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From Editor's Desk

JIAFM

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I feel immense pleasure to present before you the Second 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 commended on their efforts.

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

Professor [Dr.] Mukesh Yadav
Editor, JIAFM

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Editorial

Quality of Criminal Justice Delivery System in U.P., India: Role of Forensic Science Services /Scientific Investigation

Criminal Justice Delivery System in India is at cross road due to lack of political will and functional legal illiteracy among masses to demand for right to safety and security guaranteed by the Indian Constitution under Article 21.

Few steps in this regard in some states including Capital of India i.e. Delhi has been seen taken after the PIL. Two PIL one in Allahabad High Court and another in Delhi High Court are pending in which directions have been issued from time to time to improve the situation. Some of the important observations of the Hon'ble Courts have been discussed to highlight the situation and create awareness in this regard.

Recently the same position regarding the value of the DNA profiling has been reiterated in *Dharam Deo Yadav vs. State of U.P.*, (2014) 5 SCC 509, wherein, **modern forensic techniques for criminal investigations such as DNA profiling have been lauded, because of reliable witnesses failing to give testimony, or turning hostile due to intimidation**, though it is conceded that the DNA testing may in a particular case not be cent-percent accurate, as that would depend on the **quality of the analysis** and **whether the sample collected was kept free from contamination**.

Thus the law report observes in **paragraph 30**: [27]

"30. The criminal justice system in this country is at crossroads. Many a times, reliable, trustworthy, credible witnesses to the crime seldom come forward to depose before the court and even the hardened criminals get away from the clutches of law. Even the reliable witnesses for the prosecution turn hostile due to intimidation, fear and host of other reasons. The investigating agency has, therefore, to look for other ways and means to improve the quality of investigation, which can only be through the collection of scientific evidence. In this age of science, we have to build legal foundations that are sound in science as well as in law.

Practices and principles that served in the past, now people think, must give way to innovative and creative methods, if we want to save our criminal justice system. Emerging new types of crimes and their level of sophistication, the traditional methods and tools have become outdated, hence the necessity to strengthen the forensic science for crime detection. Oral evidence depends on several facts, like power of observation, humiliation, external influence, forgetfulness, etc. whereas forensic evidence is free from those infirmities. Judiciary should also be equipped to understand and deal with such scientific materials. Constant interaction of Judges with scientists, engineers would promote and widen their knowledge to deal with such scientific evidence and to effectively deal with criminal cases based on scientific evidence. We are not advocating that, in all cases, the scientific evidence is the sure test, but only emphasising the necessity of promoting scientific evidence also to detect and prove crimes over and above the other evidence."

Need for Improving Investigations and Trials in Rape and Murder Cases:

Bench of Allahabad High Court observed that it imperative to issue the **following directions**:

- (1) In cases of rape and murder of minor girls, which are based on circumstantial evidence, as far as possible, material which is collected from the deceased or the accused for example hair or blood of the victim or the accused, which is found on the persons or clothes of the victim or the accused or at the spot, seminal stains of the accused on the clothes or body of the victim, seminal swabs which may be collected from the vaginal or other orifices of the victim and the blood and other materials extracted from the accused which constitutes the control sample should be sent for D.N.A. Analysis, for ensuring that forensic evidence for establishing the participation of the accused in the crime, is available.
- (2) Bench also directed the Director General Medical Health U.P., Principal Secretary Health, U.P., and D.G.P., U.P. to mandate sending the accused for medical examination in each case for ascertaining whether he has any injuries caused by the resisting victim, or when he attempts to cause harm to her as is provided under section 53 A of the Cr.P.C., which was introduced by Act 25 of 2005, (w.e.f. 23.6.2006). In particular if the rape suspect is apprehended at an early date after the crime, it should be made compulsory to take both dry and wet swabs from the penis, urinary tract, skin of scrotum or other hidden or visible regions, after thorough examination for ascertaining the presence of vaginal

epithelia or other female discharges which are also a good source for isolating the victim's DNA and necessary specialized trainings be imparted to the examining forensic medical practitioners for this purpose.

- (3) Bench further directed the Principal Secretary (Health), U.P., Director General (Health and Medical Services) U.P. to prohibit conducting the finger insertion test on rape survivors, and to employ modern gadget based on other techniques for ascertaining whether the victim has been subjected to forcible or normal intercourse. Relying on the International Covenant on Economic, Social, and Cultural Rights, 1966 and the United Nations Declaration of Basic Principles of Justice for Victims of Crime and Abuse of Power, 1985 it was further held in *Lillu vs. State of Haryana*, (2013) 14 SCC 643 that no presumption of consent could be drawn *ipso facto* on the strength of an affirmative report based on the unwarranted two fingers test.
- (4) Bench find that there is absence of an adequately equipped D.N.A. Laboratory in U.P. which has advanced mitochondrial DNA analysis facilities, comparable to the CDFD, Hyderabad, (from where we were able to obtain positive results in this case, after unsuccessful DNA matching in an earlier case *Bhairo vs. State of U.P.*(decided on 6.9.11) where this Court had sent the sample of vaginal smear slides and swabs and appellant's underwear to the U.P. DNA laboratory, viz. Forensic Science Laboratory, Agra), and further directed that such a DNA centre comparable to the CDFD be established in the State of U.P. at the earliest so that Courts and investigating agencies are not compelled to send DNA samples at high costs to the specialized facility of the CDFD at Hyderabad.
- (5) The Director General of Prosecution, U.P., the Director General of Police U.P. and Director General Medical Health should ensure that blind cases of rape and murder of minor girls or other complicated cases are thoroughly investigated by efficient Investigating Officers. Effective steps should be taken for forensic investigations by collecting and promptly sending for DNA analysis all possible incriminating material collected from the deceased, victim, accused, and at the scene of the crime etc. which may give information about the identity of the accused and his involvement in the crime, after taking precautions for preventing the contamination of the material.
- (6) Bench added that this is necessary to prevent Courts being rendered helpless because the prosecution and investigating agency are lax in producing witnesses or because witnesses have been won over or are reluctant to depose in Court. Steps should also be taken for preventing witnesses from turning hostile, by prosecuting such witnesses, and even by cancelling bails of accused where they have secured bails where it is apparent that efforts are being made to win over witnesses and by providing witnesses with protection where ever necessary so that they can give evidence in Court without fear or pressure. In case there is reason to think that the Investigating Officers or medical officers or others have colluded with the accused, strict action be initiated against the colluding officials as was recommended in the case of *Dayal Singh vs. State of Uttaranchal*, 2012. It is necessary that policies and protocols be developed by the DGP, U.P., Principal Secretary Health, Director Medical Health U.P., Director of Prosecutions, U.P., for the aforesaid purposes.
- (7) The JTRI, Lucknow must ensure that proper training is given to Judicial Officers on framing proper questions for 313 Cr.P.C. examination, so that the entire circumstances of the case are put to the accused and they cannot claim the benefit of being inadequately questioned about the incriminating circumstances of the case. Copies of this order should also be placed on the record in the case of *Qasim vs. State of U.P.*, Criminal Writ Petition –Public interest Litigation No. 1797 of 2011.

Following issues emerged for discussion and considerations of the Allahabad High Court in PIL (*Qasim vs. State of U.P.* 2011):

1. Issue of Skilled Doctors for Post Mortem
2. Issue of Conditions of Mortuaries & Equipments
3. Issue of creation of posts for Forensic Labs
4. Issue of Constitution and Functioning of Committees
5. Issue of upgrading the FSL
6. Issue of Improving the Proformas: SOPs
7. Issue of timely sent of viscera for analysis
8. Issue of Toxicology Section & Field Unit of Forensic Science Laboratory

Seven Points Action Taken Report:

Bench attention has especially been drawn to the 'Action taken' report filed on 19.01.2015 which mentions action taken on **seven points** which are as under:

1. Training of medical officers,
2. Improvement in mortuaries,

3. Sanction of posts in FSL/Existing Labs,
4. Finalization of proforma,
5. Upgradation of FSL/Existing Labs,
6. Disposal of old samples of viscera collected in districts,
7. Meeting of State Level Committee. [Order dated: 01.12.2011] [Para 3]

On the next listing we would like greater details on the aforesaid points and how shortfalls are estimated regarding the level of knowledge of medical doctors engaged in forensic medical work, or the conditions of mortuaries, or the shortage in posts in Forensic Science Laboratories and the facilities therein, or with regard to the problem of over-crowding of old samples of viscera in places of storage, so that we can evaluate whether the measures suggested are equal to the tasks involved. We would also like to have feedback/ progress reports every three months on the improvements, if any, as a result of the interventions. [Order dated: 01.12.2011]

Bench also directed the Finance department to provide funds for the aforesaid plans, and provide details to the Court on the next listing about the amount and time schedule by which funds are to be released for the aforesaid purposes and how the government is planning to monitor that the funds are properly utilized in a time bound manner. [Order dated: 01.12.2011]

Human Rights of Society and Individuals:

If human rights are to be preserved and simultaneously the interest of society is also to be protected then scientific investigation is necessary both for ensuring that innocent persons are not implicated in crimes by the police for showing its success in solving cases on the basis of third degree measures or trumped up witnesses, and at the same time the actual offenders do not escape identification and punishment.

Need for Constitution of Specialized Forensic Department /Forensic Units:

The State government to come up with a plan for constituting forensic units in each district with one or more officers, a superior referral forensic unit at the divisional headquarters level and a specialized forensic department at the State level, in a similar manner to the PHCs, CHCs, district hospitals and specialized medical centres at State level that we see under the **government health scheme**.

The aforesaid 'Action taken' points are largely concerned with forensic work by specialized agencies. But we need a plan of action for actually carrying out investigations at the ground level by local investigators. This has been alluded to in the Action point No. 4 on "Finalization of Proforma."

Issue of Separation of Investigating Wing and Law and Order:

Bench added that state government also to come up before this Court with a time frame for separating the investigating wing of the police (which will help such officers to specialize in forensic work) from the law and order and VIP and other duties wing, which has been repeatedly emphasized by the Apex Court in *Prakash Singh vs. Union of India, 2006* and *Pramod Kumar vs. Bihar Vyavsayik Sangharsh Morcha, 2007* as also by decisions of this Court and to which the State and Union are also committed as per their own reports. The reasons for failure so far in carrying out these directions may also be indicated. Also what mechanism is to be devised for identifying intelligent, diligent and honest police officers for assigning them the specialized investigation work, when the separation of investigation from law and order functions is carried out. Public is more likely to have rapport with crime police men in plain clothes compared to the law and order police who are frequently in conflict with the public. Freed from law and order and other duties (which according to a Police Commission report take up 70% of the police officers time), the investigation and consequent prosecution of the offender can be expedited.

Bench reminded that we would also like to be informed about the details for the training programme in forensics and scientific investigations that are needed to be provided to all police officers engaged in investigation work. What are the bodies for training in forensic investigations in U.P. and also at the center {for e.g. the **National Institute for Criminology and Forensic Sciences (NICFS)** or the institutions run by the **Bureau of Police Research and Development, (BPRD)** and the plans for bringing about their more effective intervention? We would also like the response of the **Union Government** and the concrete steps that are to be taken in response to the proposal dated 18.10.2011 sent to it by the **State Government** regarding the development of the forensic science laboratories in the State as described in the said letter.

This Court would also like to be furnished with details of a protocol that may have already been or is in the process of being developed as to how investigation is actually to be carried out when a major crime by known or unknown offenders is reported. Court like to be informed whether the protocol mentions points such as whether the scene of the crime is to be cordoned off by a coloured ribbon by the investigating officer, where no one except the investigators and the forensic experts may enter, their

manner of collecting samples, so that it is not tampered with. Even politicians, senior district officials, VIPs and media should not have permission to enter such areas. [Order dated: 01.12.2011] [Para 12]

In this context we may recall the mess and interference with investigation that resulted because of the free access of persons to the scene of crime as in the "Arushi" and other sensational cases, which substantially damages the investigation. The manner and time frame by which the photographers and other specialized forensic personnel of different fields are to carry out their tasks- dog squad, finger or foot print collection, hair, vomit, excreta, blood or seminal stains and other items for DNA or other testing, also needs to be spelt out. The time period for submission of DNA or other forensic science laboratory (FSL) reports of the samples collected also needs to be specified, as delays facilitate accused corruptly approaching the analysts concerned and obtaining dishonest reports. This can prove fatal for proper investigations and for securing the conviction in court of the actual offenders.

Bench emphasized that this Court should also be informed about the steps taken for introducing audio-video recording of the statements of witnesses to the police or before the Magistrate which have been made permissible by the newly introduced proviso to section 161(3) and proviso to section 164(1) by the Criminal Procedure (Amendment) Act 5 of 2009 effective from 31.12.2009. The Court would also like to be furnished with information and measures taken for developing tools for combating **cyber or computer crimes** and also for analyzing inputs from **mobile or other telephones for crime detection**.

We should also be furnished with information about the system which exists or is being developed for providing legal and other expert opinion to the investigating officers on complex and technical matters requiring specialized knowledge. [Order dated: 01.12.2011] [Para 17]

The Court would like to be informed of the mechanism in place for collection of real time criminal intelligence for tackling crimes of terrorism, organized crime and drug trafficking, economic crime and crimes having inter-State ramifications etc. [Order dated: 01.12.2011] [Para 18]

Court also noted that a committee has been constituted to implement the directions of the Allahabad High Court, which consists of:

- (1) Principal Secretary, Law
- (2) Principal Secretary, Health
- (3) Director General of Police
- (4) Principal Secretary, Finance
- (5) Additional Solicitor General, State of UP representing the Central Government.

Bench further added that in view of the importance and multiple nature of issues which are required to be addressed we would like the said committee to be headed by the Chief Secretary.

Issue of Skilled Doctors for Post-mortem, Conditions of Mortuaries and Equipments:

In compliance of the **direction issued for providing skilled doctors for conducting post-mortem examination**, it is averred that **more than 750 medical officers have been sensitized and trained about procedure of conducting post mortem as well as medical legal cases, rape cases etc.**

As regarding the condition of mortuaries in the State, it was averred that the norms of the construction of mortuaries have been standardized and a standard estimate of Rs 45.27 lacs for each mortuary has been finalised. It is further averred that construction of mortuaries in as many as seven districts is going on. In 21 districts the process of construction of mortuaries has been commenced against sanction accorded in the current financial year.

It is also averred that **necessary directions have been issued to the Department of Medical and Health to standardize equipments for these mortuaries**. It is irony that State of U.P. has not been able to utilize already existing well equipped Autopsy Complexes with qualified forensic faculty in almost all private medical colleges even in Government Medical Colleges till date.

As regards direction for creation of as many as 156 posts for Forensic labs are concerned, it is averred that **the Department of Finance has accorded its consent for creation of 118 posts in Forensic Labs/existing labs**.

As regards direction for sending proposal to Central Government for upgrading the Forensic Science Laboratories, it is averred that a committee consisting of **IG Technical Services UP, IG, Crime UP, Director FSL** has been constituted with the direction to prepare the proposal for onward transmission. It is further averred that as soon as the said Committee finalizes the proposal the same shall be scrutinized and acted upon forthwith.

As regards **direction for fixing time limit for sending the viscera samples for toxicology test by Forensic Science Laboratory FSL** immediately after its collection, it is averred that a meeting was

held in the **Home Department** on 3.5.2011 in which attention was drawn to **para 766** of the **UP Medical Manual** which envisages that the viscera samples have to be sent immediately for toxicology test by FSL immediately after collection.

This matter was discussed in the meeting held on 14.7.2011 by the **State level committee**. It is averred that the **minutes of the two meetings** have been circulated to all concerned for compliance.

As regards **direction to establish Toxicology section in every commissioner, Headquarters of the State** with the **Field Unit of Forensic Science Laboratory** to provide facility of testing of viscera etc, it is averred that the issue was discussed at length by the **State Level Committee** in its meeting on 14.7.2011 and it was resolved therein that **FSL are already functional in three Commissioner i.e Lucknow Agra and Varanasi** and **establishment of FSL at Moradabad** is already under active consideration as it has **to consider various aspects including quantum of work, actual requirements of the State etc.**

As regards **direction for creation of Field Unit of Forensic Science Laboratory**, it is averred that necessary directions have been issued to **DGP** for compliance. However compliance report is still awaited from DGP. It is submitted that a reminder has already been issued on 12.8.2011. of U.P. Lucknow. In compliance of the direction issued for providing skilled doctors for conducting post mortem examination, it is averred that more than 750 medical officers have been sensitized and trained about procedure of conducting post mortem as well as medical legal cases, rape cases etc.

As regards **direction for improving the proformas of inspection report of place of incident, post mortem report, injury report etc** it is averred that in compliance of direction, **a committee consisting of Director FSL, Directorate of Medical and Health, Assistant Director Toxicology, FSL** has been constituted to delve into the matter and suggest suitable modifications.

The Committee conducted its meeting on 18.7.2011, 29.7.2011 and 9.8.2011 in which **suitable modifications were suggested** and the same were sent to **IG Technical Services UP for necessary action**. It is averred that as soon as modified proformas are received by the Government, the same will be **legally examined** and then **finalized for purpose of suitable action at various levels**.

It is also averred that direction about constitution of various committees as enumerated in the order of the Court, has been complied with and **State Level Committee** held its meeting on 14.7.2011.

Having considered the averments made in the supplementary affidavit, we are of the view that although action has been initiated and a lot of work yet remains to be done. **It is directed that the State Level Committee and other Committee shall regularly convene meeting and test the progress and update this court every three months.**

Summary and Conclusions:

Bench of Allahabad High Court are constrained to observe that even in the 21st Century, we are still sticking to Centuries old methods of investigation and have not taken concrete steps for improving investigation techniques. Investigation methods have undergone a sea change all over the world, but these changes have passed us by. The State cannot escape from its responsibility to provide a competent and effective mechanism for investigation of criminal cases on the ground of financial scarcity.

No doubt, there is some awareness in the Government circles now and gradually some steps are being taken to improve the criminal justice system, but these steps are too few and too inadequate. Bench emphasized that we must have Forensic Science Laboratories in each Districts with D.N.A. Development facilities / techniques and Mobile Forensic Squads, a member of which can immediately rush to the scene of crime soon after the incident to collect the various samples, which may give clues regarding identity of the culprits. Unless we keep pace with the times, we are destined to fail. We hope that these words of advice would not go unheeded and the State acts with all promptitudes to tone up the investigating agencies.

Bench directed that a copy of this judgment be also sent to Principal Secretary (Home), Government of U.P., Lucknow and Principal Secretary (Judicial) & L.R., Government of U.P., Lucknow for consideration and necessary action at their end.

