrification produces cartilaginous models of the manubrium, body segments (sternebrae), and the xiphoid process. Fusion of the bars at the inferior end of the sternum is sometimes incomplete. [2] This fusion defect can also be seen occasionally between the third and fourth body sternebrae. This imperfect union is known as midline sternal foramen.

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This condition is seen more frequently in the lower part of the sternum, but may occur even in the manubrium. [3, 4]

It may be an isolated malformation or may be accompanied by displacement of the heart or other midline abnormalities. [2]

Case Report:

During routine autopsy of an unknown/ unidentified dead body in the Department of Forensic Medicine PGIMS, Rohtak, Haryana, India. We observed a sternum with a large oval foramen in lower one third of the body. (Fig. 1) The length and the width of the sternal foramen were 18.75 mm and 12.50 mm respectively, measured by using digital caliper.

Fig. 1: Large Oval Sternal Foramen in the Lower Part of Body of Sternum

Discussion:

A specialized mesenchymal condensation of the anterior thoracic wall is form the sternum, which is a vertical component of

the axial skeleton. As the ribs grow laterally and anteriorly, a pair of mesenchymal sternal bars condenses and forms within the ventral body wall. By the 8th week of development, these bars begin to condrify into cartilaginous sternal plates and then fuse into a single midline structure.

As the sternal plates fuse together, the superior seven pair of ribs, which growing and have also begun to condrify, make contact with the lateral edges of the plates.

The fused sternal plates later ossify to form the sternum through the development of several ossification centers, giving rise to distinctive anatomy of the adult sternum. The manubrium and sternal body begin to ossify until child is about three years of age. [5]

Any failure in the developmental process results in various sternal anomalies, such as fissures or foramen. [6-8]

Sternal foramen is a congenital defect at the lower third of the sternum, usually asymptomatic. Sternal foramen may be associated with sternal sclerotic bands [9] sternal clefts with displacement of the heart or other midline abnormalities. Sternal foramen associated with accessory fissures on left lung were reported by using high-resolution computed tomography. [10]

The incidence of sternal foramen was evaluated as 4.3% on the chest CT by Stark [11] 6.7% in autopsy cases by Cooper [7], 6.6% by Moore et al [8] and 4.5% by Yekeler E et al. [9]

Aktan and Savas observed it in 5.1% of Turkish population. [10] The size of sternal foramina ranged between 2 and 16 mm, with mean of 6.5 mm. [9] But the sternal foramen in our study measured to be 18.75 mm and 12.50 mm, a larger size reported so far.

A sound knowledge of sternal variations and anomalies is very important for medical practitioners. Fatal cardiac tamponade resulting from a congenital sternal foramen located in the inferior part of the sternum and low thickness of sternal body was seen during the sternal puncture. [12]

Foramina in sternum were misinterpreted as acquired lesions like gunshot wounds. [13] The Forensic expert should have knowledge of gunshot wound and sternal foramen. The hole due to earlier reason should have irregular edges, beveling and fracture lines and latter have unique, smooth, rounded edges.

To be familiar with the imaging appearances of the sternal variation and anomalies, it is necessary to differentiate those from the pathological conditions, such as traumatic fissures or fracture and lytic lesions. Absence of cortical irregularity, expansion and soft tissue mass can be taken into consideration in the differentiation. [9]

Deep perpendicular needling at REN [14] is therefore contraindicated for patients with congenital sternal foramen, oblique or transverse needling should be used. [15]

Serious complications following sternal puncture for bone marrow biopsy [13] or acupuncture [14] have been reported in the literature. Fatal cardiac tamponade following sternal puncture in the inferior part of the sternum with a congenital sternal foramen was reported. Therefore, awareness of the presence of sternal variations and anomalies is important to prevent these fatal complications by avoiding the inferior part of the sternal body during bone marrow aspiration.

When sternal puncture is planned in corpus sterni region, radiographs should be taken to rule out this variation to avoid fatal complications.

Conclusion:

This article documents the occurrence of a relatively rare congenital anomaly which may be misleading and may result in serious erroneous conclusions, particularly when evaluating skeletonized human remains.

This abnormality and its relationship to medico-legal cases have not been previously reported in the forensic literature.

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Case Report

Sewer Gas Poisoning: A Report of Two Cases

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Abstract

Death associated with confined and enclosed spaces present problem to the investigating pathologist as there may be few or no diagnostic feature at autopsy. In April of 2013, two manual labourers were engaged to clean a sewerage pipe in Imphal by climbing down a manhole. As soon as they entered the manhole, they collapsed and were declared 'brought dead' in the hospital. These cases are reported here to highlight an unexpected instance of hydrogen sulphide poisoning in the middle of the city here which was heretofore unheard of in this particular part of the country. H_2S is irritant to human tissues causing kerato-conjunctivitis, lacrimation, nasal irritation, dyspnea and coughing at 50-100 ppm.