Dr. Mukesh Yadav

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Original Research Paper

Socio-demographic Profile of Head Injury Victims of Fatal Vehicular Accidents in Semi urban Region of Maharashtra

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Abstract

Vehicular accidents are the major causes of death worldwide. Road traffic accidents are most common among all vehicular accidents. Head injury is the single most common cause of mortality in road traffic accidents. India has one of the highest road accident rates in the world. There has been a steady rise in the casualties in road accidents in the country and their proportions in total deaths due to all accident have also increased considerably in the past. The present study was undertaken on 202 victims of vehicular accidents, died due to head injury brought to our postmortem centre for medico-legal autopsy. The main purpose of our study was to find out the social and demographic profile of the victims involved in vehicular accidents and to provide epidemiological data, so the preventive measures can be undertaken. Our study shows that majority of the victims of road traffic accidents were mostly male of middle age group (20-40 years), when they were going on two wheelers without wearing helmets.

Key Words: Vehicular Accidents, Head injury, two wheelers, Socio-demographic profile, RTA

Introduction:

Fast moving vehicular traffic and changing social pattern contributed to increase in incidence of trauma to human body. Head injury associated with traumatic brain injury occurs with the incidence of 20-40 cases per 100000 populations per year.

It is most common cause of death in young adults (age 15-24 years) and is more common in males than females. [1] Cranio-cerebral injury or Head injury is defined by the National Advisory of Neurological Disease and Stroke Council as "A morbid state resulting from gross or subtle changes in scalp, skull and/or contents of the skull produced by mechanical forces restricted to those forces applied externally to head.

Thus it excluding surgical ablations and internally acting forces such as raised intracranial tension resulting from oedema, hydrocephalous or intracranial space occupying lesions". [2]

Understanding transportation needs, patterns and modes is vital to ensure road safety. The growth of motor vehicle industry, liberalized economic policies of successive governments, aggressive media promotion, increasing purchasing power of people, easy availability of loans, poor public transport systems have contributed to increasing motorization and changing transportation scenario in India. [3]

A main purpose of this study was to collect pattern of head injuries in vehicular accidents, their correlation with factors such as age, sex, time of incidence, seasonal variations, economic status wise distribution, condition of roads, type of vehicle involved etc.

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Material and Methods:

The current study is two years cross-sectional study conducted from 1st December 2010 to 31st November 2012 of the cases brought to our centre for medico-legal autopsy.

The study included all the autopsied 202 victims of head injury in various vehicular accidents in the Department of Forensic Medicine and Toxicology of Government Medical College, who died in the institute while getting the treatment, dead on arrival to casualty

department and also dead body brought by the investigation agencies.

Approval has been taken by institutional ethical committee of Government Medical College. All the cases of vehicular accidents which show multiple injuries to the body along with head injuries would be taken for study.

Thorough perusal of case papers including investigation, medico-legal register and police records like panchanama was carried out to collect relevant information. Detailed history related to time, manner and hospitalization taken from relatives. Proforma specially designed for this purpose was used for collection of data.

Observation and Results:

Our study clearly demonstrates the male preponderance (90.6%) of head injury in all age groups in fatal vehicular accidents. The peak incidence (28.7%) was observed in the age group 21-30 years followed by 27.7% belonged to the age group 31-40 years.

Thus 56.4% of cases comprised of age group of 21-40 years in the study. Individuals in the age group 0-10 years were the least affected 3.5% followed by older people i.e. 60 years and above in 9.4% of total cases. The lowest age of the victim was one year and the highest age observed was 90 years.

Males comprised a majority and constituted 183 (90.6%) compared to females who were only 6 (9.4%). The male to female ratio in the study was 9.63:1. If females are considered individually major peak is in 2nd decade. (Table 1) In this study largest number of the accidents took place during the summer months of March, April, May and June (43.1%) Next in order of frequency of the number is rainy season July, August and September (29.7%) due slippage on the wet roads.

Though winter season is last in number of cases (27.7%) is slightly less than in rainy season. (Table 2) The majority of victims are from rural areas 76.7% whereas urban population is involved only 23.3% of cases in our study. (Table 3) Present study showed that the maximum number of vehicular accidents involving head injuries were sustained between 6.00 pm to 9.00 pm (the peak hours of return journey) followed by next peak in 9pm to 12am.

Thus maximum cases are seen during night between 6pm to 12am, whereas least cases are seen between 3am to 6am.

Most of the female victims are seen between 9am to 3am. (Table 4) In our study maximum victims 41.6% belong to middle class of socioeconomic status, followed by dependent class i.e. children's and housewives, 20.3%

victims belong to lower socioeconomic status. Least involved victims are from upper class of socioeconomic status. (Table 5)

Among 202 victims, 72 (35.6%) had been graduated or were studying graduation. Next 16.8% victims were illiterate were among 2nd most common category. 15.3%, 10.4%, 9.4%, 6.9%, 4% victims were studying high school, diploma, primary, middle school, post-graduate education respectively.

Illiterate victim's ranks second among all cases of fatal head injuries in vehicular accidents. (Table 6) In the present study, about half of victims (52.5%) were drivers followed by pedestrians (29.7%) and then passengers (17.8%). (Table 7) Regarding the condition of roads, maximum number of deaths was on roads which were in good condition 131 cases (64.9%), followed by bad condition 44 (21.8%). The under construction roads constituted 23 cases (11.4%). (Table 8)

Discussion:

The peak incidence 28.7% was observed in the age group 21-30 years and 56.4% of cases comprised of age group of 21-40 years in the study. The lowest age of the victim was one year and the highest age observed was 90 years. Males comprised a majority 183 (90.6%) compared to females (9.4%).

Male to female ratio in the most commonly affected age group 21-30 years was 7.28:1. Amongst female victims the highest number 7 (3.5%) of death are observed in age group 21-30 years. Due to the fact that this is one of the active periods of life in males who work outdoors and therefore one is most commonly exposed to traffic accidents. The least common 3.5% age group is 0-10 years.

This is due to fact that young children are less exposed to the traffic environment. This study was in accordance with other studies. [4-8] whereas in contrast with studies done by Kamdar B et al. [6] The present study has obvious finding of male predominance.

The highest number 33 (51.4%) of the male victims are in the 21-40 years age group, most of whom must have been the sole bread earner of their families, bringing to light the socio-economic problems that confronts the dependent of the victims. As this study has been conducted in semi-urban areas, where there is presence of orthodox socio-cultural background and the lack of exposure to the traffic environment it leads to poor sense of traffic safety rules amongst females.

Largest number of the accidents took place during the summer months, which could

be attributed to the fact that this is the season for marriages and also for harvesting and marketing of the grains. These are also the vacation months eventuated by increase movement of people from one place to another through the road transport. Next in order of frequency of the number is rainy season Though winter season is last in number of cases (27.7%) is slightly less than in rainy season, attributable factor being not only the festive months of Diwali, but also the harvesting months for the autumn crops.

It is also possible that the foggy weather of the winter months leads to improper visualization and reason for total accidents leading to the vehicular accident. These findings were consistent with studies of Adhya S et al and Jha S et al [9, 10] and contrast to Eke N et al study. [6] In this study the majority of victims were from rural areas 76.7% whereas urban population is involved in 23.3% of cases.

The two wheelers are most common means of transportation in rural areas. Traffic rules are not followed by majority of rural population. Thus more awareness and strict implementation of traffic rules is required in these regions. [11] Most of the incidents (30.19%) of vehicular accidents, occurred between 6-9 pm and a large percentage of cases 49.99% occurred between 6 pm to 12 mid night, followed by 25.24% between 9am to 3pm.

The least number of incidents occurred between 3am to 6am. Congestion is more on the roads as everybody is in hurry to return back to home from jobs during evening periods and lighting conditions are poor on most of the roads on the outskirts of city as well as surrounding sub urban and rural areas, similar to other authors' studies. [11-13]

In this study maximum victims 41.6% belong to middle class of socioeconomic status and least were from upper class of socioeconomic status, similar to other studies. [11] Among 202 victims 72 (35.6%) had been graduated or were studying graduation. This region is well known educational hub of Marathwada region of Maharashtra.

The victims with and studying higher education included in graduate class showed major peak, as frequent use of motorized two wheelers by this class.

Also this class is always in hurry either to attend their jobs or educational classes and henceforth more prone for accidents as traffic exposure is more that too in rush hours. Illiterate victim's ranks second among all cases of fatal head injuries in vehicular accidents.

Jha S et al [10] study showed that over 3/4th (65 i.e. 76.8%) victims were either illiterate

or had education only up to schools level. In this series of accidents highest number of victims were students (16 i.e. 20.7%) followed by farmers (15 i.e. 19.5%). Present study findings were not comparable with Jha S et al study.

In our study maximum number of deaths was on roads which were in good condition 131 cases (64.9%), followed by bad condition 44(21.8%). This showed that in majority of cases carelessness and speed of vehicle might be major factor involved.

Probable cause may be the speed and carelessness and relaxing attitude of driver on good roads which lead to loss of control and increase in number of accidents. On the contrary at under-construction road the frequency of road traffic accident was less, as individuals are more conscious and speed is also restricted at under-construction roads.

Accident on pucca (94.9%) found to be significantly higher ($p < 0.05$) than kuccha road (5.1%). Present study is partly accordance with study of Kumar D et al. [11]

Summary and Conclusions:

Distribution and causes of head injury are more or less similar to the pattern found in most of other studies. The accidents occur most commonly in age group of 20-40years with male predominance. Most of the incidents of vehicular accidents occurred between 6 pm to 9 pm and almost half of the incidences occurred between 6pm to 12 mid night.

Largest number of the accidents took place during the summer months of March, April, May and June (43.1%) which could be attributed to the fact that this is the season for marriages, and also for harvesting and marketing of the grains.

These are also the vacation months eventuated by increase movement of people from one place to another through the road transport. Middle class graduated or were studying graduation were most common victims of fatal road traffic accidents.

Drivers' involvement was hallmark of all vehicular accidents, followed by pedestrian and passengers are least involved of total cases.

Motorized two wheelers were most commonly involved, neither driver nor passenger of motorized two wheelers were wearing helmet.

The rate of incidence is higher in India because of its traffic patterns and their demographic profile. Possibly, the lack of preventive measures such as helmets in motor cyclists, seatbelts in automobiles, poorly controlled traffic conditions and poor road

conditions are other factors responsible for injuries.

Recommendations:

Keeping in view the results of study, Multi factorial approach is needed to prevent road traffic accident and to minimize their consequences.

The mortality in road traffic accident victims can be reduced with following recommendations:

A. Safety Education:

1. Safety education must begin with school children.
2. Mass media can also be utilized.
3. Children and youth involvement in various social programmes for awareness among common masses regarding vehicular accidents.
4. Drivers need to be trained by an authorized centre in proper maintenance of vehicle, safe driving and first aid.

B. Enforcement of Law:

1. Good enforcement of law is an integral part of road safety; legislation embodies codified set of rules. These are enforced by state to prevent accidents.
2. Setting an enforcing speed limit and its strict implementation.
3. Increasing helmet wearing through the enforcement of law, as their use is important, especially in our country where two wheeler uses is high and current level of helmet wearing is low.
4. Helmets should be properly ventilated and designed as per comfort of occupants, so that its utilization will increase.

C. Measures to Reduce Environmental Risk Factors:

- Categorization of roads according to road functions and speed.
- Be careful while driving on defective and narrow roads, defective layouts of cross-roads, speed breakers, T junctions, pedestrians crossing and traffic signals.
- Avoid poor lighting and overloaded, overcrowded vehicles.
- Avoid illegal transport system and prefer public transport

There is no panacea that will prevent all road traffic accidents, what is required is an organized team work by people in many disciplines such as education, engineers, medical practitioners, psychologists and enforcement officers for effective prevention of road accidents and to minimize their consequences.

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Table 1: Age and Sex wise Distribution

Age grps (Yrs)	Male (%)	Female (%)	Total (%)
0-10	06(03.0)	01(0.5)	7(3.5)
11-20	10(05.0)	00(0.0)	10(5)
21-30	51(25.2)	07(03.5)	58(28.7)
31-40	53(26.2)	03(1.55)	56(27.7)
41-50	30(14.9)	03(1.5)	33(16.3)
51-60	16(07.9)	03(1.5)	19(9.4)
>60	17(08.4)	02(1.0)	19(9.4)
Total	183(90.6)	19(9.4)	202(100)

Table 2: Season Wise Distribution

Season	Cases	Percentage
Summer	87	43.1
Rainy	60	29.7
Winter	55	27.2
Total	202	100

Table 4: According to Time of Incidence

Time of Incidence	Cases	Male	Female	Percentage
00.01am-03.00am	7	6	1	3.46
03.01am-06.00am	3	3	0	1.48
06.01am-09.00am	11	11	0	5.44
09.01am-12.00pm	29	23	6	14.35
12.01pm-03.00pm	22	16	6	10.89
03.01pm-06.00pm	29	26	3	14.35
06.01pm-09.00pm	61	58	3	30.19
09.01pm-12.00am	40	40	0	19.80
Total	202	183	19	100

Table 3: Area Wise Distribution

Area	Cases	Percentage
Urban	47	23.3
Rural	155	76.7
Total	202	100

Table 5: According to Economic Status

Socioeconomic Status	Cases	Percentage
Upper Class	14	6.9
Middle Class	84	41.6
Lower Class	41	20.3
Dependent	63	31.2
Total	202	100

Table 6: According to Educational Status

Education Level	Cases	Percentage
Not Applicable	3	1.5
Illiterate	34	16.8
Primary	19	9.4
Middle School	14	6.9
High School	31	15.3
Diploma	21	10.4
Graduate	72	35.6
Post Graduate	8	4
Total	202	100

Table 7: According to Type of Road User (Deceased)

Type of Road User	Cases	Total (%)
Pedestrian	60	29.7
Driver	106	52.5
Passenger	36	17.8
Total	202	100

Table 8: Distribution According to Condition of Road

Condition of Road	Cases	Percentage
Good	131	64.9
Bad	44	21.8
Under construction	23	11.4
Not applicable	04	2
Total	202	100

Original Research Paper

Pattern of Fingerprints in Different ABO and Rh Blood Groups

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Abstract

Identification is a vital of crime investigation and practice of forensic medicine. Many characters are used for identification. To establish the absolute identity among the many characters finger print is one of the most important tool easily available. It is one of the oldest and reliable methods of identification. Many studies conducted worldwide have proved the correlation between fingerprints and different ABO blood groups along with certain diseases. The present study was conducted on 400 Indian medical students having different ABO blood groups. Their fingerprinting and blood grouping was done, tabulated and analyzed. The study revealed that there is an association between distribution of fingerprint patterns, blood group and gender. Loop was most frequently seen fingerprint followed by whorl and arch. O positive is most common blood group and AB negative is rarest. Loops are predominant in blood group O followed by B and AB in both Rh positive and Rh negative.

Key Words: Fingerprint, Blood Group, Gender, Identification, Forensics, Disease

Introduction:

Identification has paramount importance in the practice of Forensic Medicine. Identification of individual in unidentified bodies and criminals by fingerprints left at crime scene is vitals of crime investigation. Identification is defined as determination of the individuality of a person based on certain physical characteristics which are unique to that individual. [1]

Many characters are used for identification like race, religion, sex, age, complexion, external features, moles, hair, scars, tattoo marks, deformities, footprints, fingerprints, occupational marks, teeth, hand writing, cloths, personal articles etc. [2]

To establish the absolute identity among the above characters finger print is one of the most important tool easily available, because it has been estimated that chances of two persons having identical fingerprints is about one in sixty four thousand million population of the world. [3]

It was in early 20th century that fingerprinting was accepted formally as a valid personal identification method by law enforcement authorities and become a standard procedure in Forensics.

Individual can change his behavior, physical appearance, voice, color etc. but biological characteristics like fingerprints and blood groups cannot be altered or replicated. [4] Hence they are considered more reliable, authentic and credible in Forensic science.

Fingerprints are impressions of patterns formed by the papillary/epidermal ridges of finger tips. [1] This ridge pattern of fingers appears in the form of volar pads around 6-8 weeks after conception. These volar pads begin to recede around 10-12 week, around 13th week skin ridges appear and take the shape.

At last around 21st week after conception the fingerprint patterns are completed. [4] The volar skin is composed of two layers, the outer epidermis and inner dermis. [5] Pattern of these papillary ridges remains unchanged in an individual throughout life. [5]

The secretions in the fingerprints contain residues, various body fluids and their metabolites which can be detected and used as additional factor for identification in Forensics. Fingerprints present at the scene of crime can be used to identify suspects, which will help the law enforcing authorities to arrest/exclude the accused and also to process the investigation in right direction. Fingerprints aren't just for identification anymore. Studies determined your

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fingerprint patterns may hold clues to revealing potential health threats, including certain diseases and cancers.

Due to immense potential of fingerprints as an effective method of identification an attempt has been made in the present work to analyze their correlation with gender and blood group of an individual. This correlation between fingerprint pattern and these parameters may help in using fingerprints as an important aid in sex and blood group determination and vice versa, thus, enhancing the authenticity of fingerprints in detection of crime and criminals.

Aims and Objectives:

- To study the pattern of fingerprints in Indian population.
- To study the pattern of blood groups in Indian population.
- To observe any correlation between pattern of fingerprints and blood groups.

Materials and methods:

The study was conducted in the Department of Forensic Medicine, SDM College of Medical Sciences & Hospital, Dharwad (Karnataka). 400 (200 male and 200 female) medical students were selected randomly for the study. Informed consent was obtained prior to obtain prints. Their fingerprints were taken by using ink and slab method and blood grouping was done using slide method.

Data regarding age, sex and address were recorded in proforma. The digits were numbered as per Henry's classification system. (Table 1) The patterns of fingerprints were observed by powerful hand lens and classified accordingly. This data was analyzed statistically and conclusion was drawn.

Results and Observations:

In the present study loop (55%) was the most frequently observed pattern in both males and females, followed by whorl (34.4%) and arch (5.5%). (Table 2) Majority of the individuals in the study belonged to blood group O (37.7%) followed by B (31%), A (25.7%) and AB (5.3%). Blood group B found to be most common among males whereas O among females.

Majority of Rh positive individuals were found in blood group O (38.6%), followed by B (31.2%), A (25%) and AB (5.4%), whereas Rh negative individuals were more common in blood group A (35.7%), followed by B (32.1%), O (28.6%) and AB (3.6%). (Table 3)

Frequency of loops was highest in both Rh positive and Rh negative individuals of ABO blood groups followed by whorls and arches, except AB blood group where whorls predominate followed by loops and arches.