Hydrogen sulphide is quickly absorbed through the lungs and gastrointestinal tracts. The suddenness of the deaths shocked the general public and has served as an eye-opener to the possibility of similar occurrences in the future. Certain precautions are also suggested here to prevent such mishaps.

Key Words: Manhole, Hydrogen Sulphide, Oxygen Mask, Keratoconjuntivitis

Introduction:

Hydrogen sulphide in combination with CO_2 and methane formed in sewers is known as 'sewer gas'. Sulphureted hydrogen is the chief and dangerous constituent in sewer gas.

It is colourless with a smell of 'rotten eggs', heavier than air and tends to settle at the bottom of pits and cellars or sewers. It is the second leading cause of toxin-related deaths (after carbon monoxide) in the workplace. [1]

It is a by-product generated in several industries and also present in sewer gas, cesspools and wherever putrefaction takes place. In 2007, OSHA (Occupational Safety and Health Administration) recorded 13 work-related asphyxiation deaths' [2]

OSHA General Industry permissible exposure limit is ceiling of 20 ppm with a 50 ppm 10 minutes peak, once during 8-hr shift.

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Case Report:

As per the history given by the police, on 25/04/13 at around 8:00 AM, two workers fell down inside the manhole of sewerage pipe located at North AOC, Imphal while trying to clean the pipe. They were almost immediately evacuated to hospital but were declared 'brought dead'.

Case One:

The 1st case was a 35 yr. old man and was brought to the mortuary of Dept. of Forensic Medicine, RIMS, Imphal for post-mortem examination on the same day at 1:50 PM. On post mortem examination, externally, rigor mortis was developed; post mortem staining was developed on the back, but not yet fixed. Face was congested and cyanosis was present on lips and fingers. No external injuries were seen.

Internal findings showed that all the organs were congested and oedematous with a greenish tinge. Heart was filled with dark fluid blood and petechial haemorrhages were present on the surface.

Case Two:

The 2nd case was a 45 years old man. Post-mortem examination was done at 2:30 PM on the same day. Post mortem findings were similar with the previous case. In this case, traces of froth were also present in larynx and trachea.

Crime Scene Visit:

Air sample analysis was done using lead acetate paper. [1] When lead acetate paper was exposed to the gas/vapor in the hole, few

blackish brown spots were developed on the paper (Indicative of the presence of H_2S). [2] When lime water was exposed to the gas/vapor present in the hole, turning of lime water milky could not be observed which rules out the presence of CO_2. From these, it could be inferred that H_2S gas was present in the hole and CO2 was absent.

Toxicological Analysis:

Toxicological analysis of the viscera confirmed the presence of Hydrogen sulphide (CFSL Kolkata Report No. 05(04)2013/FSL-Man/CSI Dt. 27-4-14).

From the post-mortem findings and the crime scene and toxicological analysis, the cause of the deaths was "**Asphyxia resulting from Hydrogen sulphide poisoning and Accidental in nature."**

Discussion:

Death associated with confined and enclosed spaces present problem to the investigating pathologist as there may be few or no diagnostic feature at autopsy. Findings and surrounding circumstances need to be taken into account in determining the cause and manner of death. [3] In the present cases, there are specific features of H_2S poisoning at autopsy i.e. greenish discoloration of tissues, organs and bronchial secretion.

H_2S is irritant to human tissues causing kerato-conjunctivitis called 'gas eye'; causes lacrimation, nasal irritation, dyspnea and coughing at 50-100 ppm.

Despite its distinctive odor, smell is not a dependable way to detect as it rapidly paralyzes olfactory nerve ending at high concentration. [4] Loss of smell at 100-200 ppm, pulmonary edema at 250-500 ppm, and concentrations greater than 500 ppm often called the "Knockdown concentration"- can cause respiratory arrest, collapse, and death within minutes. [5]

Hydrogen sulphide is quickly absorbed through the lungs and gastrointestinal tracts. Eliminated through the lungs or faeces, and metabolites are passed in urine. Majority of poisonings (approx. 86%) occur in confined spaces and are the direct result of others trying to help co-workers in need. [6]

Treatment is empirical with a combination of nitrite and hyperbaric oxygen. Once the patient is evacuated, first step of treatment should be performed in an airy space. If suspected in patient's expiration, mouth to mouth resuscitation should be avoided. [7]

When transferring in vehicle, all windows should be opened and well ventilated. Accurate decontamination in the field and in-transport ventilation is important to keep paramedics safe from secondary injury. [7]

Conclusion:

Death due to H_2S poisoning is almost without exception, accidental in manner. Awareness regarding the safety measures and health hazards of occupational works should be promptly given to the sewage workers. Appropriate preventive steps must be taken to prevent fatalities associated with H_2S poisoning. Workers should use respiratory personal protective equipment while at work and Rescuer should use self-contained breathing apparatus.

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Fig. 1: Manhole

Fig. 2: Closure View of the Manhole

Fig. 3: Dead body of Case One

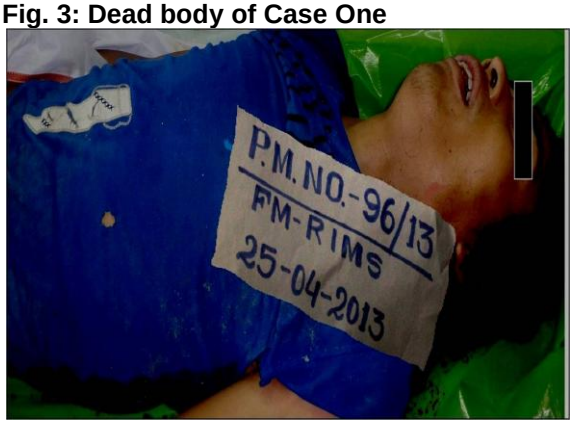

Fig. 4: Dead body of Case Two

Fig. 5: Lead Acetate Paper Test for Hydrogen Sulphide

Fig. 6: Crime Scene Visit and Test done

Case Report

Rose Flower Petal Showering: Explosion Brings Sorrows at Auspicious Marriage Ceremony

[1]R. Sudha, [2] V. Jayasurya Prasad Babu, [3]D. Sravan

Abstract

As a part of custom and tradition, rose flower petals are showered at guests of auspicious ceremony. At one of such ceremony nitrogen gas cylinder (part of equipment used for showering flower petals) exploded; lead to massive explosion injury to the young male operating the compressed gas cylinder of Nitrogen. At about 08:30pm, 30 May 2013, deceased, who was assisting his father in operating above said machine opened the valve accidentally and the compressor filled with Nitrogen gas blasted causing massive disruption of the abdominal area of the deceased who was closer to that machine. His father who was away sustained minor injuries. He died on the spot due to massive blast injury of the abdomen. His spot death made the ceremony tragic to the extent that host changed the venue to continue. As such Nitrogen gas is non inflammable and its non industrial explosions are very far and few of off. Due to rarity of its kind and having potential of being a preventable accident the case is presented in detail.

Key Words: Rose flower petal showering, Blasting machine, Compressed nitrogen gas cylinder, Explosion injury

Introduction:

Nitrogen is a non toxic odorless colorless in liquid or gaseous form. Nitrogen constitutes 78 percent of Earth's atmosphere and is a constituent of all living tissues. It is non-inflammable compressed gas stored in cylinders at high pressure. It is sold as a pure product 99%. It is simple asphyxiant and can cause rapid suffocation when concentrations are sufficient to reduce oxygen levels below 19.5% by displacing oxygen in air.

In growing edge of advancements in almost each and every field; use of compressed gas like oxygen, carbon dioxide, argon, acetylene, nitrogen has been very common.

Precautions in form of check list having many dos and don’ts can definitely check safety in industries dealing with compressed gas cylinders. However, accidental explosions off compressed gas cylinders still finds place in lay press.

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“Three persons were killed and one suffered injury after an oxygen cylinder blast at job site” [1], “two people died and one sustained serious thermal injury following explosion of cylinder” [2] and “One person has died while three others have suffered critical injuries in what is reportedly a freak nitrogen cylinder blast at an Aluminium dye casting unit a private Aluminium casting unit manufacturing smaller components of nozzles and spares used in automobile components..”[3] are some examples of lay press.

Bio medical literature of recent past has mention of few cases in details. Rani M et al [4] reported case of a death due to explosion of acetylene gas cylinder used for welding. Gupta and Jani [5] also reported a case of oxygen cylinder blast claiming three lives.

Case History:

On 30 May 2013 a male aged 16 years along with his father attended a marriage at Hyderabad, Telanagana with a “Rose petal flower blasting machine” of their own. (Fig. 1) They used that instrument to sprinkle rose petals in marriage functions etc. to earn livelihood.

At about 08:30pm he was assisting his father in operating above said machine; opened the valve accidentally and the cylinder filled with Nitrogen gas blasted. He bore brunt of the explosion since he stood closer to cylinder as operator. His father who was away sustained only minor injuries. [6]

Post-mortem was conducted and extensive disruption of the lower abdomen and pelvic regions was found with multiple intestinal perforations and contusions and lacerations of pelvic tissues with fragmentation of pelvic bones and upper third of the right femur. The skin over the left thigh is avulsed with contusions and lacerations of the upper and middle third of the left thigh. The liver was lacerated, both the lungs were disrupted with interstitial hemorrhages and external genitals lacerated. (Fig. 2)

Discussion:

Nitrogen as a gas is simple asphyxiant can cause rapid suffocation when concentrations are sufficient to reduce oxygen levels below 19.5% and to overcome that; self contained breathing apparatus (SCBA) may be required. However, present case does deal with toxicity of nitrogen gas but explosion effects due to accidental blast while handling compressed gas cylinder having nitrogen.