Incidence of loop was highest in O (37.5%) blood group followed by B (31.1%), A (27.9%) and least among AB (3.5%). Whorls showed highest incidence in O (39.4%) blood group followed by B (29.8%), A (23.2%), and least among AB (7.6%). Arches were highest in O (36.3%) blood group followed by B (33.9%), A (22.6%), and least among AB (7.2%). (Table 4)

Discussion:

The present study reveals that loop was the most frequently observed pattern of fingerprint followed by whorl and arch in both males and females. Gender dimorphism was not observed. The pattern observed was similar to the study conducted on south Indian population by Gangadhar MR and Nithin MD. [6, 2]

The studies conducted in Southern Nigeria, India, Libya, Kenya and Tanzania revealed similar ridge pattern. [5,7-9]

The findings does not coincide with the study conducted in New Zealand which revealed abundant whorls (55.6%) than loops (43.6%) in males and much higher frequency of whorls (65.6%) and lower frequency of loops (33.7%) in females. [10]

Majority of the subjects in the study belonged to blood group O followed by blood group B, A and AB. Majority of subjects (372) were Rh positive while only 28 were Rh negative. Blood group B found to be most common among males while O among females. [11] These findings does not coincide with the study conducted by Mehta AA, which revealed B as predominant blood group and AB as least common among the Indian population. [7]

Whereas the study conducted by Fayrouz INE revealed O as most common blood group followed by A, B and AB in Libyan population. [8] Our study asserted that blood groups O, B and A are associated with more loops and less whorls than blood group AB. Whereas blood group AB is more associated with Whorls than loops. [11-13]

The present study reveals that there is an association between distributions of fingerprint pattern in relation to ABO blood groups. High frequency of loops, moderate of whorls and low of arches was observed. This is similar to the studies conducted by Bharadwaj A and Gowda MST. Similar findings were seen in Rh positive and Rh negative individuals. [12, 14]

Apart from Forensic implications the pattern of fingerprints will help us in prediction of certain diseases. Carcinoma of breast is frequently associated with individuals having six/more digital whorls. [15] Alzheimer's disease is associated with individuals having eight/more

digital loops. [16] Similar prediction of various diseases can be easily made out with the help of blood group of the individual.

Blood group O is associated with skin cancer and Hodgkin's disease, whereas blood group A is associated with ovarian, endometrial and stomach carcinoma. [17-19] Rh positive individuals are more frequently associated with colon cancer. [20]

Conclusion:

Our study concludes that there is an association between distribution of fingerprint patterns, blood group and gender. The most frequent pattern of fingerprint in Indian population was loop followed by whorl and arch. Gender dimorphism was not observed.

O positive is most common blood group and AB negative is the rarest. Loops are predominant in blood group O, B, and A in both Rh positive and Rh negative. Whorls are predominant in blood group AB.

With the recent advances in fingerprint sensing technology and improvement in the accuracy the biometric technology matures. Fingerprints will remain an integral part of the preferred biometric based identification solution in future. A relationship of fingerprint pattern to blood group presents scope for additional identification data as personal identification and also for possible prediction of certain diseases.

The association between whorl pattern of fingerprint and breast cancer might be potentially used for screening of breast cancer in under developed and developing countries, here access to mammograms may not be possible. These additional factors can be validated along with increasing the accuracy of prediction by encouraging and conducting the study on larger population groups.

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Table 2: Sex wise Pattern of Fingerprints

Fingerprint	Male (%)	Female (%)	Total (%)
Loop	1067(48.4)	1136(51.6)	2203(55)
Whorl	709(51.5)	668(48.5)	1377(34.4)
Arch	109(49.3)	112(50.7)	221(5.5)
Composite	115(57.8)	84(42.2)	199(5.1)

Table 1: Henry's Classification System

Finger Number	Left Little	Left Ring	Left Middle	Left Index	Left Thumb	Right Thumb	Right Index	Right Middle	Right Ring	Right Little
	10	9	8	7	6	1	2	3	4	5

Table 3: Pattern of Blood Groups in Male and Female

Blood Group	Male (%)	Female (%)	Total (%)	Rh +ve (%)	Rh -ve (%)	Total
A	44(42.7)	59(57.3)	103(25.7)	93(25)	10(35.7)	103
B	73(58.4)	52(41.6)	125(31.3)	116(31.2)	9(32.1)	125
AB	13(61.9)	8(38.1)	21(5.3)	20(5.4)	1(3.6)	21
O	70(46.4)	81(53.6)	151(37.7)	143(38.6)	8(28.6)	151

Table 4: Pattern of Fingerprints among ABO & Rh Blood Groups

Finger Print	A (%)	B (%)	AB (%)	O (%)	Total (%)	Rh +ve (%)	Rh -ve (%)
Loop	615(27.9)	684(31.1)	77(3.5)	827(37.5)	2203(55)	2057(55.3)	146(52.1)
Whorl	320(23.2)	410(29.8)	104(7.6)	543(39.4)	1377(34.4)	1278(34.4)	99(35.4)
Arch	50(22.6)	75(33.9)	16(7.2)	80(36.3)	221(5.5)	203(5.4)	18(6.4)
Composite	45(22.6)	81(40.7)	13(6.5)	60(30.2)	199(5.1)	182(4.9)	17(6.1)
Total	1030	1250	210	1510	4000	3720	280

Original Research Paper

Secretors in Manipuri Population: A Study

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Abstract

The term 'secretor' is used for an individual who secretes ABO blood group antigens in body fluids such as saliva, sweat, tears, gastric juice, semen, urine, etc. The present study has been taken up to find out the distribution of secretors and non-secretors in the Manipuri population.

In this study, saliva samples from 400 individuals, 213 males and 187 females who were in the age group of 15 to 60 years were collected, and the samples were examined by haemagglutination inhibition technique. The samples were also examined at different time intervals from the time of collection of samples. The findings were entered in proforma and statistically analyzed. It is observed that 49.5% of the Manipuri subjects in this study are secretors and 50.5% are non-secretors. The percentage of agglutinins is the highest in the blood group 'O'. The ABO group antigens can be detected from the saliva of secretors up to 180 days or 6 months from the time of collection of samples. A relatively higher number of people in the Manipuri population are non-secretors and the percentage of agglutinins is highest in blood group 'O'.

Key Words: ABO blood group, Secretor, Non-secretor, Manipuri population

Introduction:

In the investigation of crimes, such as murder, dacoity, rape, etc., the examination of biological materials plays an important role in connecting the criminal with the crime.

Such biological specimens may be in the form of body fluids, stains or other materials viz. blood, saliva, semen, urine, faecal matter, milk and hair. The existence of serological differences among the individuals described by Landsteiner K [1] in 1901 was a landmark discovery. According to him, people of this world, irrespective of age, sex, caste, colour, etc., can be broadly divided into four main groups: A, B, AB and O.

The basis for classification was antigenic character present on RBC membrane. Workers like Weiner AS [2] observed that blood group antigens are not only present on RBC membrane, but also secreted in various body fluids like saliva, gastric juice, semen, amniotic fluid, sweat, urine, tears, etc.

The agglutinogens of the ABO system present in the body tissues appear in lipoidal and water soluble forms. In about 80 percent of the people they appear in water soluble form and can be demonstrated in all the body fluids except the cerebrospinal fluid. They are not found in nerve tissues, epithelium, skin appendages, bone and cartilages. A person who possesses only the lipoidal form are known as 'non secretors', while those who possess a water soluble form are known as 'secretors'.

In other words, a 'secretor' is an individual who secretes ABO blood group antigens in body fluids. It has been established that, secretion of group specific substance is controlled by a pair of alleles *Se* and *se*. Thus, individuals can be homozygous (*SeSe*), heterozygous (*Sese*) or homozygous (*sese*). The first two classes are called secretors and the third group is known as non-secretors.

Secretors possess H antigens on their red cell irrespective of their blood groups of their ABO system. However, the amount of H antigen is the highest on the red cells of 'O' group persons. The ability to secrete agglutinogens into the body fluids remains constant throughout and transmitted as Mendelian dominant.

The Rh agglutinogens are distributed widely in the body tissues but are not found in the body fluids, except the amniotic fluids. [3] One of the richest and most readily available sources of group specific substance is saliva. However, in other body fluids such as sweat, tears and urine the concentration is fairly low. [4]

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In Caucasians, approximately 80% are secretors & 20% are non-secretors, whereas in Negroes, 60% are secretors and 40% are non-secretors. [5]

Keeping this knowledge in mind, the present study has been taken up to determine the distribution of blood groups, secretors & non-secretors in the normal healthy population of Manipur and this may act a useful tool in medico-legal investigations of crimes.

Materials and Methods:

The study, which was conducted during the period of August 2010 to July 2012, was a community based cross sectional study in a study population of any Manipuri subject in the age group of 15 to 60 years residing in and around Imphal city area.

Exclusion Criteria: (1) History of recently transfused non-specific group blood, (2) History of bone marrow transplantation, (3) Subjects with malignancies like Leukemia which leads to weakening or loss of blood group antigens on cells, (4) Subjects with gram negative septicaemia, intestinal obstruction and carcinoma of colon or rectum leading to acquired 'B' antigen like activity. [6]

The sample size was calculated based on the prevalence rate of 80% from previous study. [5] The allowable error was taken as 5%; and so the study was conducted on 400 normal healthy Manipuri subjects. Of these, 213 subjects are male and 187 subjects are female. The method of sampling was random sampling.

Method:

After obtaining approval of the Institutional Ethics Committee and taking informed consents, the saliva samples were collected from 213 males and 187 females from Imphal city and surrounding areas.

The saliva samples were collected on a piece of washed cotton cloth and were air dried and placed in coded envelopes. The ABO and Rh blood group were determined by slide agglutination method.

The secretor status was determined by 'Haemagglutination Inhibition technique' which was introduced by Weiner AS, [2] and later modified by Roy MN and Chatterjee JB. [7]

The dried saliva stained cloth was cut into small pieces, about 1cm² and the pieces were soaked in 1ml of 0.9% saline for about 10-15 minutes. Then, 0.1ml of the saliva solution was taken in each of 3 well marked test tubes - one drop of each diluted anti sera was added in corresponding tubes containing diluted saliva.

The tubes containing the saliva-antisera mixture were kept in the refrigerator for 2 hours

at 4° C. After 2 hours, the tubes were taken out and then brought to room temperature and one drop of blood of known blood group was added in each test tube containing saliva-antisera mixture. After shaking the tubes, one drop of the solution from each tube were taken on a clean glass slide and examined under the microscope for agglutination reaction.

The samples with no agglutination i.e. no clumping, were taken as secretors and the samples with agglutination i.e. clumping, were taken as non-secretors.

Then, examination of the saliva for the detection of ABO (secretor) was done at different time intervals viz. 30 days, 60 days, 90 days, 120 days, 150 days and 180 days.

All the observations of the work were recorded systematically in proforma and statistical analysis was done by chi-square test.

Results:

In this present work, out of these 400 subjects, 213 were males and 187 were females who were above 15 years and below 60 years. (Fig. 1) The predominant blood group in the present study was 'B' group which was 35%, followed by group 'O' which was 33.25% and the least dominant was 'AB' group which was 9.25%. (Table 1)

In our study 198 subjects (49.5%) were secretors and 202 subjects were non-secretors (50.5%) and the difference is statistically significant. (Fig. 2) Amongst the blood groups, highest number of secretors was observed in 'O' group, whereas the least number of secretors were observed in group 'AB'. (Table 2)

Out of 213 males, 116 subjects (54.46%) were secretors and 97 subjects (45.54%) were non-secretors; whereas in 187 female subjects, 82 subjects (43.85%) were secretors and 105 subjects (56.15%) were non-secretors. (Fig. 3)

In this study, the ABO group was examined and detected from saliva (secretors) at different time intervals from the time of collection of samples. The secretor status can be detected in all the samples up to 180 days i.e. 6 months and the difference is statistically not significant. (Table 3)

Discussion:

Blood group factors in body fluids are of medico-legal importance in detection of crime, and saliva testing is of particular medico-legal importance in the examination of bite marks.

At the same time, it may also be required in the investigation of sexual cases. Saliva may be identified on stamps, envelopes, cigarette ends and the like and saliva stain

grouping on such articles from the scene of crime is very helpful in the identification of the criminal. In case of salivary stains on fabrics, the fibers of the stained part of the cloth can be subjected to mixed agglutination test to find out any group specific substances secreted by the person and this helps in identification of the person. [8]

Many other workers [9-11] have studied and confirmed the presence of ABO blood group agglutinins in saliva. Haemagglutinins are more stable in blood stains than in stains of saliva because of the presence of higher concentrations of various salts and a much greater buffering capacity than saliva. [12]

In the present study, haemagglutination inhibition method has been selected for the detection of secretors and non-secretors from saliva as it was done by workers like Boettcher B [10], Akhter S [11], Karpoor C [13], and the slides were examined under the microscope for antigen – antibody reaction.

In the present work, 49.5% were secretors and 50.5% were non secretors in the Manipuri population who generally belong to the Mongoloid race. But, according to Race RR and Sanger R [5] in Caucasians approximately 80% are secretors and 20% are non-secretors and in Negroes 60% are secretors and 40% are non-secretors. In Bangladeshi population, 60% are secretors and 40% are non-secretors as observed by Akhter S et al [11]

In a study by Vyas GN et al [14] in Gujarat population, 79.6% were secretors and 20.4% were non secretors. In Karnataka, Kulkarni DG and Venkatesh D [15] observed that 76.78% of the population was constituted by secretors and 23.22% were non-secretors.

These findings are in contrast with the findings of the present study, and this may be attributed to racial variations in these study populations. Interestingly, the finding of the present study may be favourably compared with the findings of an earlier study by Loitongbam BC [16] who studied the frequency of ABO secretor status in Manipuri youth population, and observed that 39% were secretors and 61% were non-secretors.

The difference in the percentage may be due to the difference in sample size. In the present study, the predominant blood group was B group (35%) followed by O group (33.25%) and in blood group O, 54.14% were secretors and 45.86% were non secretors.

Here, the percentage of agglutinins is highest in blood group O. This finding is similar to the findings of Wilson RM and Green GE [9] who found agglutinins in a higher proportion of

saliva from group O persons than in those from A or B individuals. It is also comparable with that of Boettcher B who detected ABO agglutinins in a significantly higher proportion of saliva from O individuals than those from B or A individuals.

In this study, the ABO group was examined and detected from saliva of secretors at different time intervals from the time of collection of samples. The secretor status can be detected in almost all the samples up to 180 days i.e. 6 months which is similar to the findings of Harrington JJ et al [12] who observed that the salivary haemagglutinins may be sufficiently stable over periods of one to several days at ambient room temperatures to be of aide to forensic science investigation.

Conclusion:

From the present work, it may be concluded that a relatively higher number of people in the Manipuri population are non-secretors. The percentage of agglutinins is highest in blood group 'O'.

The effect of environmental factors was negligible on the detectability of blood group from saliva as they could be detected up to 180 days i.e. 6 months after the collection of the sample. However, no attempt was made beyond this time period in the present study for detection of blood group from saliva and more studies may be taken up in the future to establish the time limit for detection of blood group from saliva sample.

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Table 1: Distribution of Cases According to Blood Groups

Blood Group	Subjects	Percentage (%)
O	133	33.25
A	90	22.50
B	140	35.00
AB	37	9.25
Total	400	100

Table 2: Frequency of Secretors and Non-secretors in Different Blood Groups

Blood group	Subjects	Secretors (%)	Non-secretors (%)	Chi-square (x ²)
O	133	72(18.0)	61(15.25)	98.80
A	90	46(11.5)	44(11.0)	
B	140	65(16.25)	75(18.75)	
AB	37	15(3.25)	22(5.50)	
Total	400	198(49.5)	202(50.5)	

(P < 0.001, Significant)

Table 3: Detection of ABO from Saliva (Secretor) in Relation to Time of Examination of Samples

No. of Days	No. of samples	Positive Cases	Percentage
30	16	16	100
60	16	16	100
90	16	16	100
120	16	15	93.75
150	16	15	93.75
180	16	14	87.50

Fig. 1: Sex wise Distribution of Cases

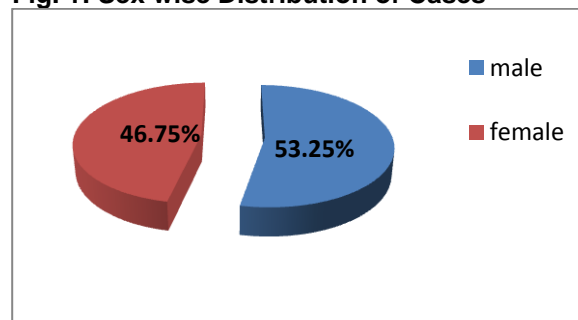


Fig. 2: Secretor and Non-secretor status (P < 0.001, Significant)

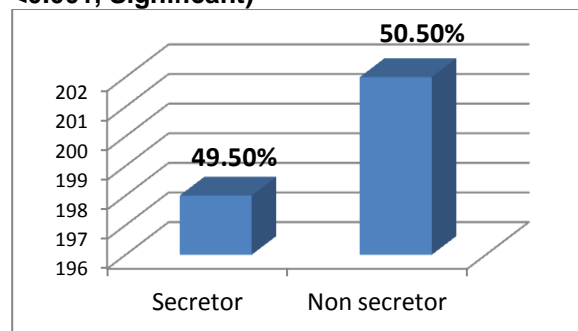
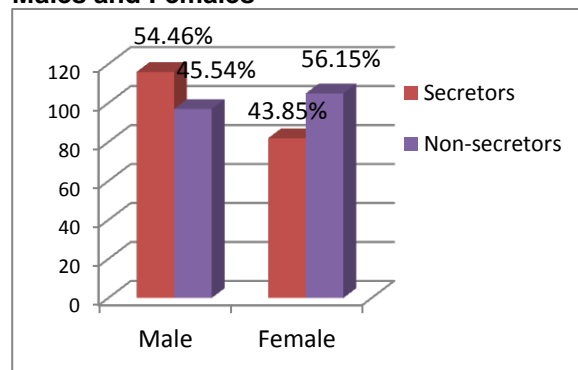


Fig. 3: Secretor and Non-secretor Status in Males and Females



Original Research Paper

Comparative Evaluation of Lip Prints Among Indian and Malaysian Students

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Abstract

Cheiloscopy, the study of lip prints is an upcoming tool for the identification of persons. The lip print of every person is unique and can be used for personal identity. This study was done to compare and determine the most common lip print pattern among Indian and Malaysian students in both the genders and to ascertain if the lip prints behold the potential for determination of gender of the individual.

Study was conducted on 60 students (30 each from Indian and Malaysian origin) which included 20 males and 40 females. Lip stick was applied on each individual and the lip-print was obtained on a bond paper. The lip impression patterns were studied classified and recorded using magnifying lens with light. Study revealed that Type I pattern was seen in 42.7% for complete lip and 36.6% for central portion of lip among Indian students and 56.1% for complete lip and 60% for central portion of lip among Malaysian students. Type I pattern is the most common and there is no statistical difference in both the genders in lip print pattern among Indian & Malaysian students.

Key Words: Cheiloscopy; Lip prints; Gender determination; Racial; Indians; Malaysians

Introduction:

According to Locard's exchange principle, when two objects come into contact, there is always a transfer of material from each other. Traces from the scene of crime may be carried away on the person and at the same time may be left at the scene. [1]

Lip print is one of the evidence that can be left in the crime scene which helps in identification purpose. Lip prints are the normal lines and furrows in the form of wrinkles and grooves present in the human lip having certain individual characteristics like fingerprints.

During investigation it can be found over wine glass, love letters, on private parts etc. [2] Study of lip prints is known as Cheiloscopy.

It is unaltered from six week of intrauterine life till death. [3] Fischer in 1902 first described the furrows on the red part of the human lips. [3]

However, it was only in 1932 that Edmond Locard recommended the use of lip prints in personal identification. [4]

Snyder in 1950 reported that the lip prints are individually distinctive as finger prints. [5] Suzuki, in 1967, recorded the measurement of the lips, made detailed study on the use and colour of rouge. He also elaborated on the method of its extraction to obtain useful data for Forensic application.

He said that the hereditary factors may have some influence on the lip print patterns. In 1970, he recalled the attention of everyone on the possible use of lip prints in personal identification and classified the lip prints into five types. [6] Mc Donell in 1972 conducted a study on two indistinguishable identical twins and found their lip prints to be different. [4]

Thus, lip prints are unique to a person and hence can be used as an aid in personal identification. The aim of the present study was to evaluate the distribution of lip print patterns in two different populations and to know the importance of lip prints in gender determination.

Materials and Methods:

Study was conducted on randomly selected 60 dental students (30 Indian and 30 Malaysian) studying in JSS Dental College & Hospital, Mysore. The study included a total of 20 males (12 Indians and 8 Malaysians) and 40 females (18 Indians and 22 Malaysians).

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All individuals were aged between 18 to 24 years. Lips which were normal and free of any disease were included in the study.

Individuals with known hypersensitivity to lipsticks, with any malformation or inflammation or trauma or scar or any other abnormality of the lip were excluded from the study. The materials used in the present study were bond paper, oil free lipstick or matted lipstick, lip stick applying brush and magnifying glass with light.

The subjects were asked to clean the lips and the matted lipstick was applied using a lipstick brush. The lip prints were recorded on the bond paper by placing it between the lips and asking the subjects to close the lips gently without applying pressure. Two duplicate prints of each individual were taken to avoid any improper prints or errors.

They were then studied carefully using a magnifying glass with light. While studying, each individual's lips were divided into six compartments, i.e. three compartments on each lip, and were allotted the digits one to six in a

clock-wise sequence starting from the subject's upper right.

The lip prints were classified based on Suzuki and Tsuchihashi's classification as:

- **Type I: Complete vertical,**
- **Type I': Incomplete vertical pattern,**
- **Type II: Branching or 'Y' pattern,**
- **Type III- Criss-cross pattern,**
- **Type IV: Reticular pattern and**
- **Type V: all other patterns. [6]**

The lip prints were analyzed in two categories, one as whole/complete lip and in the other only the central portion of the lip separately. The data entry and statistical analysis was done using statistical package for social sciences (SPSS) version 14 for windows.

Results:

In the present study, we found that no individual had single type of lip print in all the compartments and no two or more individuals had similar type of lip print pattern. The detailed results of the evaluation of the lip prints were recorded. (Fig. 1, 2)

Fig. 1: Distribution of Lip Print Patterns for the Complete Lip

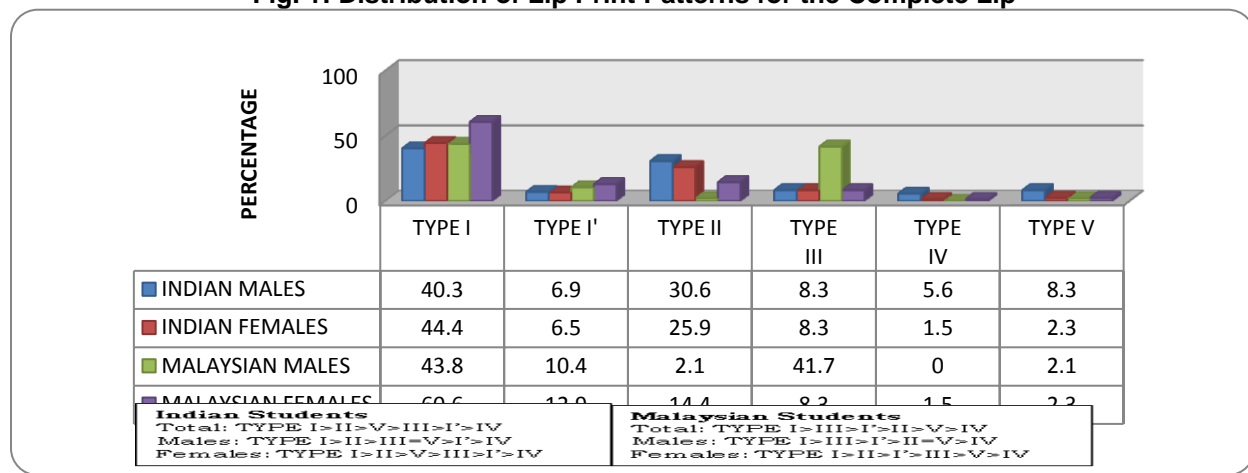
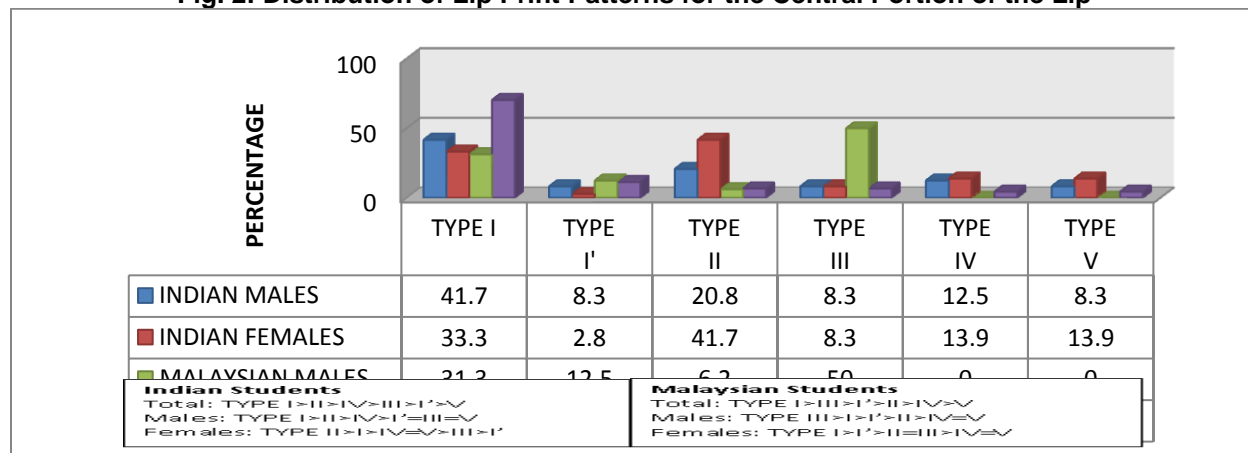


Fig. 2: Distribution of Lip Print Patterns for the Central Portion of the Lip



Discussion:

Personal identification is necessary for an unknown person in heir-ship, marriage, divorce, legitimacy, rape, homicide, suicide, accident; mass disaster etc. and various methods are available for this.

Usually the personal identification using cheiloscopy can be made by comparing the ante-mortem record with that of the postmortem record, if definite descriptions of the lip prints are available for that individual. [7] It is thought that hereditary factors may have some influence on the lip print patterns. [4]

Lip print identification is generally acceptable within forensic science as a means of positive identification, because lip print patterns are unique like finger prints. [8] It has been observed that lip prints are dissimilar among different individuals and also among identical twins. [4]

Recently, a detailed cheiloscopic study of the lip print patterns in Saudi males and females proved the individuality of lip prints, as no identical patterns appeared in two subjects.

They reported that even when two subjects exhibited the same type of groove in the same area of the lip, there was specificity in the site and pattern of groove branching or reticulation. [9]

Another study done in Nigeria showed that no lip print patterns matched each other, thus establishing the uniqueness of lip prints. [10] In the present study also we found that lip prints were dissimilar among different individuals and no two individuals had same pattern, thus emphasising its uniqueness.

It has also been suggested that variations in lip print patterns among males and females could help in gender identification and studies have proved that gender difference does exist in lip print pattern. [7]

Different studies have shown that type I & type I' patterns are the most predominant patterns among females. [8, 11-13] A variation from this was reported as type IV to be the most predominant pattern in females. [14, 15] In males, it varied slightly.

According to some authors both type III & IV were found to be the most predominant patterns among males. [8, 11] Other studies reported type IV [12, 14, 15] or only type III [13] to be the most predominant patterns.

Others opine that type I pattern was the most predominant among both the genders and that the patterns in different quadrants varied in males than in females who tended to have the same pattern. [16] A study in Maharashtra

revealed that they were able to identify the gender with high degree of accuracy based on lip prints. [14, 16]

In the present study, type I pattern was the most prominent pattern among Indian and Malaysian males & females for the complete lip. For the central portion of the lip, type I was the most prominent pattern for Indian males & Malaysian females, type II for Indian females and type III for Malaysian males. Hence, we could not appreciate the gender based identification based on lip print pattern.

It was observed that an individual does not have a single type of lip print, but a mixture of different patterns and that no two individuals have similar type of lip-prints. [17] Further, it was seen that lip-prints did not change on repeated sampling in the same individual. [18]

We also found a mixture of different patterns rather than a single type of pattern in an individual. The prints at the corner of the lips are not very clear even in the prints of very good quality and it is usually the central strip of the lip which can be recorded better. [19]

In our study too, we observed that the central portion of the lip recorded better than the corners. Hence, more studies on the central portion of lips are necessary to validate this finding. It is assumed that lip print pattern variation is seen among different races or population. Manipady, in 2002 studied Indian and Chinese population and found no such variation, with both the population showing type II pattern predominantly. [14]

Some researchers found type J pattern (horizontal with other forms) as the most common lip print pattern in both the genders in subjects from Saudi Arabia & Nigeria. [9, 10]

Another study showed that type III as the most predominant pattern in Malaysian males and type I & type I' as the most predominant in Malaysian females. [13] But in the present study we could not elicit any racial variations, probably because of our small sample size.

Conclusion:

Findings from lip print studies make a strong evidence for their use in solving crimes. Although not useful for identification under conditions where only skeletal structures remain, intact lips provide prints that can provide valuable legal evidence, as lip prints are unique for every person. In our study, no two lip print patterns matched each other thus establishing the uniqueness of lip prints.

Although the uniqueness of lip prints has been widely established, further research needs

to be done to arrive at guidelines regarding gender & racial prediction.

Hence, more collaborative work needs to be done, maximizing the number of subjects involved in the study, to reach a consensus and have practical implications.

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Original Research Paper

Epiphyseal Union at Lower End of Radius and Ulna in the Age Group of 16-20 Years in Jodhpur Region of Rajasthan

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Abstract

Among the variety of scientific procedure available in age assessment, there is wide agreement in methods based on sexual, skeletal, and dental maturity. However in age group 16-20 years X-ray of lower end of radius and ulna is most accurate method. The present study was undertaken on 100 individuals from Jodhpur region (52 males and 48 female) between the age group of 16 to 20 years.

Radiological examination of both wrist joints was done to study epiphyseal union at lower end of radius and ulna. The study showed that the processes of union start around 16 years in both male and female. Epiphyseal union at lower end of radius occurs in advance of the lower end of ulna and the difference is about one year. Average age for complete epiphyseal union of lower end of radius among the people of Jodhpur region is 17-18 year for both males and females. Average age for complete epiphyseal union of lower end of ulna among the people of Jodhpur region is for males 19-20 years and for females 18-19 years. The age for epiphyseal union of lower end of radius and ulna is bilaterally same.

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

Introduction:

Verification or determination of age is prerequisite for personal identification in living as well as dead. Age estimation in living as well as dead is one of the most important tasks for a Forensic expert. In developing countries like India because of illiteracy the births are not registered or records of birth are not properly maintained. It is a prerequisite for personal identification and it is increasingly important in criminal and civil matters.

In fact, if doubt arises regarding the age of a person in any legal inquiry, forensic age estimation is promptly requested by authorities to ascertain whether the person concerned has reached the age of imputability.

Here, age estimation becomes a valuable tool to assist in administration of many civil and criminal procedure codes.

After puberty the process of growth in length of the long bones stops at different ages in different parts of different long bones. This stoppage of growth process is indicative on x-ray examination by fusion of the epiphysis with its respective diaphysis, or can say secondary centre with primary centre.

This process is complete by the age of 22 years as described by various authors. Further it is found that the age for the fusions is fairly constant with minor variations among different study groups of different geographic areas. Various studies have shown that the lower end (epiphysis) of radius and ulna fuses with their respective diaphysis within the age group of 16-20 years.

The minor differences in the age of fusion could be due to effects of changes in climate, economic, hereditary, dietetic conditions or involving some unknown factors. [8]

Materials and Methods:

The present prospective study is carried out at Forensic Medicine Department of Dr. S.N. Medical College, Jodhpur during the one year period from January to December 2013. The subjects were selected on cross-sectional basis from the students of Dr. S.N. Medical College and patients or their relatives at MGH/MDM Hospital, original native of Jodhpur region.

Subjects with criteria affecting the growth of bones and epiphyseal fusion like congenital deformities, fracture cases, chronic illness, on steroid therapy etc., were excluded from the study.

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A total 100 apparently healthy subjects, 52 males and 48 females, irrespective of caste and religion with known birth-date and from the age-group of 16-20 years were selected for the purpose of the study.

Preliminaries of the subjects including sex, age, height, weight, dietary habits were recorded. They were asked for the copy of any one proof of birth-date like identity card, driving license, school leaving certificate, birth registration certificate, aadhar card etc.

The chronological age of each subject was calculated using information on the certificate received for proof of birth-date and date of examination, therefore allowing calculation of exact age. Purpose was explained to the subjects and written informed consent was obtained for the X-ray.

X-ray of both wrist joints showing lower end of radius and ulna were taken in antero-posterior view in all 100 subjects. Subjects of either sex were grouped into 4 age-groups as follows:

1. **Group one: 16-17 years**
2. **Group Two: 17-18 years**
3. **Group Three: 18-19 years**
4. **Group Four: 19-20 years**

The X-rays of these subjects were showing union of lower end of radius and ulna with their respective diaphysis at various stages. The findings of epiphyseal fusion are divided into 4 stages.

1. **Stage 0: Non-union.** A dark black radiolucent line seen between the area of diaphysis and epiphysis.
2. **Stage I: Union in progress.** Gap between diaphysis and epiphysis begins to decrease but complete union does not occur.
3. **Stage II: Complete union with white dense line.** Union between diaphysis and epiphysis completed but white dense line still visible at diaphysis-epiphyseal junction.
4. **Stage III: Complete union without any white line.** Union between diaphysis and epiphysis completed and no white dense line visible at diaphysis-epiphyseal junction.

The findings are recorded on a specially designed proforma, tabulated, analyzed and compared with similar studies by different authors.

Observation and Results:

Present study showed that in males the epiphyseal fusion at lower end of radius of both hands in age group 16-17 years, 02 out of 26 (7.69%) cases showed starting up process of epiphyseal union, whereas 20 out of 26 (76.92%) were of grade II fusion and 04 out of

26 (15.38%) were of grade III fusion. In 17-18 years age group 100% cases were of grade III fusion. In remaining age groups i.e. 18-19 years (16 out of 16) and 19-20 years (42 out of 42) were showing 100% grade III fusion. (Table 2)

Our study showed that the epiphyseal union at lower end of radius in males starts about 16 years of age and completed by the age of 17-18 years.

It also showed that there was no difference in the timing of the epiphyseal fusion at lower end of radius whether it is right hand or left hand. Thus the epiphyseal fusion at lower end of radius goes bilaterally symmetrical in males. (Table 2)

In this study the epiphyseal fusion at lower end of ulna of both hands at age group 16-17 years, 06 out of 26 (23.07%) were showing epiphyseal fusion in 0 grade, 20 out of 26 (76.92%) in stage I in males.

In 17-18 years age-group all samples were showing grade I epiphyseal fusion, 20 out of 20. In age group 18-19 all samples (16) showed grade II fusion. In 19-20 age groups all cases (42) showing grade III complete fusion. (Table 4)

Our study showed that process of epiphyseal fusion of lower end of ulna starts about the age of 16-17 years and completed at the age of 19-20 years in males.

There was no difference in the timing of the epiphyseal fusion at lower end of ulna whether it is of right hand or left hand. Thus the epiphyseal fusion at lower end of ulna goes bilaterally symmetrical in males. (Table 4)

Our study showed that in females the epiphyseal fusion at lower end of radius of both hands in age group 16-17 years, 12 out of 56 (21.42%) x-rays were showing starting up process of epiphyseal union, whereas 44 out of 56 (78.57%) were showing grade II fusion.

In 17-18 years age group all showed grade III fusion. In remaining age groups i.e. 18-19 years (20 out of 20) and 19-20 years (10 out of 10) years were showing 100% grade III fusions. (Table 6)

In this study the epiphyseal union at lower end of radius in females starts about 16 years of age and completed by the age of 17-18 years and there was no difference in the timing of the epiphyseal fusion at lower end of radius whether it is of right hand or left hand.

Thus the epiphyseal fusion at lower end of radius goes bilaterally symmetrical in females. (Table 6) Present study showed that epiphyseal fusion at lower end of ulna of both hands in age group 16-17 years, 10 out of 56 (17.85%) x-rays showed grade 0 fusion whereas 46 out of 56

(82.14%) showed grade I fusion. In 17-18 years age group all (10) showed grade II fusion. In remaining age groups i.e. 18-19 (20 out of 20) years and 19-20 (10 out of 10) years were showing 100% grade III fusion. (Table 8)

Our study showed that the epiphyseal union at lower end of ulna in females starts about 16-17 years of age and completed by the age of 18-19 years and there was no difference in the timing of the epiphyseal fusion at lower end of ulna whether it is of right hand or left hand. Thus the epiphyseal fusion at lower end of ulna goes bilaterally symmetrical in females. (Table 8)

Discussion:

In the present study it is observed that fusion of lower end of radius in males complete in 17-18 years. These observations are similar to the observation done by Galstaun [2], Kothari [4], Goel, M.R [3], Dutta Sumanta. [1]

Observations of present study are differ from the following observation by different authors Lall & Natt [5], Loomba [6], Pryor [8] and Sharma Yogesh [10], showed late age of fusion at lower end of radius.