As it is noninflammable and does not support combustion; in the present case thermal injuries were significantly absent and only "disruptive" effect on the victim's body was found.

Material safety data sheet [7] mentions many steps to avoid accidental blast which includes certain suggestions which we applied in our case to determine the reason of blast:

S N	Precaution	Status in the case
1	To be stored upright;	OK
2	Storage below 52^0C	OK (Time of blast 08:30 Pm- can't be 52^0!)
3	Valve protection caps and valve outlet seals shall be proper	OK
4	Don't drag, roll or slide the cylinder	OK
5	Pressure reducing regulator or valve shall be used	OK
6	**Wrench, screw driver, pry bar etc not to be inserted into valve cap openings**	**NO: Cylinder blasted when operator tried to handle the valve for releasing gas under pressure.**

Keeping in mind the history given by eye witnesses, police report and autopsy findings We attribute "Rapid crack propagation theory" responsible for the blast. The operator tried to handle the valve for release of gas under pressure in a controlled way, but sudden and rapid release of gas might have crossed the safe limits of 2200 psi and sudden release of stored energy transformed into kinetic energy producing a blast effect.

We feel that operators of such compressed cylinders must be properly trained and educated so as to prevent accidents. Entire incident not only claimed life of young male and injured another but the shocked family of the bride and bridegroom shifted the ceremony to some other nearby place.

Careful and meticulous articulation of different facts of case of such type can explain the cause of blast in a scientific manner and help all concerned to advise steps for prevention.

Conclusion:

We feel that such accidental deaths while handling compressed gas cylinders are preventable ones. Educating the individuals dealing with cylinders about handling, transportation and storage with high degree of care and caution; wherever used in medical and other fields can ensure the safety of operators and even the public.

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Fig. 1: Part of "Rose Petal Flower Blasting Machine" attached to Nitrogen Gas Cylinder

Fig. 2: Dead Body of Victim at Scene: Massive Disruptive Injuries to Trunk &Extremities

Case Report

An Unusual Case of Accidental Hanging by Cloth (Shawl) Entangled in the Rolling Shaft of a Crane

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Abstract

Accidental hanging although a rare entity, but occasionally reported in literature. It is very difficult to differentiate in suicidal and accidental hanging. Circumstantial evidence alone can sufficiently indicate the accidental nature of occurrence. In the present case a 25 year old male was accidentally hanged when the shawl wrapped around his neck got entangled in rolling shaft of crane. Initially, he was completely hanged for some time and then fell on iron rods and bars placed on the ground. He was immediately shifted in an unconscious condition to Govt. Medical College Nagpur but was declared brought dead. The Autopsy performed subsequently revealed ligature mark around neck with multiple injuries on lower limb, un-displaced fracture of thoracic ribs and of thoraco-lumbar vertebrae. This case reports a rare case of accidental hanging in an adult male, which would have been mistaken to be homicidal considering the other injuries present on the body.

Key Words: Adult male, Shawl, Accidental hanging, Asphyxia

Introduction:

It is a great challenge before the autopsy surgeon to decide the manner of death, whether it is suicidal, homicidal or accidental, especially in those cases where the body of deceased has associated injuries which are sufficient in the ordinary course of nature to cause death in addition to the main cause of death. Moreover, such injuries may arouse the suspicion regarding the manner of death.

Hanging represents one of the most common causes of suicide in our country. As per NCRB data of 2013, the most preferred method adopted to commit suicide is hanging and it contributes to 39.8% deaths. [1]

Hanging is almost always suicidal unless it is disproved [3], but a few cases of accidental hanging are also on record. Accidental hanging is rare in all age groups but it is even rarer in adults except in case of autoerotism [2], intoxication and person under the influence of drugs. In autoerotism the death is not expected by person but trying to constrict the neck to produce partial asphyxiation.

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Children are usual victims because they hang accidentally while playing, in crib or cot or young children may try to copy the scenes that they have seen in movies or on television.

Case History:

A corpse of a 25-year-old male was brought for an autopsy to the Department of Forensic Medicine at the Government Medical College and Hospital, Nagpur with an alleged history of hanging under suspicious circumstances, while working at the plant site in a company.

As per his co-workers, deceased had come for his routine night shift on the day of the incident i.e. 14/1/14, around 8 pm at the construction site. As he climbed the stairs of the crane and was walking on the rolling area of its platform, the shawl wrapped around his neck suddenly got entangled in the rotating shaft of the crane and he was pulled up and hanged for some time, subsequently falling on the iron rods and bars on other side of rolling shaft.

The co-workers rushed to help him, but by that time he had lost consciousness. They removed the neck cloth by cutting it into two parts and took him to Govt. medical college and hospital Nagpur, where he was declared brought dead by CMO in casualty on 14/01/14, 10:45 pm. The body was shifted to forensic medicine dept. for medico legal autopsy.

Autopsy Findings:

At autopsy, the clothes were soiled with mud but intact. External examination revealed fixed postmortem lividity confined to the back.

The face was congested, the nails cyanosed with brownish blood tinged fluid oozing from nostrils and the left angle of the mouth. External genitalia were intact with no obvious injuries or purging. Multiple external and internal injuries were found over the body.

A ligature mark present over neck in the form of a reddish brown pressure abrasion running on both sides of neck obliquely placed, encircling the neck on posterior aspect and both right and left side of neck, right limb of ligature mark terminating over the right side of neck at mid-clavicular region directed downwards, and left limb ends over undersurface of mandible at sub-mental surface, present over midway of the thyroid cartilage, the underlying area appearing dry, hard and parchmentized.

The ligature mark had a maximum breadth of 4cm throughout and a circumference of 36 cm. deficient for 5cm on right side of neck. The point of suspension is supposed to be present over right anterolateral aspect of neck.

Other External Injuries:

- A lacerated wound present over upper 1/3 of left leg 5cm below knee joint of size 5cm x 3cm x bone deep, compound fractures of tibia and fibula.
- A bluish coloured contusion over anterior aspect of middle 1/3 of right thigh 15 x 8cm and displaced fracture of underlying shaft of femur.
- Reddish brown abrasion over the right gluteal region 5 x 4cm.
- Three small reddish brown abrasions over right shin of tibia in the upper 2/3 region 2 x2 cm each.
- Reddish brown abrasion over middle 1/3 of left leg 11 cm below knee 4 x 4 cm.

Internal Examination:

Un-displaced fracture of 2nd, 5th, 6th and 7th ribs was noted in right mid-clavicular line with infiltration of blood in the surrounding area and the lungs were edematous with widespread petechial hemorrhages. Fracture of spine between L1- L3 and T1-T3 with infiltration of blood in surrounding spaces and contusion of spine corresponding to fractured area. Hyoid bone and thyroid cartilage were intact.

Mucosa of respiratory tract was congested and showed multiple petechiae in larynx and epiglottis. The brain matter showed petechial hemorrhages. Visceral organs were congested.

Discussion:

Among the various types of asphyxial deaths, hanging is most prevalent, followed by strangulation (throttling and mugging) and gagging. The neck is the common target in assault (strangulation or throttling) etc. because of its easy accessibility, rounded counters, minimum body shields, small diameter, unsafe location of airway and presence of vital blood vessels and spinal cord in the region. [2]

Homicidal hanging is even rarer and occurs in those who are weak and debilitated like children and elderly or in those who are intoxicated. Accidental hanging is rare and represents just 2% of the 250 cases of hanging autopsied at the department of Legal Medicine of Sousse Tunisia over a period of 15 years.

According to Davison (1989), it would represent about 5% of all hangings. [6] A survey in North Ireland revealed that 95.5% of hangings were suicidal, and only 4.5% were accidental. [2, 5] Hangings by the seat belt (Ross and Roger) or the electric window of the cars (Pelizza, 1995), hanging due to compression of the neck between the side bars of a bed in elderly subjects affected by neuropsychiatric pathologies (Osculati and Fassina, 2000) are some of the reported cases in literature of Forensic Medicine.

Dhiab et al reported 4 cases of accidental hanging, eight-year-old boy was discovered suspended by his woolen pullover hanged from the trunk of an olive tree, a four-year-old boy with mental illness found suspended when his neck caught in a hole of curtain, a nine-year-old girl discovered suspended on a rope that was used previously for religious celebration for tying the sheep, the rope was fixed to a plank, a chair was discovered close to the corpse, investigation found that it's a case of accidental hanging as the girl was playing and wanted to imitate the suspension of the slaughtered sheep. [6]

Sarathchandra Kodikara et al [2] reported a 25-year morphine intoxicated man returning from a night party was found dead, hanging from the protruded root of tree in sitting position, the back of his T-shirt was entangled with a jutted out root, whereas the front part of it was compressing the neck, just as a ligature, the scene being a slope having a slippery footpath.

Salem et al reported 40 years male patient was hanged when his collar of his shirt was fixed in a hook of iron fence, postmortem toxicological analysis found high level of alcoholic intoxication. [4]

In the present case, the deceased was walking on a platform made of iron rods and bars and a rolling crane shaft which is coming down and lifting up, and operated by an operator. but due to the darkness or imbalance while walking, the shawl wrapped around the

neck of deceased got entangled in the shaft of crane and lifted up, he remain for some time in that position and tried to make some noise but due to tight ligature he was helpless and can't call anyone and no one noticed him immediately.

When he fall on other side of crane, due to this noise of fall and crying coworkers rush for helping but by that time he had lost his consciousness but ligature mark still was wrapped around neck so they cut it into two parts. The manner of death in police requisition was mentioned as accidental hanging but prominent ligature mark around the neck associated with the injuries to rib cage, injuries to spine, injuries to both legs with fractures are present and these associated injuries and pattern of these injuries aroused at least some degree of suspicion, which was further clarified after a close investigation of the scene of crime.