S. M. Hepworth study [9] showed early age of fusion at lower end of radius. (Table 3)

In the present study it is observed that fusion of lower end of ulna in males complete in 19-20 years. These observations are similar to the observation done by Lall & Nat. [5]

Observations are differing from the following observation by different authors. Galstaun [2], Hepworth [9], Kothari [4], Sharma Yogesh [10], Goel MR [3], Dutta Sumanta [1] studies showed early age of fusion at lower end of ulna while Loomba [6] study showed late age of fusion. (Table 5)

In the present study it is observed that fusion of lower end of radius in females complete in 17-18 years. These observations are similar to the observation done by Kothari [4], Sharma Yogesh [10], Goel MR [3], Dutta Sumanta. [1]

Observations of present study are different from the observation by different authors. Loomba [6], Pryor [8] showed late age of fusion at lower end of radius. Galstaun [2], S.M.Hepworth [9], showed early age of fusion at lower end of radius in their study. (Table 7)

In the present study it is observed that fusion of lower end of ulna in females complete in 18-19 years. These observations are similar to the observation done by others. [4, 6]

Observations of present study were different from the Galstaun [2], S. M. Hepworth [9], Pryor [8], Sharma Yogesh [10], Goel MR [3]

& Dutta Sumanta [1] observations, which showed early age of fusion at lower end of ulna. (Table 9)

Conclusion:

Epiphyseal union at lower end of radius and ulna:

- The processes of union start around 16 years in both male and female.
- Epiphyseal fusion at lower end of radius occurs in advance of the lower end of ulna and the difference is about one year.
- Average age for complete epiphyseal fusion of lower end of radius among the people of Jodhpur region is 17-18 year for both males and females
- Average age for complete epiphyseal fusion of lower end of ulna among the people of Jodhpur region is for males 19-20 years and for females 18-19 years.

Bilaterality:

- The age for epiphyseal fusion of lower end of radius and ulna is bilaterally similar, i.e. it occurs at the same age in both hands.

Sex:

No age difference is seen as far as the epiphyseal fusion of the lower end of radius is concerned however in lower end of ulna it occurs earlier by about one year in females as compared to males.

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Table 1: Age and Sex Wise Classification

Age groups (yrs)	Male	Female	Total
16-17	13	28	41
17-18	10	05	15
18-19	08	10	18
19-20	21	05	26
Total	52	48	100

Table 3: Comparison between Different Authors Studies on Age of Epiphyseal Fusion at Lower End of Radius in Male

S.N	Authors	Subjects	Radius(Yrs)
1	Galstaun ²	India –Bengal	18
2	Hepworth ⁹	Indian –Punjab	16-17
3	Kothari ⁴	India –Rajasthan-Marwar	17-18
4	Lall & Nat ⁵	India –U.P.	19
5	Loomba ⁶	India –U.P.	20-21
6	Pryor ⁸	American	20
7	Goel M.R. ³	India-Rajasthan	18-19
8	Dutta Sumanta ¹	India-Rajasthan-Jaipur	17-18
9	Sharma Yogesh ¹⁰	India-Rajasthan-Mewar	19-20
10	Present study	India –Rajasthan-Jodhpur	17-18

Table 9: Comparison between Different Authors Studies on Age of Epiphyseal Fusion at Lower End of Ulna in Female

S.N.	Authors	Subjects	Ulna
1	Galstaun ²	India –Bengal	17
2	Hepworth ⁹	Indian –Punjab	16-17
3	Kothari ⁴	India -Rajasthan	18-19
4	Loomba ⁶	India –U.P.	18-19
5	Pryor ⁸	American	16
6	Sharma Yogesh ¹⁰	India –Rajasthan-Mewar	16-17
7	Goel M.R. ³	Goel M.R	17-18
8	Dutta Sumanta ¹	India-Rajasthan-Jaipur	16.6-17
9	Present study	India–Rajasthan-Jodhpur	18-19

Table 5: Comparison between Different Authors Studies on Age of Epiphyseal Fusion at Lower End of Ulna in Male

S.N	Authors	Subjects (India)	Ulna
1	Galstaun ²	India –Bengal	18
2	Hepworth ⁹	Indian –Punjab	16-17
3	Kothari ⁴	India–Rajasthan-Marwar	18-19
4	Lall & Na ⁵	India –U.P.	19
5	Loomba ⁶	India –U.P.	20-21
6	Pryor ⁸	American	19
7	Sharma Yogesh ¹⁰	India-Rajasthan-Mewar	18-19
8	Goel M.R. ³	India-Rajasthan	18-19
9	Dutta Sumanta ¹	India-Rajasthan-Jaipur	18-19
10	Present study	India–Rajasthan-Jodhpur	19-20

Table 7: Comparison between Different Authors Studies on Age of Epiphyseal Fusion at Lower End of Radius in Female

S.N.	Authors	Subjects	Radius
1	Galstaun ²	India –Bengal	16-17
2	Hepworth ⁹	Indian –Punjab	16-17
3	Kothari ⁴	India -Rajasthan	17-18
4	Loomba ⁶	India –U.P.	18-19
5	Pryor ⁸	American	19
6	Sharma Yogesh ¹⁰	India –Rajasthan-Mewar	17-18
7	Goel M.R. ³	India-Rajasthan	17-18
8	Dutta Sumanta ¹	India-Rajasthan-Jaipur	16.5-17

**Table 2
Epiphyseal Fusion at Lower End of Radius of Both Hands in Male**

Age grps (yrs)	Various degree of epiphyseal fusion at lower end of radius of both hand in Male (cases)								Total Cases
	0		I		II		III		
	R	L	R	L	R	L	R	L	
16-17	00	00	01	01	10	10	02	02	26
17-18	00	00	00	00	00	00	10	10	20
18-19	00	00	00	00	00	00	08	08	16
19-20	00	00	00	00	00	00	21	21	42
Total	00	00	01	01	10	10	41	41	104

**Table 4
Epiphyseal Fusion at Lower End of Ulna of Both Hands in Male**

Age grps (yrs)	Various degree of epiphyseal fusion at lower end of ulna of both hands in male (Cases)								Total Cases
	0		I		II		III		
	R	L	R	L	R	L	R	L	
16-17	03	03	10	10	00	00	00	00	26
17-18	00	00	10	10	00	00	00	00	20
18-19	00	00	00	00	08	08	00	00	16
19-20	00	00	00	00	00	00	21	21	42
Total	03	03	20	20	08	08	21	21	104

Table 6
Epiphyseal Fusion at Lower End of Radius of Both Hands in Female

Age grps (yrs)	Various degree of epiphyseal fusion in lower end of radius of both hand in female (Cases)								Total Cases
	0		I		II		III		
	R	L	R	L	R	L	R	L	
16-17	00	00	06	06	22	22	00	00	56
17-18	00	00	00	00	00	00	05	05	10
18-19	00	00	00	00	00	00	10	10	20
19-20	00	00	00	00	00	00	05	05	10
Total	00	00	06	06	22	22	20	20	96

Table 8
Epiphyseal Fusion at Lower End of Ulna of Both Hands in Female

Age grps (yrs)	Various degree of epiphyseal fusion in lower end of ulna of both hands in female (Cases)								Total Cases
	0		I		II		III		
	R	L	R	L	R	L	R	L	
16-17	05	05	23	23	00	00	00	00	56
17-18	00	00	00	00	05	05	00	00	10
18-19	00	00	00	00	00	00	10	10	20
19-20	00	00	00	00	00	00	05	05	10
Total	05	05	23	23	05	05	15	15	96

Original Research Paper

A Retrospective Analysis of Suicidal Poisoning Deaths in a Metropolitan City of South India

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Abstract

India, an agrarian country has a rising encumbrance to meet the demands of the population explosion. Overt and indiscriminate use of pesticides to enhance the agricultural yield has led its way to a steep rise in poisoning related deaths amongst the population, both accidental and deliberate. In this context, a retrospective observational study was undertaken in the Department of Forensic Medicine and Toxicology, Kempegowda Institute of Medical Sciences, Bangalore between June 2012 to May 2014, with an objective to study the socio demographic profile and mortality pattern in autopsy cases with an alleged history of suicidal poisoning thereby drawing attention of the policy makers of health to strive and prevent casualties. Out of 245 autopsied poisoning victims, 95.91% of cases were suicidal deaths. 44.26% victims were between 21-30 years of age, males constituted 67.65% of the total victims. Maximum cases occurred during the evening between 6 pm-12 am (45.54%). Financial and family problems were the root cause for 44.86% of the deaths. Organophosphorus was the most common poison consumed. This study emphasizes that multilevel interventions with good governance, policy support, reliable technical team would help reduce the rising suicidal poisoning rates.

Key Words: Poisoning, Autopsy, Suicide, Demographic profile, Organophosphorus

Introduction:

'If you drink much from a bottle marked **'Poison'** it is certain to disagree with you sooner or later. -Lewis Carol

Self-harm, a problem posed earlier amongst the industrialized nations has shifted its paradigm into the developing world. As per the National Crime Records Bureau (NCRB) statistics for 2013, there were 1467 deaths /day due to accidents and suicides amongst which 369 were suicidal deaths each day.

National data of suicidal deaths showed a number of 134799 cases of suicidal death out of which Karnataka accounted for 11266 cases in 2013. The four Metropolitan Cities- Bangalore (2,033), Chennai (2,450), Delhi (1,753) and Mumbai (1,322) have reported higher number of Suicides.

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These four cities together have reported almost 35.5% of the total suicides reported from 53 mega cities. The pattern of suicides reported from 53 cities showed that Hanging (58.4%), Poisoning (15.0%) and Self Immolation (9.5%) were the prominent means adopted by the suicide victims. [1]

Poisoning is a major epidemic of non-communicable disease in the present century. Among the unnatural deaths, deaths due to poisoning come next only to road traffic accident deaths. In earlier times, the poisoning deaths from pesticides were mainly accidental but easy availability, low cost and unrestricted sale have led to an increase in suicidal and homicidal cases as well. [2]

The World Health Organization (WHO) estimated 3 million cases of poisoning every year worldwide, of which 99% of fatal poisoning cases occur in developing nations annually. [3]

The purpose of the present study was to describe the demographic profile and mortality pattern in autopsy cases with an alleged history of suicidal poisoning, thereby drawing attention of the health policy makers to enhance the legislative measures and prevent such casualties.

Materials and Methods:

The study consisted of 1210 medico-legal autopsy performed in the Department of Forensic Medicine, Kempegowda Institute of Medical Sciences, Bangalore, Karnataka during

the period of 2 years from June 2012 to May 2014. Out of total 1210 medico-legal autopsies, 245 were poisoning victims (20.24%).

Necessary information for the study was gathered from Police, inquest report and hospital treatment records. The relatives, friends, and neighbors of the victims were also taken separately for data collection.

In few cases adequate information could not be obtained and such cases were put under "Undetermined group". A detailed proforma for recording history, epidemiological data and the details of poisoning etc. was prepared for filling the observation of the present study.

The information thus collected, was statistical analyzed.

Observations and Results:

During this study period, 1210 cases were brought for post-mortem examination out of which 245 (20.24%) deaths were due to poisoning. Out of the 245 cases, 95.91% were deaths due to suicidal poisoning. (Fig. 1)

In this study maximum number of victims 104 (44.26%) belonged to age group of 21-30 years. There were 159 (67.65%) male and 76 (32.35%) female casualties amongst suicidal poisoning cases. Maximum sex differentiation was observed in the age group of 61-70 years with male and female ratio of 5:1 followed by 3.55:1 in 31-40 years age group.

If we considered age group of 21-50 years, it showed more than 3/4th of total poisoning victims (77.88%). The males outnumbered the females in totality and male to female ratio was 2.09:1. (Table 1)

In our study most of cases 107(45.54%) were reported during the evening (6 pm-12 am) followed by 55 cases (23.41%) reported during day time (6AM-12 noon). A greater number of suicidal poisoning cases 114(48.51%) were registered in the summer.

Most of cases (91.06%) took place at residence and 119 (50.64%) victims belonged to lower socioeconomic status.

Majority of the victims were Hindus consisting of 213 (90.85%) cases. It was also found that 46 cases (19.64%) were spot dead whereas 95 cases (40.48%) succumbed to death after 24 hours of hospital stay. (Table 2)

Amongst the 235 victims of suicidal poisoning, 58.55 % cases were hospitalized for treatment. (Table 3)

Present study showed that financial problems were the main reason for poison consumption in 23.46% of the cases which was closely followed by family problems accounting for 21.40% of the cases. (Table 4)

In this study, we observed that Organophosphorus was the most common consumed poison which accounted for 135 cases, followed by Aluminium phosphide poisoning which accounted for 72 cases. (Fig. 2)

Discussion:

In the present era, misuse of the imperative chemical substances is on the surge. The cold statistics of suicidal poisoning deaths point to a greater crisis of huge human tragedy of national proportions. In the present study, males constituted 67.65% and females constituted only 32.35% of the total victims.

Table 1: Age and Sex wise Distribution

Age Grps (Yrs)	Male	Female	Total (%)	Sex ratio
0-10	0	0	0	-
11-20	13	9	22 (9.36)	1.44:1
21-30	71	33	104 (44.26)	2.15:1
31-40	39	11	50 (21.28)	3.55:1
41-50	18	11	29 (12.34)	1.64:1
51-60	10	9	19 (8.09)	1.11:1
61-70	5	1	06 (2.55)	5:1
71-80	3	2	05 (2.12)	1.5:1
TOTAL	159	76	235 (100.0)	2.09:1

Table 3: Cases According to treatment

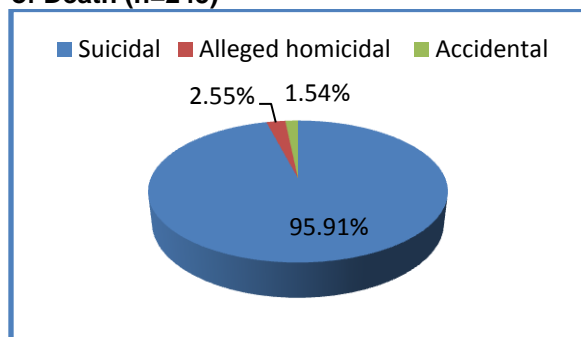
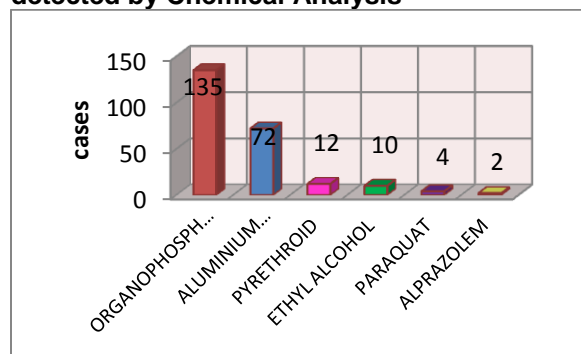
Treated	Number	Percent
Yes	138	58.55
No	97	41.45
Total	235	100.00

Table 4: Cases According to Motive

Motivation	Number	Percentage
Bereavement	4	1.60
Dowry	13	5.50
Educational	31	13.36
Family problems	50	21.40
Financial problems	55	23.46
Ill-health/Mental illness/Psychological	25	10.68
Love failure	22	9.21
Marital disharmony	12	5.43
Unemployment	14	5.76
Undetermined	9	3.6
TOTAL	235	100.00

Table 2: Demographic Profile of Suicidal Poisoning Victims (n=235)

Characteristics	Frequency (%)
Religion	Hindu 213(90.85)
	Muslim 15(6.38)
	Christian 7(2.77)
Socio economic status	Lower 119(50.64)
	Middle 91(38.72)
	Upper 25(10.64)
Time	6am -12 Noon 55(23.41)
	12 Noon – 6pm 34(14.56)
	6pm – 12am 107(49.54)
	12am-6am 39(16.59)
Weather	Summer 114(48.51)
	Winter 70(29.78)
	Rainy 51(21.71)
Place of consumption	Residence 214(91.06)
	Workplace 17(7.23)
	Others 4(1.71)
Period of survival	Spot death 46(19.64)
	< 6 hours 43(18.23)
	6-24 Hours 51(21.65)
	>24 hours 95(40.48)

Fig 1: Poisoning Cases According to Manner of Death (n=245)**Fig. 2: Cases According to Type of Poison detected by Chemical Analysis**

Males being the breadwinner in majority of family are exposed more frequently to outdoor work & lead a more stressful life than female due to family responsibilities. This explains the rising suicidal tendency amongst males. Similar findings were observed in the studies conducted by S P Singh [2], Bharath [3], Mrinal [4], Adarsh Kumar [5], and Mizanur Rahman. [6]

Age between 21-40 years was found to be more vulnerable to suicidal poisoning. This was in accordance with the studies conducted by others. [2, 5, 7, 8] Emotional, aggressive, intolerant and irrational behavior amongst the youth made them vulnerable whereas the least fatalities were observed in the victims in their extremes of ages due to limited exposure to poisonous substances. Our findings were not in agreement with the study by Margaret Warner and Shin. [9, 10]

Most of the victims were Hindus (90.85%). This may be due to the low percentage of Muslims and Christian populations in South Bangalore region as well as their religious beliefs. More cases were found to be amongst lower socio economic status (50.64%).

The rising prices of the basic amenities and inability to meet them financially could be the reason for cynicism in life and also due to inability to afford the standard of treatment after exposure. About 44.86 % cases were had family and financial problems as the motive for suicide.

Analyzing the place and time of consumption, most of the incidents (91.06%) took place in the residence, because agricultural insecticides were available. Most lethal period of poisoning found to be 6PM-12 AM (45.54%), due to emotional outburst resulting from tiredness at the end of busy life & disappointments.

The highest number of suicidal poisoning cases 114 (48.51%) was recorded in the summer season followed by winter season 70(29.78%) cases. A possible reason to explain this could be that in these months, there is more availability of pesticides due to the active agricultural activities. These observations are consistent with a study conducted at Assam. [4]

Studying seasonality has an important implication in establishing public health policy. [13] A study on young suicides by violent Methods in Rural China by Cun-Xian Jia & Jie Zhang, found that violent methods were easily employed by suicides as in winter or spring, pesticides and other poisons were not easily obtained by suicidal people. [14]

Thus in preventing suicides by poisonings, different strategies should be carried out according to different season patterns.

A total of 138 victims were treated for poisoning and period of survival beyond 24 hours were noted in 40.48% of total number of cases. This shows the better accessibility and apt management of medical aid.