Conclusion:

The major possibility of the incident is accidental entanglement of neck cloth into the rolling shaft of a crane, as a result of which the victim was unable to free him and was hanged as the shaft was hoisted up. When the shaft turned to the other side, the body of the victim was suddenly struck against the platform made of iron rods, thereby inflicting the associated major injuries and fractures on the body.

And the fracture of cervical spine is due to sudden jerk to spine while hanging as the point of suspension being anteriorly. The absence of any struggle mark or defence injuries on the body and absence of disturbance at the scene of death lessens the possibility of death by unnatural means.

Even though the injuries present on body were collectively sufficient to cause death, the prominent ligature mark over the neck and signs of asphyxia strongly suggest death by hanging.

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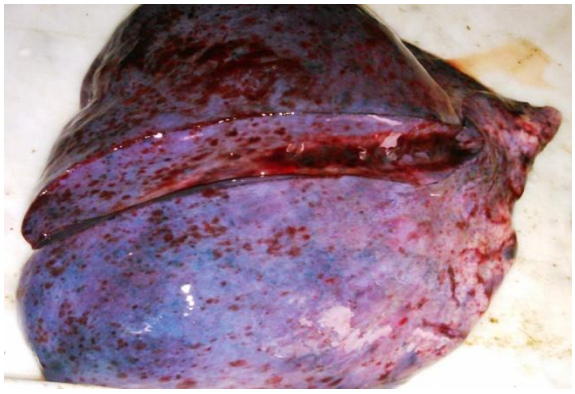
Fig.1: Right Limb of ligature mark Ends Just below Clavicle

Fig. 2: Ligature Mark on Left Side of Neck and Small Abrasions due to Friction of Ligature Material

Fig. 3: Fracture of Ribs on Right Side of Chest without Displacement, Infiltration of Blood at Surrounding Intercostal Area

Fig. 4: Petechial Hemorrhages over the Lung Surfaces



Case Report

Multiple Violent Suicidal Attempts by One Mentally Ill Person: A Rare Case

[1]Sujash Biswas, [2]Chandan Bandyopadhyay, [3]Sayan Biswas, [4]Deepsekhar Dalal, [5]Shobhan Roy

Abstract

Suicide is a potential threat to our society at present. Young aged boys and girls are most common victims of suicide. Social, economic factors play major role in commission of suicide. People may attempt suicide adopting various means like hanging, burning, poisoning etc. Sometimes multiple methods are adopted at a time. In this case we will discuss such a case where a young aged male person committed suicide using various means. The victim cut his throat at two places and also anterior aspects of both the forearms at a time. Hesitation cut marks were present over neck and right forearm. Presence of poison in the stomach was incidental finding. A painful death was the ultimate fate of the life reflecting an intense depressive state of the mind resulting from long term unemployment. Our goal is to make the society aware so that similar incidences can be prevented to some extent in future by proper precautionary measure and counselling.

Key Words: Suicide, Cut Throat, Depressive, Poisoning, Mental illness

Introduction:

Suicide is the only offence for which the offender cannot be punished. India is witnessing more and more numbers of suicides each year.

The young aged population is the most vulnerable group. People adopt various methods of committing suicide. Factors like depression, stress can turn the mind so desperate that a person can adopt much painful and multiple unusual means of committing suicide which are very difficult for us even to think about.

This case is about such an unusual multiple suicidal attempts.

Case History:

One 27 years old male subject attempted to commit suicide after a long episode of mental depression as a consequence of long term unemployment and poverty.

The history was obtained from inquest and also from family members.

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The victim was rushed to the emergency of Medical College, Kolkata with bilateral wrist cut and also two cut throat injuries.

He was then admitted and expired after few hours despite all the best possible efforts from the doctors. It was also stated by the family members that the person tried to commit suicide in few previous occasions and he was also being treated with some antipsychotic drugs for last few months.

Autopsy Findings:

Deceased was well nourished with body length of 5'6'' and body weight of 72 kg. There were two stitched up incised injuries over neck.

One over right sided posterio- lateral aspect which was 3'' in length and directed anterior to posterior. The other was over anterior aspect of neck which was 3.5'' in length and directed left to right. Hesitation cuts were evident around the wound margins. (Fig. 1)

Deep vessels were involved at the corresponding level. (Fig.2) Trachea was involved under the incised wound over anterior aspect of neck. (Fig. 3)

Two stitched up incised injuries were found over anterior aspect of both forearms.

Both were horizontal and surgically extended in a vertical direction as evident in bed ticket. (Fig. 4) The left sided one was less deep whereas deeper vessels were involved in right sided one. (Fig. 6) Multiple old linear scar marks were present over anterior aspect of right forearm which were indicative of self-inflicted injuries. (Fig. 5)

On dissection, incidentally, bluish green semisolid substance was found in stomach with peculiar smell and sub- mucosal haemorrhage over stomach wall which was a strong evidence of poisoning. (Fig. 7)

Discussion:

Suicide is taking away someone's own life. [1] Attempt to suicide is a punishable offence under sec 309 IPC [2] but seldom one individual is punished for this offence.

No question of punishment arises when the person dies. According to National Crime Record Bureau, 134799 people committed suicide in 2013 and 15 to 29 years of age group are most vulnerable. [3] Women attempt suicide more than men but suicidal death is more common among men. [4] This may be because more desperateness of mind and ability to tolerate more pain.

This case is a classic example. Suicide by cutting throat, cutting forearm or any accessible body part or poisoning are not uncommon but adopting all these methods at a time is not common.

In this particular case death was due to combined effect of injuries and poisoning. Shock due blood loss, involvement of vital structure like trachea contributed to the death. [5]

Moreover tailing of wound indicated direction [6] and hesitation cuts indicate suicidal tendency of mind [7] which help to reconstruct the incidence. Bluish coloured substance in the stomach points towards the probability of $CuSO_4$ poisoning. [8] Due to these multiple factors, all the efforts of doctors failed.

Past history of psychiatric illness due to long term unemployment suggest the cause of such unusual desperate violent suicidal attempt.

Conclusion:

As mentioned before, multiple suicidal attempts in a single case are growing in number day by day in our country. Considerable numbers of young population are becoming so much disillusioned from life that they are becoming desperate in putting an end to their life resulting in multiple suicidal attempts.

We, the doctors and also other aspects of this society should come forward in the prevention of this suicidal ideation with proper counselling and care.

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Fig. 1: Incised Injury over posterio-lateral aspect of Neck with Hesitation Cuts Tailing

Fig. 2: Incised Injury over Anterior aspect of Neck

Fig. 3: Incised injury over neck with Tracheal Involvement

Fig. 4: Incised injury over forearm with Surgical Extension

Fig. 5: Hesitation Cuts over Anterior Aspect of Forearm

Fig. 6: Deep Vessel Injury

Fig. 7: Superficial Incised injury over Fingertip

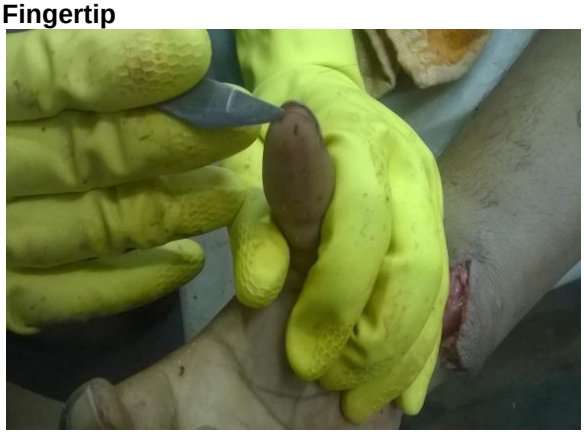

Fig. 8: Bluish Green Semisolid Substance in Stomach

Case Report

Death due to Choking in Road Accident: A Case Report

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Abstract

Choking refers to the blockage of internal airways, usually between the pharynx and the bifurcation of the trachea. It is usually due to the inhalation of a foreign body, but it can be caused by inhalation of the products of the disease (or violence) or by anatomical changes due to disease. The choking deaths are mostly accidental and commonly observed in the pediatric age group. Food related items and plastic toys are the foreign materials commonly encountered in choking. The various circumstances reported in the literature when choking occurs were while eating, playing, studying, cleaning ears and making fun. Death due to choking in road accident is very unusual occurrence though road accidents occur frequently. Here we present a case of death due to choking of seven month old boy in road accident resulted due to the unsafe and illegal transportation, ignorance of safety rules, and bad condition of the roads. The joint efforts by personnel of education, engineering, medical, law enforcement agencies are required for prevention of such deaths.

Key Words: Choking death, Road accident, Foreign material

Introduction:

Choking is the variety of asphyxia caused by an obstruction within the air passages. It is usually due to the inhalation of a foreign body, but it can be caused by inhalation of the products of the disease (or violence) or by anatomical changes due to disease. [1]

Choking can be fatal if it results in serious impairment of respiration. Choking is a leading cause of morbidity and mortality among children, especially those who are three years of age or younger. The most common objects on which children choke are food, coins, balloons, and other toys. [2] The un-witnessed deaths by choking in normal healthy child are usually referred to the hospitals as sudden and suspicious deaths. [3]

The accidental choking usually occurs during eating when food is accidentally inhaled, especially when victim is laughing or crying. [1] The other reported instances of choking were during playing, studying, cleaning ears and making fun. [1-5]

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The road accidents are frequent in occurrence and a leading cause of death in India. Most of the deaths occurred during road accident were attributed to the trauma. While in rare instances, death might occur because of pathological disease and/ or some other ailment rather than trauma itself.