In our study, the most common poison detected in Forensic Science Laboratory was Organophosphorus compounds (57.44%) followed by Aluminium phosphide (30.64%). Similar findings were observed in the studies conducted by Murari Atul [8], Reddy NKS [11], Lan Zhou [12], and RK Gorea. [13] It is not in accordance with studies by conducted by Adarsh Kumar. [5]

Conclusion:

Suicide, although largely an unforeseeable event, is subject to preventive intervention which can reduce its negative impact on the health sector.

The major reforms in economic and agricultural policies, appropriate social security and satisfactory interpersonal relationships through scientific counseling are the multipronged approaches which along with the support of community can ensure the reduction in incidence of suicidal poisoning.

Similarly strict implementation of the pesticide act and special policy by the government to educate and create awareness about the magnitude of the menace could help

ameliorate the problem. Government grants for the setting up of better poison information centers and research on recent advances in the treatment of poisoning cases would be recommended for reducing the mortality rates.

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Original Research Paper

Study of Weapons Related to Mechanical Injuries In Fatal Assault Cases Autopsied at Victoria Hospital

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Abstract

Weapons are instruments used with the aim of causing damage or harm to living beings. They are used to increase the efficacy and efficiency of tasks such as in humans fighting, defence, the committing of criminal acts and the preserving of law and order. Weapons are employed individually or collectively either by single assailant or multiple assailants. Commonly knives, daggers, choppers, bamboo sticks are used to inflict injuries. A cross sectional study was conducted in the Department of Forensic Medicine, Victoria Hospital, Bengaluru over a period of 1 year from Jan 2010 to Dec 2010 to highlight the weapons examined related to mechanical injuries in fatal cases of assault autopsied. Single weapon was commonly used in 20 (46.51%) cases of assault. Face (67.44%) was most commonly injured. Sharp heavy weapons like choppers were commonly used in assault cases.

Key Words: Weapons, Assault, Assailant, Injuries, Fatal, Autopsy

Introduction:

Weapons are the means or mechanical devices which when applied in a hostile manner, will produce injury. [1] Dangerous weapon is any instrument used for shooting, stabbing or cutting, or any instrument which, if used as a weapon of offence is likely to cause death: or by means of fire or any heated substance, or by means of any poison or any corrosive substance or by means of any explosive substance or by means of any substance which is deleterious to human body to inhale, to swallow or to receive into blood or by means of any animal. [1]

Deadly weapon- whoever is guilty of rioting, being armed with deadly weapon, which when used as a weapon of offence is likely to cause death, shall be punished with imprisonment of either description for a term which may extend to 3 years, or with fine, or with both. [1]

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Sharp weapons still stand as a very frequent cause of medico-legal deaths. The usual weapons for cutting and stabbing in today's era are knives, daggers, ice picks, hatchets and choppers. It has been observed that these weapons are used in enmity, robberies, and street-crimes, snatching especially in public transport and sometimes by the addicts. Such vicious means of deaths are indicative of extreme violence. [2]

Homicide is killing of a human being by another person. Homicides are of great concern all over world as they affect life and safety of the people. The frequency and the magnitude of such crimes induce a sense of insecurity and fear in the community. [3]

The pattern of homicides varies from country to country and is influenced by many factors which include method of killing depending on the availability of weapons as well as cultural influences which include family relationships, religious attitudes, criminal activity, drug culture, alcoholism and social, moral and political factors. Although the methodology of homicide differs from country to country, the pattern of homicide in any particular geographical area is surprisingly stereotyped.

For example in the United States, firearms are the most common weapons of assault. This is in contrast with South Asian countries like India where the most preferred choices are by means of inflicting blunt and sharp force trauma. [4]

There is an association between the weapon used and the fatal injury inflicted on the

body. [5] Assailants usually select a part of the body where the maximum damage can be inflicted with minimum effort and the outcome of the attempt depends on a number of factors e.g. type of weapon used, target site on the body, number blows, fitness of the victim etc. [6]

This study was conducted with the aim to highlight the weapons examined and their association with fatal injury inflicted on the body in fatal cases of assault autopsied at Victoria hospital Bengaluru.

Materials and Methods:

A cross sectional study of a total of 43 fatal cases of assault was conducted in the Department of Forensic Medicine, Victoria Hospital, Bengaluru over a period of one year from Jan 2010 to Dec 2010. The data was collected from the information furnished by deceased relatives and police; post-mortem examination and weapons brought by concerned police for examination. The data was analysed using descriptive statistics.

Observations and Results:

In this one year study total number of fatal cases of assault was 43 and total number of weapons used by assailants in these cases was 130. Single weapon was commonly used in 20 (46.51%) cases of assault followed by two and three weapons in six (13.95%) cases in our study. (Fig. 1)

Our study showed that single assailant was involved in 12 cases (27.9%) where they all used single weapon to inflict the injuries and more than five assailants were involved in 6 six cases (13.95%), among them; more than five weapons were used in 4 (9.3%) cases. But number of assailants was not known in 8 cases (18.6%). (Table 1)

Weapons were classified conventionally as light, moderate and heavy based on their weight. If the weight of the weapon was less than 0.1 kg, it was considered as light and if the weight of weapon was more than 0.5 kg, it was considered as heavy weapon.

Similarly if weight of the weapon was >0.1kg and <0.5kg, it was considered as moderate. In this study sharp weapons (84.5%) were commonly used in assault cases followed by blunt weapons (18.5%). Among sharp weapons, heavy sharp weapons (64.6%) were commonly used. (Table 2) Total 130 weapons were examined which were used in fatal assault cases. Among them, choppers (41%) were most commonly used weapon in infliction of injuries followed by knife (28%). (Fig. 2)

Our study showed that chop injuries (n=191) were the common injuries observed in

cases of fatal assault followed by stab injuries (n=112). Contusions (n=24) were least commonly found in assault cases. (Fig. 3) It was observed from this study that overall face (67.44%) was most commonly injured followed by front of chest 27(62.79%). When blunt weapon was used; face (20.93%) was commonly targeted.

When Sharp weapon was used, front of chest was targeted. Among sharp weapons, when light cutting weapon was used, front of chest was commonly injured but when heavy cutting weapon was used, head was commonly injured. (Table 4)

Discussion:

In total 43 cases of fatal assault, single weapon was commonly used in 46.51% cases which is similar to study by Subba SH et al [7] (94.2%). This observation can be explained that the number of weapons used by assailant(s) depends on availability of weapons and mind set of assailant(s).

In total 43 cases of fatal assault, single assailant was involved in 27.9% where they all used single weapon to inflict the injuries. More than 5 assailants were in 13.95%; among them, more than 5 weapons were used in 9.3% cases.

This observation could be due to variation in availability of weapons, motive, and circumstances of assault. Sharp weapons (84.5%) were commonly used in assault cases followed by blunt weapons (18.5%).

Among sharp weapons, heavy sharp weapons (64.6%) were commonly used. Our study findings were similar to observations by Shivakumar BC et al [8] (50%, 30%), Vij A et al [4] (49.4%, 34.8%), Mohanty S et al [9] (36.6%, 24.4%) Hugar BS et al [10] (33.25%, 28%) that sharp weapons were commonly used followed by blunt weapons in fatal assault injuries.

On the other hand, blunts weapons were commonly used than sharp weapons in studies conducted by Oberoi SS et al [11] (52.5%, 25%), Gupta S et al [12] (42.49%, 33.68%), Buchade D et al [13] (37.2%, 32.8%), and Rastogi AK et al [14] (31.75%, 21.96%).

This can be explained that type of weapons used in fatal assault cases depends upon availability of weapon, mind set of assailant, criminal activity, drug culture, alcoholism and social, moral and political factors. Out of 130 weapons examined, choppers (41%) were most commonly used weapon by assailants in infliction of injuries followed by knife (28%) whereas wooden sticks were commonly used in study by Subba SH et al. [7] Chop injuries (n=191) were the common

injuries observed in cases of fatal assault followed by stab injuries (n=112).

Contusions (n=24) were least commonly found in assault cases. This observation is consistent with common use of choppers followed by knife by assailants to inflict injury.

Overall face (67.44%) was most commonly injured followed by front of chest (62.79%). When blunt weapon was used; face (20.93%) was commonly targeted. When Sharp weapon was used, front of chest was targeted. Among sharp weapons, when light cutting weapon was used, front of chest was commonly injured but when heavy cutting weapon was used, head was commonly injured.

In contrast to this, Mohanty MK et al [5] observed that when the blunt objects were used, the head was the usual target and if a sharp object was used both head and abdominal regions were commonly involved.

This could be due to number of factors e.g. type of weapon used, position of victim as well as assailant, target site on the body, number blows, defence by victim etc.

Different perpetrators may execute multiple injuries on different body parts; in such cases it is prime responsibility of forensic pathologist to determine the fatal or non-fatal component of the injury. Such findings are useful in the court of law while deciding punishment or penalty for various offenders in particular case of homicidal death. [12]

A blow with a weapon having a flat surface will produce less severe injury than that due narrow object, because of diffusion of energy over a larger area. If a blow is struck with a weapon having a projecting object, a much more severe wound is caused as all of the force will be delivered to the end of the projection.

A blow to a rounded portion of the body, such as the top of the head will produce a more severe wound than the back same force delivered to a flat portion of the body, such as the back, where the force is dissipated because of contact with a larger area. [15]

Conclusion:

Single weapon was commonly used in fatal cases of assault. Sharp heavy weapons like choppers were commonly used in assault cases. When blunt weapon was used; face (20.93%) was commonly targeted and when sharp weapon was used, front of chest was targeted.

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Fig. 1: Weapons Used in Fatal Assaults Cases

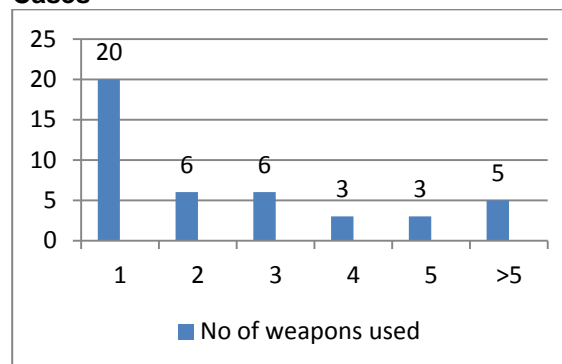


Fig. 2: Type of Weapons Used by Assailants

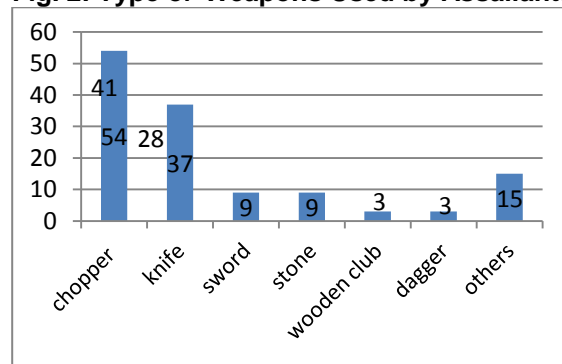
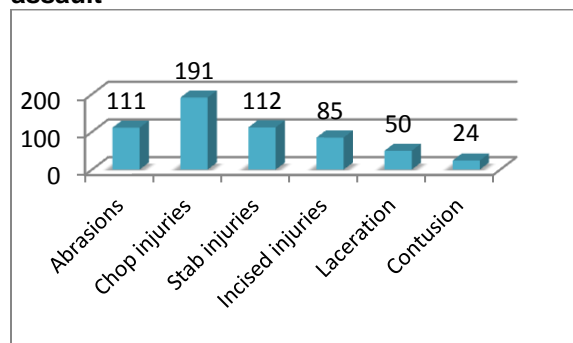


Fig. 3: Injuries inflicted on the victim of assault**Table 2: Kind of Weapons**

Weapon	Frequency(n=130)	(%)
Sharp	106	81.5
Light	22	16.9
Single edge	16	12.3
Double edge	6	4.6%
Heavy	84	64.6
Blunt	24	18.5
Light	2	1.5
Narrow surface	0	0
Broad surface	2	1.5
Heavy	22	16.9
Narrow surface	18	13.84
Broad surface	4	3

Table 1
Number of Assailants and Weapons Used in Fatal Assaults Cases

Number of Assailant	Number of Weapons						Total (%)
	One (%)	Two (%)	Three (%)	Four (%)	Five (%)	More than five (%)	
Unknown	4(9.3)	3(7)	0(0)	0(0)	0(0)	1(2.3)	8(18.6)
1	12(27.9)	0(0)	0(0)	0(0)	0(0)	0(0)	12(27.9)
2	2(4.65)	2(4.65)	0(0)	1(2.32)	0(0)	0(0)	5(11.6)
3	1(2.32)	0(0)	5(11.6)	0(0)	0(0)	0(0)	6(14)
4	1(2.32)	1(2.32)	0(0)	2(4.65)	0(0)	0(0)	4(9.3)
5	0(0)	0(0)	0(0)	0(0)	2(4.65)	0(0)	2(4.65)
>5	0(0)	0(0)	1(2.32)	0(0)	1(2.32)	4(9.3)	6(14)
Total	20(46.5)	6(14)	6(14)	3(7)	3(7)	5(11.6)	43(100)

Table 3
Kind of Weapon and Site of Injury

Site of Injury	Blunt (%)	Sharp (%)	Light (%)	Heavy (%)	Total (%)
Head	8(18.6)	15(34.88)	7(16.27)	8(18.6)	23(53.4)
Face	9(20.93)	20(46.51)	13(30.23)	7(16.27)	29(67.44)
Neck	2(4.65)	18(41.86)	13(30.23)	5(11.62)	20(46.51)
Front of Chest	3(6.97)	24(55.81)	17(39.95)	7(16.27)	27(62.79)
Back of Chest	1(2.32)	5(11.62)	5(11.62)	1(2.32)	6(13.95)
Front of Abdomen	1(2.32)	16(37.2)	12(27.9)	4(9.3)	17(39.53)
Back of Abdomen	0(0)	5(11.62)	3(6.97)	2(4.65)	5(11.62)
Lower limb	2(4.65)	12(27.9)	10(23.25)	2(4.65)	14(32.55)
Upper limb	4(9.3)	20(46.51)	13(30.23)	7(16.27)	24(55.81)
External Genitalia	0(0)	1(2.32)	1(2.32)	0(0)	1(2.32)
Axilla	0(0)	4(9.3)	3(6.97)	1(2.32)	4(9.30)

Original Research Paper

Determination of Time Elapsed since Death from Changes in Morphology of Red blood cells in Ranchi, Jharkhand

¹Binay Kumar, ²Tulsi Mahto, ³Vinita Kumari**Abstract**

Determination of 'time elapsed since death' (TSD) is one of the important content of the post-mortem report. Although the changes in morphology of red blood cells are variable, depending on different factors like other parameters used for the purpose of determination of time since death but it is less variable as compared to others. The study sample comprised of 150 medico-legal autopsies conducted in the department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand during June 2006 to September 2007. In present series of studies in majority of cases the shape of RBCs became dimorphic, and peripheral area became pale in 12 to 24 hrs after death. In 18 to 36 Hrs normal central pallor lost and 24 to 48 Hrs majority of RBC lysed.

Key Words: RBC, Dysmorphic, Central pallor, Periphery pale, Time Elapsed since Death (TSD)

Introduction:

Determination of 'time elapsed since death' (TSD) helps in the investigation of complex and mysterious cases to unearth the truth for the administration of justice in many ways. In general, determining the time of death is extremely difficult, and accuracy is almost impossible. Although by careful study of different macroscopic, microscopic, chemical and biological parameters, the TSD can be determined in considerably narrow range.

Irreversible changes occur in the RBCs in the internal environment due to non-availability of oxygen, accumulation of carbon dioxide, pH change and accumulation of toxic products. [1] The changes in morphology of red blood cells (RBC) are also variable depending on different factors, like other parameters used for the purpose of determination of TSD but it is less variable as compared to others.

Materials and Methods:

The study sample comprised of 150 medico-legal cases for autopsies conducted in the department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, during June 2006 to September 2007.

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Only those cases whose TSD were known by relatives, police or doctors and verified by other post-mortem changes, were included in this study. Blood samples were collected from heart chambers and slides were prepared on spot at the time of autopsy. Slides were stained by Leishman's stain and examined under light microscope.

The study was based upon variation in:

1. **Red Blood Cells:** Morphology of red blood cells (RBC) was noted in following manner:
 - a. **Integrity:** Intact, Mixture of intact & lysed, and Lysed & not recognizable
 - b. **Shape:** Intact, Slightly dysmorphic and grossly Dysmorphic
 - c. **Central Pallor:** Intact, Reduced and Lost
 - d. **Periphery:** Red and Pale

For the purpose of classifying the observation systematically, the dead bodies were grouped in the following manner based on the known time elapsed since death:

Group	Time elapsed since death
I	0—03Hrs
II	06—12 Hrs
III	12—18 Hrs
IV	18—24 Hrs
V	24—36 Hrs
VI	36—48 Hrs
VII	>48 Hrs

Inclusion Criteria:

- When TSD was known by the relatives, police or doctors
- When it is verified by other post-mortem changes

Exclusion Criteria:

- a. Body was grossly affected with septicemia.
- b. Anaemia

- c. Nutritional deficiency
- d. Malignancy of blood
- e. Blood disorder.
- f. Charred body

Observations:

a. Integrity

In all cases examined up to 12 hours after death the RBCs were found to be intact, where as in between 12 hours to 18 hours after death in 94.7% cases cells were intact and in 5.3 % cases the mixture of intact and lysed RBCs was found in the slides.

In the cases examined in between 18 hours to 24 hours after death in 58.8% cases cells were intact whereas in 41.2% cases the mixture of intact and lysed RBCs was found.

Among the cases examined between 24 hours to 36 hours after death in 55.6% slides mixture of intact and lysed RBCs and in 33.3 % slides all cells were found lysed & unrecognizable.

In between 36 hours to 48 hours after death in 16.7% cases mixture of intact and lysed RBCs was present where as in 83.3% RBCs were completely lysed & unrecognizable. No RBCs was found intact after 48 hours of death.

b. Shape

Out of three cases examined in first 3 hours of death the shape of the RBCs was found to be normal in all cases.

Among the cases examined during 3 hours to 6 hours after death RBCs were normal in 38.9% cases slightly dysmorphic in 61.1% cases where as in the cases examined in between 6 hours to 12 hours after death RBCs were found normal in 7.1% cases, slightly dysmorphic in 60.7% cases and grossly dysmorphic in 32.2% cases.

In between 12 hours to 18 hours after death in 12.5% cases RBCs were slightly dysmorphic and in 87.5 % cases it was found grossly dysmorphic where as it was found to be grossly dysmorphic in all cases examine during 18 to 24 hours after death.

In the cases examined during 24 hours to 36 hours after death RBCs were found to be grossly dysmorphic in 55.6% cases, mixture of dysmorphic and lysed in 11.1% cases and they were completely lysed & unrecognizable in 33.3% cases.