However, the death due to choking in road accident is very unusual in occurrence. Here we report a death of a child due to choking in road accident in which the death was supposed to be caused by some blunt trauma.

Case History:

A laborer couple along-with their two children was travelling to new work-place in a trailer of a tractor. The trailer was crowded with families of other laborers and their household belongings. The tractor met with an accident at an acute turn of the road and trailer turned upside down. Consequently, the couple's seven months boy was found by the side of road in unconscious state with the wheat flour scattered all around.

The lid-free tin box was present nearby and they also witnessed small amount of wheat flour was on face and chest region of the victim.

Prior to the aforementioned accident, the tin-box containing about five Kilograms of wheat flour was located in the trailer in close proximity to the victim boy.

They immediately transported him to the hospital without any resuscitative attempt at the crime scene due to unavailability of trained

person. He was declared brought dead in Casualty Department of our Institute.

On detailed inquiry, the parent gave history of frequent travels in trailer along-with items required for cooking and other household belongings. Death in road accident forms the basis of medico-legal investigation in the present case and it was subjected to medico-legal autopsy by Police officer.

As per the Police official, the supposed cause of death was 'some blunt trauma'.

Autopsy Findings:

External examination showed the presence of flour over the body at places (Fig. 1) and bluish discoloration of fingers, toes and lips was evident. There was no any visible external injury over body. The internal examination did not detect any trauma to organs; but signs of asphyxia were evident.

On dissection of neck, internal airway showed wheat flour mixed with mucous, completely obstructing the larynx and trachea. (Fig. 2) The cause of death was opined as, **"Asphyxia due to Choking".**

Discussion:

Injuries and deaths due to road accident continue to be major public health problems in India. The deaths during road accident are routinely autopsied and contribute to large portion of autopsies conducted in India. The most commonly affected population in road accidents are poor people, as they are mostly pedestrians, cyclists, and passengers of public transports. [6]

The tractor trailer as such is not meant for the public transport, but it is a common scene in India that, the laborer families travel in the tractor trailer to work places along-with their household belongings. Most of the deaths occurred at the scene of the road accident and those occurred before victims had reached the hospital, were caused by the major trauma which was obvious and/ or detected on autopsy.

In present case, the death was supposed to be caused by some trauma during road accident, although the victim had no obvious external injury. The careful and meticulous autopsy also did not detect any external or internal trauma; but revealed choking as the actual cause of death.

The diagnosis of death due to choking in present case was based on the identification of the foreign material obstructing the internal airways with recognition of the signs of asphyxia, the circumstances and the exclusion of other possible causes of death.

Uncoordinated swallowing mechanisms in young children, inability to time swallowing and breathing, immature dentition (lack of molar teeth until 3-5 years), physical activity, the habit of exploring objects with the mouth are the risk factors involved in childhood asphyxiation due to ingestion and inhalation of foreign body. [7]

The spectrum of airway foreign bodies varies from country to country, depending on the diet and customs of the population. [8] Sinha et al [9] reported that, groundnut was the most common trachea-broncheal foreign body observed in Indian population.

In the study conducted by Jaswal et al [10], the most common type of trachea-broncheal foreign body observed below 3 years of age was food material (seeds, beans).

The hotdogs and peanuts are the most commonly aspirated foreign body in Western countries. [2, 7, 8] The inhalation of foreign material in the trachea-bronchial tree is an emergency condition with high mortality if prompt measures are not being taken at the earliest. [9] The important factors that determine the possibility of favorable outcome in choking cases are age of the affected person, level of consciousness, occurrence of crying, and characteristics of the foreign bodies. [11]

The aspirated foreign material observed in the present case was wheat flour which was very unusual to be found in choking. The release of the tin-box lid and subsequent inhalation of wheat flour by victim, while turning over of the trailer is the possible explanation for this incident. The presence of scanty wheat flour over victims' face, early and immediate removal of victim and presence of wheat flour mixed with mucous in trachea and major bronchi rules out the possibility of the death due to immersion in the wheat flour itself.

The presence of wheat flour on victim and at the scene of crime was ignored by the persons who witnessed the incident as they were unaware about choking. Even if the present choking incident would have been identified, the inhaled foreign material could not be removed by general measures.

Conclusion:

The death due to choking in road accident is an unforeseen occurrence. The unsafe and illegal transportation, ignorance of safety rules, and bad condition of the roads had resulted to the present incident of death due to choking by an unusual foreign material.

The joint efforts by personnel of education, engineering, medical, law enforcement agencies are required for

prevention of deaths and disabilities due to such transportation.

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Fig. 1: Presence of Wheat flourover Body at Places

Fig. 2: Wheat-flour mixed with mucous in Trachea