Among the cases examined between 36 hours to 48 hours after death mixture of dysmorphic and lysed RBCs were found in 16.7 % slides and it was completely lysed in 83.3% slides. Beyond this period cells were lysed in all the slides.

c. Central pallor

Within 6 hours after death central pallor of RBCs were normal in 81.8% cases, reduced in 18.2% cases.

In between 6 hours to 12 hours after death they were normal in 14.3% cases, reduced in 82.1% cases and lost in 3.6% cases where as in between 12 hours to 18 hours after death central pallor was reduced in 62.5% cases and lost in 37.5% cases.

The central pallor was reduced in 20.6% cases and lost in 79.4% cases examine during the 18 hours to 24 hours after death where as in between 24 to 36 hours after death it was reduced in 11.1% cases, lost in 55.6% cases and cells were found lysed in 33.3% cases.

Among the cases examined in between 36 to 48 hours central pallor was lost in 16.7% and cell were found lysed in 83.3%.

In all the cases examined beyond this period cells were found lysed.

d. Periphery of the cell

In the cases examined during first 6 hours after death periphery of the RBCs were found normally red in 90.9% case.

Among the cases examined during 6 hours to 12 hours after death the periphery of RBCs were found to be red in 64.3% and pale in 35.7% cases where as it was found red in 7.5% cases and pale in 92.5% cases during 12 to 18 hours after death.

In all slides examined in between 18 hours to 24 hours after death periphery of the cell was found to be pale.

Periphery of the RBCs were found to be pale in 66.7% and cells were lysed in 33.3% cases among the cases examined during 24 hours to 36 hours after death where as during 36 hours to 48 hours after death it was pale in 16.7% and cells were found to be lysed in 83.3% cases.

Discussion:

Rajesh Bardale observed RBC identifiable up to 18 Hrs postmortem. [2]

Penttila A, Lahio K states that when corpses were kept at +4°C the red cells were quite rapidly transformed from discoid configuration to crumbled discs, echinocytes and spherocytes, but no debris or burst cell configurations were seen. [3]

Besides the red blood cells many workers has worked on other different type of cells. H Dokgoz et al found that eosinophils and monocyte were identifiable up to 72 Hrs, neutrophils up to 96 Hrs and lymphocytes up to 120 Hrs after death in non-refrigerated cadavers. [4] Rajesh Bardale states that he had not found morphology of any cell identifiable

beyond 30 Hrs contrary to other studies. [1, 2, 4] The reason might be that degenerative cellular changes occur earlier and more rapidly in cadaveric blood than in vitro blood of controls [1, 2, 4, 5] or might be attributable to environmental and temperature difference. [2, 3]

Plat et al studied cerebrospinal fluid cells where they found that if the postmortem duration is greater than 12 hour, the cells become vacuolated and cannot be identified. [6]

Wylar D et al states that the post-mortem cell count in cerebrospinal fluid correlates to the time after death and can be described mathematically (Polynomial curve of third order). [7]

Conclusion:

From present study the changes in the morphology of red blood cells can be concluded. (Table A) It may prove helpful as supplementary procedure for estimating time since death. It is also a very simple procedure and interpretation of above mentioned findings is easy.

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Table A: Change in Morphology of RBC

Time since death	Changes in morphology of red blood cells
0—03 hrs	Integrity - intact Shape - normal Central pallor - intact Periphery - red
03—06 Hrs	Integrity - intact Shape - slightly dysmorphic Central pallor - intact Periphery - red
06—12 Hrs	Integrity - intact Shape - slightly dysmorphic Central pallor - reduced Periphery - red
12—18 Hrs	Integrity - intact Shape - grossly dysmorphic Central pallor - reduced Periphery - red
18—24 Hrs	Integrity - intact Shape - grossly dysmorphic Central pallor - lost Periphery - pale
24—36 Hrs	Integrity - mixture of lysed and intact RBCs Shape - grossly dysmorphic Central pallor - lost Periphery - pale
36—48 Hrs	Completely lysed and not recognizable in majority of cases.
> 48 Hrs	Completely lysed and not recognizable in all cases.

Table 1
Integrity of RBCs in Different Time Intervals

TSD (Hrs.)	RBC intact	RBC intact and lysed mixed	RBC lysed & Not recognizable	Total
0—6	22 (100%)	0	0	22
6—12	28 (100%)	0	0	28
12—18	38 (94.7%)	2 (5.3%)	0	40
18—24	20 (58.8%)	14 (41.2%)	0	34
24—36	1 (11.1%)	5 (55.6%)	3 (33.3%)	9
36—48	0	1 (16.7%)	5 (83.3%)	6
>48	0	0	11 (100%)	11
Total				150

Table 2
Shape of RBCs in Different Post-mortem Interval

TSD (Hrs.)	RBCs normal	RBCs slightly dysmorphic	RBCs grossly dysmorphic	RBCs mixture of dysmorphic and lysed	RBCs lysed & unrecognizable	Total
0—3	3 (100%)	0	0	0	0	3
3—6	7 (38.9%)	11 (61.1%)	0	0	0	19
6—12	2 (7.1)	17 (60.7%)	9 (32.2%)	0	0	28
12—18	0	5 (12.5%)	35 (87.5%)	0	0	40
18—24	0	0	34 (100%)	0	0	34
24—36	0	0	5 (55.6%)	1 (11.1%)	3 (33.3%)	9
36—48	0	0	0	1 (16.7%)	5 (83.3%)	6
>48	0	0	0	0	11 (100%)	11
Total						150

Table 3
Central pallor of RBCs in Different Post-mortem Interval

TSD (Hrs.)	Central pallor normal	Central pallor reduced	Central pallor lost	Cells lysed	Total
0—6	18 (81.8%)	4 (18.2%)	0		22
6—12	4 (14.3%)	23 (82.1%)	1 (3.6%)	0	28
12—18	0	25 (62.5%)	15 (37.5%)	0	40
18—24	0	7(20.6%)	27 (79.4%)	0	34
24—36	0	1 (11.1%)	5 (55.6%)	3 (33.3%)	9
36—48	0	0	1 (16.7%)	5 (83.3%)	6
>48	0	0	0	11 (100%)	11
Total					150

Table 4
Periphery RBCs in Different Post-mortem Interval

TSD (Hrs.)	Periphery red	Periphery pale	Cells lysed	Total
0—6	20 (90.9%)	2 (9.1%)	0	22
6—12	18 (64.3%)	10 (35.7%)	0	28
12—18	3 (7.5%)	37 (92.5%)	0	40
18—24	0	34 (100%)	0	34
24—36	0	6 (66.7%)	3 (33.3%)	9
36—48	0	1 (16.7%)	5 (83.3%)	6
>48	0	0	11 (100%)	11
Total				150

Original Research Paper

Alcohol in Teenagers of Amritsar District: A KAP Study

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Abstract

Today alcohol is widely available and aggressively promoted throughout society. And alcohol use continues to be regarded as normal part of growing up. Yet underage drinking is dangerous not only for the drinkers but also for society as evident by the number of alcohol involved motor vehicle crashes, homicides, suicides and other injuries. As children move from adolescence to young adulthood, they encounter dramatic physical, emotional and lifestyle changes. They are at the threshold of adolescence and ready to step into adult role. They follow their peers and mimic their parents ultimately forming their own opinions. Experimentation with new things and ideas is the new mantra for living their lives. For some teens thrill seeking might include experimenting with alcohol. An adolescent who expects drinking to be a pleasurable experience is more likely to drink than one who does not. In the present study we have tried to assess the knowledge, attitude and practices regarding alcohol in the students belonging to age group 17- 20years.

Key Words: Adolescent, Underage, Drinking, Knowledge, Opinion

Introduction:

Adolescence is an age of visuals and impressions. They are at the threshold of being called adults legally and at the same time are being treated as immature kids. Confusion leads to chaos which is the scenario these young adolescents have to handle.

They see their parents and their peers ultimately forming impressions that if it is right for them it is good for them too. Adolescence is marked by considerable existential conflicts as well as exposure and vulnerability to substance abuse. The legal age for drinking in India varies from 21 to 25 years but the recent studies have been proving that wrong.

Alcohol is a group of chemicals which are found in wide variety of products such as mouth washes, deodorants, body cleansers and beer, wine and spirits. There are four groups of alcohols namely:

1. Grain alcohol
2. Aromatic alcohol
3. Denatured alcohol
4. Fatty alcohol

Grain alcohol also known as ethanol is made from fermentation of sugars and starches and is the type found in beer, wine and spirits.

Rest three types are used in health products or cosmetics. Alcohol abuse and alcohol dependence are not only adult problems but they also affect a significant number of adolescents and young adults between the ages of 12 and 20 even though drinking under the age of 21 is illegal. Majority of the people who consume alcohol view it as a means of unwinding after a long hard day at work or as a social drink. It is a common thought that alcohol helps us to relax.

It gives us confidence in unfamiliar situations and enables us to interact with others or is a means of celebrating an occasion. Even in small amounts, alcohol use has a number of consequences, such as risky sexual behaviour, increased suicide rate, violence, juvenile delinquency, familial conflicts, conflicts with friends, a greater risk of accidents and illicit drug use and is therefore considered a serious public health problem. [1-6]

Alcohol is the only psychotropic drug accepted and even encouraged by society, which allows early contact (even prior to 11 years of age) and increases the risk of future dependence. [7-9]

Materials and Methods:

A pretested proforma to assess the knowledge, attitude and practices regarding alcohol in the young adults of Amritsar region was administered to 300 students who were freshly enrolled into courses in Sri Guru Ram

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Dass Institute of Medical Sciences & Research, Engineering College running under the aegis of Global Institute & DAV College Amritsar. The students were informed about the purpose of study & their consent was taken after assuring them full confidentiality.

Aim and Objectives:

1. To study the knowledge and attitude regarding safe limits and practices about alcohol consumption in adolescents in the age group 17-20 years.

Observations and Discussion:

In the present study, 154(59.3%) students were males belonging to 17-19 years of age group while 106 (40.7%) students were females. Out of 40 students in the age group of 20-22 years, 19 (47.5%) were males and 21(52.5%) were females. (Table 1)

Out of the total 300 adolescents studied, 95 (31.6%) had consumed alcohol while 205 (68.3%) had not consumed alcohol. (Table 2)

In this study from the total of 95 who had consumed alcohol, 76.9% of adolescents had consumed alcohol on occasions such as weddings, farewell parties or birthday's etc. while 23.1% consumed it twice a week regularly. (Table 3) Our study showed that in the majority of cases, 53 (55.7%) said they were initiated into drinking by friends followed by cousins 17 (17.8%) while 16.8% of the teenagers studied had started on their own and 4% had been initiated by their fathers. (Table 4)

In this study 91.3% of the adolescents did not know about the quantity permissible for driving while only 2% had the knowledge and 6.7% gave incorrect answer. (Table 5)

To assess the knowledge and attitude regarding alcohol, students were asked their opinion regarding whether they considered alcohol to be addictive, whether it is beneficial for health and whether it is acceptable if females consume alcohol.

About 53.6% of the teenagers were of the view that alcohol is addictive. 76.6% of the students were of the opinion that consuming alcohol is not good for health while 23.4% actually considered it healthy. 85% of the teenagers considered it a wrong practice for the girls to consume alcohol while only 15% of them considered it acceptable.

In Portugal, approximately 50% of adolescents report having experimented with alcohol. Studies carried out in Brazil report prevalence values of alcohol experimentation ranging from 48.3 to 71.4% in adolescence, as well as a 27.3% frequency of regular use, 22.1% frequency of drunkenness at some time in life

and 8.9% frequency of heavy use. [10] In the United States, it is estimated that 4.6% of adolescents between 12 and 17 years of age have a dependence on alcohol. [11]

In a study done by social development foundation of the Associated Chambers of Commerce & Industry in India, 45% of intermediate students in metropolitan cities consumed alcohol excessively at least 5-6 times a month. The study surveyed over 2000 teenagers revealed that liquor consumption was most prevalent in Delhi & Mumbai followed by Chandigarh and Hyderabad.

The surveyed adolescents said that they took to drinking out of peer pressure. Others said they resorted to alcohol as they felt it distracted them from day to day problems.

Over 32% admitted to drinking when they were upset and 18% said they drank when alone. About 15% said they drank when they were bored while 45% consumed alcohol to get high. About 70% teens consumed alcohol at birthday parties, farewells and other such occasions. [12]

Conclusion:

From the above observations it is established that though there has been an exponential increase in the students or teenagers who start consuming alcohol at a tender age they are very much lagging behind in their knowledge about alcohol, its safe limits and attitude. Peer pressure and family environment certainly plays a very important role in determining the inclination, initiation and practices towards alcohol consumption.

These days road rage, zero tolerance towards each other and modern stresses have turned the youth towards habit forming drugs and drinks. This has further led to increase in drunken driving accidents. Rave parties where drugs and booze are served freely with no regard to the age of the consumer are now a commonly heard and read feature.

Lack of parental support, monitoring and communication has been significantly related to frequency of drinking. Parent's drinking behaviour and favourable attitudes about drinking have been positively associated with adolescents initiating and continuing drinking.

Children who were warned about alcohol by their parents and children who reported being closer to their parents were less likely to start drinking. Harsh inconsistent discipline and hostility or rejection towards children has also been found to significantly predict adolescent drinking.

Peer drinking and peer acceptance of drinking has also been associated. Alcohol consumption among teenagers in the age group of 15-19 years has increased due to absent parents, easy money and rising stress and depression. Support from one's family, school and society is essential to combating early alcohol use and its consequences.

There is need for educational and preventive programmes at individual, social and family level to tackle the growing menace of alcohol and substance abuse if we want to save our coming generations.

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Table 1: Distribution of Students According To Age and Sex

Age group (years)	Males (%)	Females (%)	Total (%)
17-19	154 (59.3)	106 (40.7)	260(86.6)
20-22	19 (47.5)	21 (52.5)	40 (13.4)
Total	173 (58.7)	127 (42.3)	300 (100)

Table 2: According to Percentage of Students who have Consumed Alcohol

S. N.		Students	Percentage
1	Consumed alcohol	95	31.6%
2	Not Consumed Alcohol	205	68.33%
3	Total	300	100%

Table 3: According to Frequency of Consumption

S. N.	Frequency	Students	Percentage
1	On occasions	73	76.8%
2	Twice a week	22	23.1%
3	Total	95	100%

Table 4: According to Initiator of Alcohol to Them

S. N.	Initiator	Case	Percentage
1.	Cousins	17	17.8%
2.	Friends	53	55.7%
3.	Father	04	4%
4	Self	16	16.8%

Table 5: According to Knowledge Regarding Legal Permissible Limit of Alcohol

Knowledge Regarding Legal Permissible Limit	Students (%)
Know correctly	6(2.0)
Incorrect knowledge	20(6.6)
Do not know	274(91.3)
Total	300(100)

Table 6: According to Opinion about Alcohol Consumption

S. N.	Opinion about Alcohol Consumption	Students (%)
1	Addictive	161(53.6)
2	Good for health	70(23.3)
3	Acceptable for girls to drink	45(15)

Original Research Paper

Profile of Acute Poisoning In Paediatric Age In District Moradabad: A Hospital Based Study

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Abstract

Rapid socioeconomic development in India during the last decade may have led to changes in the profile of child hood poisoning. To determine the profile and outcome of acute poisoning in paediatric patients presenting to the tertiary care centre in Moradabad we retrospectively analysed the children admitted to the ward of TMMC & RC and district hospital of Moradabad. The median age of the children was 5.5 and standard deviation was 5.84 in the age range of 9 month to 17.5 years. Male: Female ratio was 1.3:1. 77.19% patients reached the hospital within six hour. Insecticides & Pesticides (55.04%), household cleaners (21.48%) and drugs (11.41%) were the most frequent implicated agents. Vomiting (63.75%) was the most common presenting symptom followed by altered sensorium (38.92). Almost two third (63.76%) were accidental in nature whereas (32.89%) was suicidal. Median duration of stay was 2 day with stay of 1-3 day commonest in 55.03% of cases. One twenty six (84.56 %) patients were discharged after the treatment. 10.73 % leaved against the medical advice and seven (4.71%) died during the treatment.

Key Words: Children, Poisoning, Insecticide, Suicidal, Accidental

Introduction:

Poisoning in children is an important health problem and is one of the common medical emergencies encountered in paediatric practice and is a worldwide problem. [1] It has significant cost in the form of financial as well as emotional and is largely an accidental in nature.

It has been identified as one of the major cause of childhood and adolescent hospital emergency presentations and admissions in most of the developed countries including the U.S, U.K & Australia. [2]

The studies done in the developed countries like U.S.A, U.K, Australia and European has variations according to the demography, cultural practices, education and socioeconomic status while the developing countries like India has few studies for the incidence and outcome of paediatric patient. Poisoning in children can be acute or chronic.

In acute poisoning symptoms suddenly appears soon after the ingestion, inhalation or after coming in contact with poisonous substance. In chronic poisoning symptoms develop gradually by exposure of poisonous substance and there is complete disappearance of symptoms on the removal of patients from surrounding. Acute childhood poisoning is an important cause of morbidity and mortality in children and can be significantly and effectively controlled by preventive measures.

Accidental poisoning is 12th leading cause of admission in the paediatric ward in India and accounts for 1% hospitalization. [3]

While the rate of childhood morbidity and mortality due to the infections is decreasing because of the universal immunization programme launched by the Government of India and also by the immunization done by the paediatricians in private practice, the rate of acute poisoning is almost the same because least attention is given by the family members.

The pattern of poisoning is related to the developmental stage of child and the accessibility of the poisonous substance.

Accidental poisoning is common in the preschool or toddler age group because the children up to this age have exploratory tendency for the substance by taking it into the mouth while the suicidal poisoning is due to arguments by parents or stress [4] in adolescent age group because they have access to the common household known poisonous substance

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kept in the house carelessly by the family members. It is preventable by putting the substance into the child proof bottles and packings [5] the measures yet to be taken by the developing countries like India.

Aims and Objectives:

- To determine the Clinico-epidemiological profile and outcome of acute childhood poisoning in Moradabad
- To find out different house hold agents involved in acute poisoning.

Material and Method:

The present retrospective study was conducted by Department of Forensic Medicine, T.M.M.C & R.C Moradabad. All children up to the age of 18 years admitted to the paediatric ward and emergency of T.M.M.C & R.C hospital and District hospital with history of acute poisoning due to ingestion of household poisonous substance from June 2012 to May 2014 were included in the study and there details were obtained from the medical records kept in the medical record section.

The cases of insect bite, animal bite, contact poisons, food poisoning, chronic poisoning and those having no signs and symptoms of poisoning were excluded from the study. Data regarding the age, sex, time of poison ingestion, aetiological agents, time of arrival at hospital, manner of poisoning and hospital outcome were entered in the predesigned Performa.

No toxicological analysis report was available for any patient and diagnosis was made on the basis of history, detailed clinical examination, investigations and general and specific management procedures were carried out accordingly and outcome was measured in terms of complete recovery and expiry.

The data was collected, analysed and presented in form of Table & Figures.

Observations and Result:

Total 9370 children of paediatric age group from one month to 18 year excluding the neonates were admitted in the paediatric ward of T.M.M.C & R.C hospital and district hospital of Moradabad. Out of these 149 were admitted for the acute intoxication with household poisonous substance. The incidence of poisoning is 1.6%.

Median age of children was 5.5 and standard deviation was 5.84 in the age range of 9 month to 17.5 years.

In this study age varies from less than one year to 18 years and peak incidence was observed in age group 1-6 year comprising 79 (53.02%) cases followed by 12-18 yrs which has 56 (37.59%) cases. (Table 1) Out of total 149

cases 85(57.07%) were male while 64(42.93%) were female. Thus male: female ratio of 1.3:1 was observed. (Table 1)

Present study showed that 66(44.30%) patients reached the hospital in 1-6 hrs followed by 49(32.89%) patients who arrived within 1 hr. Thus majority of the patients 115(77.19%) reached within 6 hrs for the treatment. (Table 2)

Majority of poisoning cases 82(55.04%) was due to insecticides and pesticides followed by house hold cleaners and detergents 32 (21.48%) cases. Drugs and kerosene were involved in 17(11.41%) and 8(5.36%) cases respectively.

Among insecticides organophosphates was most common agent responsible in 48(32.21%) cases followed by zinc phosphide 12(8.06%) cases. (Table 3)

In this present study vomiting was the most common presentation seen in 95(63.75%) cases followed by altered sensorium 58(38.92%) and then drooling of saliva from the mouth in 43(28.85%) cases.

Rest of the symptoms present in cases were convulsions 32(21.47%), odour of poisoning 29(19.46%), pain in abdomen 22(14.76%), diarrhoea 15(10.06%), blurred vision 10(6.71%) and cyanosis 9(6.04%). (Table 4) In our study accidental poisoning was commonest manner of poisoning seen in 95(63.76%) cases followed by suicidal 49(32.89%) and least was homicidal seen in 5(3.35%) cases. (Table 5)

Duration for which maximum patients were hospitalized was 1-3 days seen in 82(55.03%) cases followed by the 31(20.80%) patients who were discharged on same day. Mean duration of hospital stay was 2.92. Median duration was 2 day. (Table 6) Overall survival was seen in 126(84.56%) cases and the patients were discharged. Among the remaining 16(10.73%) cases leaved against medical advice and 7(4.71%) cases died in the hospital during the treatment. (Fig. 1)

Discussion:

Acute poisoning in children is significant cause of morbidity and mortality in paediatric age group in India and the incidence of poisoning in the present study was 1.3% which is similar to the study done by others. [6, 8, 12]

However the study done by Budhathoki S et al [13] showed the incidence of poisoning was 3.4% in paediatric admission and there is a variation from 0.33% to 7.6% of admissions in hospitals across India. [4] It suggested that the magnitude of the problem in Moradabad is more than the actual incidence due to under reporting

of cases. The reason behind this may be the treatment of accidental cases of poisoning in the private clinics and the hospitals.

Majority of the children 79 (53.02%) are in the age group of 1- 6 years of age and this is common finding in the other studies also [4, 6-10] but it is in contrast to the study done by Sharma J et al [12] where the most common age group is 11-18 years and Singh M et al [15] reported maximum incidence were above 5 years of age. This is due to the reason that children in this age group especially the toddler group or the preschool children are curious and they explore their world with all the senses including taste.

They keep each and every thing in mouth because of rapid neurological development and are unaware of consequences. Males outnumbered the females in the present study with the male: female ratio of 1.3:1 and is comparable with most of other studies. [4, 6-13]

Poisoning is more common in boys as compared to girls because males are more active, curious and adventurous by nature.

Most of the patients 115(77.19%) arrived within the six hours after ingestion of the poisonous substance. Singh S et al reported the average time of 6.77 hrs. [9] It was due to the availability of transportation facility and due to the better connectivity of rural and urban area by the roads. About 34(22.81%) cases get delayed and reached the hospital within 24 hrs and it may be due to ignorance by the parents or may be due to the late appearance of symptoms.

In the present study the maximum numbers of cases of poisoning are due to the pesticides & insecticides 82(55.04%) followed by house hold cleaners & detergents 32 (21.48%) and drugs 17(11.41%). The most common insecticide responsible was organophosphates and is consistent with other studies. [6, 12, 13]

Others were zinc phosphide, Organochlorine and Pyrethrins. Children are exposed to these compounds as these are available in different forms of agricultural and household insecticides and are kept carelessly in homes within the reach of children.

Studies done in earlier two decades by Indian authors [7, 8, 10] and other adjoining regions showed that kerosene was the most common poisoning agent accounting for 25-50% of cases. Kerosene poisoning 8(5.36%) is fourth most common cause in our study and the trend is decreasing as shown in the study done by Bhat N.K et al, Sharma J et al and Budhathoki S et al. [6, 12, 13] Kerosene is no longer used as a cooking fuel by the rural population and is also not available easily because of the distribution of

the LPG by the government and also due to the availability of LPG in the black market.

Toxicity by the drugs is also common in our country [4] as well as in the developed countries because the drugs which are used by the family members for the non-communicable diseases like diabetes, hypertension, insomnia, depression, epilepsy and general medicines for pain they are in easy reach of the child and also they are not kept in child proof packs and containers. Buch et al [14] reported the medicine to be the commonest substance for poisoning.

Vomiting was the most common clinical presentation observed in more than half 95(63.75%) cases. Similar finding was reported by other researchers. [6, 12, 13] Next common in decreasing order are altered sensorium 58(38.92%), drooling of saliva from the mouth 43(28.85%), convulsions 32(21.47%), odour of poisoning 29(19.46%), pain in abdomen 22(14.76%). This is because commonest poison was insecticide and pesticide.

In the present study majority of the 95(63.76%) cases were due to the accidental poisoning followed by suicidal 49(32.89%) cases and least was the homicidal poisoning seen in only 5(3.35%) cases. Accidental poisoning is commonest by insecticides in children of lower age groups because they explore the substance by taking it into mouth kept in the home within their reach.

Suicidal poisoning is common in adolescent age group [10, 11, 13] by house hold cleaners and drugs and are deliberately consumed to show the attempt of suicide due to the scolding by their parents, stress of performing better in studies and other personal matters. Homicidal poisoning may be due to drug overdose or may be a form of child abuse.

Average duration of stay in this study was 2.92 days. Duration of stay is similar to that observed by Tak et al and Gupta et al. [17, 18]

Overall survival in our study was seen in 126(84.56%) cases and the patients were discharged and 16(10.73%) cases leaved against medical advice Mortality was in 7(4.71%) cases. [12, 16] However Singh S et al [9], Budhathoki S et al [13] had reported the mortality rate of 12.5% and 12% respectively.

Reason for the low mortality is due to the timely admission in the hospital and proper care and treatment given in the hospital.

Conclusion:

Acute poisoning in the children is an important cause of morbidity and mortality along with other diseases of paediatric patients. The profile of poisoning in our study is almost similar

to the other hospital based studies done in other parts of the country. Due to rapid socioeconomic development of Moradabad, a district of western Uttar Pradesh in the last couple of decades and with the wider availability of LPG and lower availability of kerosene, the kerosene poisoning is decreased to the fourth common cause of childhood poisoning.

Incidence of suicidal poisoning is increasing in the teenagers either due to stress or due to the arguments by the parents and can be prevented by proper counselling.

Accidental poisoning can be reduced by simple measures like parental education, replacing the poisoning agent with one of lower toxicity, legislation regarding the child resistant packaging of necessary poisons.

Poison control centres should be established by tertiary care centres and numbers to be displayed for the first aid and referring more severe poisoning cases for treatment in hospital.

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Table 1: Age & Sex wise Distribution

Age grps (Yrs)	Male (%)	Female (%)	Total (%)
< 1	1 (0.67)	0 (0.00)	1 (0.67)
1- 6	55 (36.92)	24 (16.10)	79 (53.02)
6-12	7 (4.70)	6 (4.02)	13 (8.72)
12-18	22 (14.78)	34 (22.81)	56 (37.59)
Total	85 (57.07)	64 (42.93)	149 (100)

Table 2: Time between Ingestion and Arrival at Hospital

Time (hrs)	Cases (%)
< 1	49 (32.89)
1 – 6	66 (44.30)
6 – 24	34 (22.81)
Total	149 (100)

Table 3: Aetiological Agents Causing Poisoning in Children

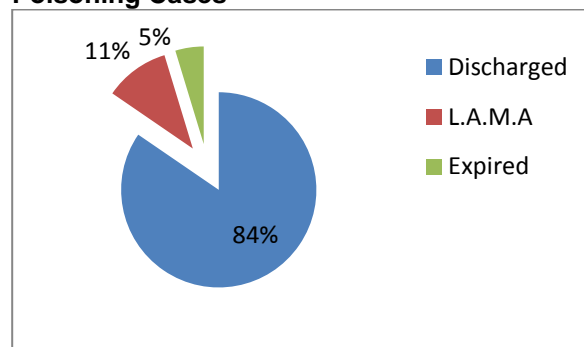
Poisons	Type of Poison	N	%
Insecticides & Pesticides		82	55.04
	Organophosphates	48	32.21
	Zinc Phosphide	12	8.06
	Pyrethrins	9	6.05
	Organochlorine	8	5.36
	Carbamates	5	3.36
Cleaners & Detergents		32	21.48
	Phenyl	18	12.08
	Bleaching Powder	6	4.03
	Acids	5	3.36
	Surf	3	2.01
Drugs		17	11.41
	Antidepressants	8	5.36
	Oral hypoglycaemic	4	2.69
	Anticonvulsants	2	1.35
	Antihistamines	1	0.67
	Antihypertensive	1	0.67
	Pain relievers	1	0.67
Kerosene		8	5.36
Plants		4	2.69
Naphthalene		3	2.01
Alcohols		2	1.34
Unknown		1	0.67
Total		149	100%

Table 4: Common Modes of Presentation with Poisoning

Symptoms	Cases	%
Vomiting	95	63.75
Altered sensorium/Unconsciousness	58	38.92
Drooling of Saliva	43	28.85
Convulsions	32	21.47
Odour of Poison	29	19.46
Pain in Abdomen	22	14.76
Diarrhoea	15	10.06
Blurred vision	10	6.71
Cyanosis	9	6.04
Headache	7	4.70
Fever	5	3.35
Hematemesis	5	3.35
Restlessness/Agitation	4	2.68
Respiratory Distress	2	1.34
Oliguria/Anuria	2	1.34
Red hot skin	1	0.67
Haematuria	1	0.67

Table 6: Duration of Stay in Hospital

Duration	Cases (%)
< 1 day	31 (20.80)
1 – 3 day	82 (55.03)
3 – 6 day	25 (16.77)
6 – 9 day	11 (7.40)

Fig. 1: Outcome after the Treatment of Poisoning Cases**Table 5
Manner of Poisoning by Various Agents**

Poison	Accidental	Suicidal	Homicidal	Total (%)
Insecticides & Pesticides	66	13	3	82 (55.03%)
Cleaners & Detergents	11	20	1	32 (21.47%)
Drugs	7	10	0	17 (11.40%)
Kerosene	6	2	0	8 (5.36%)
Plants	2	2	0	4 (2.68%)
Naphthalene	2	1	0	3 (2.01%)
Alcohols	1	1	0	2 (1.34%)
Unknown	0	0	1	1 (0.67%)
Total	95 (63.76%)	49 (32.89%)	5 (3.35%)	149 (100%)

Original Research Paper

Correlation of the Dimensions of Hand & Feet with Stature of an Individual: A Study on Central Indian Adults

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Abstract

Identification of Human remains is a crucial problem and is of utmost importance to Forensic experts. Human beings are considered bilaterally symmetrical. Prediction of stature can be given from long bone measurements with certain degree of accuracy. The present study was done to find out the correlation between the Hand length, breadth & Foot length to the stature of an individual and to arrive at a regression formula. The prospective study was carried out on 230 Students (120 Male & 110 Female) between the age group of 17-25 years studying in Medical & Dental College in Sawangi (Meghe) Wardha.

To avoid diurnal variations all the measurements were taken at a particular period of time. The students born & brought up in Central India only were included in the study. The dimension of the hand which was dominant was taken. There is a definite correlation between Stature & Dimensions of Hand and Foot as is derived from a regression formula which may help the forensic experts in estimating Stature in mutilated or fragmented bodies.

Key Words: Stature, Identification, Hand length, Foot length, Fragmented remains

Introduction:

Identification forms an integral part of investigations in cases of mass disasters like Bomb blasts, Plane crash, Stampede, Terrorist attacks and in bodies which are disintegrated or mutilated or amputated in the events of murders, accidents or natural calamities. [1-3] Various methods are in use for identification of an individual. Stature is one of the important parameters in identification and can be measured using various methods in fragmented bodies. [1, 4, 5]

Hand and Foot length has been found to have a correlation with the stature of an individual. There are many studies that have been undertaken to emphasise the importance of measuring the hand length as well as foot length to estimate stature. [2-4, 6-8]

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Stature which is primarily determined from body physique is known to be influenced by climatic, hereditary, nutritional & racial factors. [2, 4, 5, 8, 9]

The use of anthropometry in the field of Forensic Medicine dates back to 1882 when (Alphonso Bertillon) a French police expert invented a system of criminal identification. [3]

He suggested the use of bones for the various identification procedures. Since then anthropological assessments have formed an important aspect of Forensic investigations. Almost any or all the bones of the human body can be used for anthropometric studies and a close estimate of a persons' physique can be derived from the information derived.

The dimensions of the Hand & Feet also have a bearing on the estimation of stature of an individual. Though studies have also shown that dimensions of the Hands & Feet vary in different races and also with the dominance of the hand used, they can form a reliable source of data for a given geographical location. [5-7, 10, 11]

The variations in rate of growth in males and females during the course of development may be one area of difference; with ossification being complete and skeletal maturity attained by the age 25 years. [8]

Females tend to show higher growth rate during first half of second decade where as in males it is during the second half of second decade due to hormonal control. [8, 10] The present study is designed to correlate the stature

of an individual with hand dimensions and foot length in adult population (17-25 years of age group) of Central India in both the sexes. Rutishauser demonstrated for the first time that the reliability of prediction of height from foot length was as high as that from long bones.

Ossification and maturation occurs earlier in the long bones & therefore during adolescent age, stature can be accurately predicted from hand & foot measurements as compared to that of long bones. [11]

There is strong correlation between stature and Foot & Hand dimensions and if either of the measurements is known the other can be calculated. With this objective the present study was designed to correlate the Hand length, breadth & Foot length with Stature of an individual and to record the standard deviation in the estimation of Stature. Also to arrive at the linear regression formula & multiplication factor for estimation of Stature which can be applied to people in Central India.

Materials & Methods:

This prospective study was carried out in the Department of Forensic Medicine, JNMC, Sawangi (Meghe) Wardha over a period of 2 years. It included 230 normal healthy adult (120 males & 110 females) students admitted to Medical & Dental College, Wardha between the age group of 17-25 years.

Only those students who were born & brought up in Central India were included in the study. Students from other regions, NRI students, those with poorly defined wrist creases, deformities of vertebral column & limbs, and history of trauma were excluded from the study. [4] After obtaining informed written consent, physical parameters were recorded at a fixed time between 2:00-4:00 pm to eliminate diurnal variations. [7, 10, 11]

Height was measured from vertex to heel in upright position with Student standing bare foot with the help of Height weight machine Design no. 1013522, Instrument marked up to 200 cm, (Photo 1) Hand length was measured as distance from L1 & L2 from Proximal crease of Wrist to tip of Middle finger & Midpoint of interstyloid line to tip of Middle finger in mm. (Photo 2 & 3)

Hand breadth was measured as B1 & B2 from Radial side 2nd metacarpopharyngeal joint to ulnar side 5th metacarpopharyngeal joint and from 1st metacarpopharyngeal joint to base of 5th metacarpal in mm using Vernier Calliper. (Photo 4 & 5) Foot length was measured as distance between anterior & posterior point of foot in mm. (Photo 6) Correlation between hand

length, breadth and foot length with the stature of an individual was evaluated by obtaining linear regression equations & multiplication factors using SPSS 17.0 software and results were assessed statistically.

Observations and Results:

In our study a significant positive correlation is found between the dimensions of Hand i.e. Hand length at point 1 & 2, Hand breadth at point 1 & 2 and Foot length to that of the stature of an Individual. (Table 1, 2 & 3) with Foot length showing more correlation value of 0.83 followed by Hand breadth at point 2 (0.74) & at point 1 (0.69) & Hand length at point 2 (0.38) and at point 1 (0.35) respectively.

The gender wise comparison of all the dimensions shows higher values for male parameters as compared to females in estimating the stature from the dimensions of hand & Foot and shows a statistically significant Z value & P value. (Table 4 & Graph 4)

Discussion:

Height of an individual is an important parameter for identification in Forensic examinations. It is influenced by many factors like Nutrition, Environment, Genetics, Physical development, Gender, Muscular exercise, Age etc. Many studies have been carried out on different racial & regional groups which show there is a definite relationship between the stature and dimensions of hand and foot.

This has led many researchers to work on correlation of these parameters. This study was carried out to correlate the Hand & Foot dimensions to stature in Central Indian population. In the present study the mean stature is 165.02 & S.D is 8.41 which correspond with other studies done on Indian Population. [11, 14] The Mean hand length at point 1 & 2 is 171.13 and 182.17 respectively with S.D of 11.81 & 12.37. The mean hand breadth at point 1 & 2 is 68.04 & 79.82 and S.D of 6.47 & 8.19 respectively.

The mean of Foot length is 237.63 with S.D. of 16.66. The study shows that hand breadth is more accurate than the hand length in estimation of stature. The highest coefficient correlation of all dimensions is found in Foot length ($r=0.83$) followed by hand breadth at point 2 ($r=0.74$) followed by hand breadth at point 1 ($r=0.69$) subsequently followed by Hand length at point 2 ($r=0.38$) and hand length at point 1 ($r=0.35$).

These findings support the study carried out by Patel PN et al [2], Krishan & Sharma [5] where foot length shows more significant correlation to stature in people from Gujarat than

hand length & hand breadth; but P. Rastogi et al in their study on South Indian population [4] found that HL-2 shows highest correlation followed by HL-1 & HB.

The mean & Standard deviation for correlating the stature with the Length & Breadth of hand at point 1 & 2 respectively shows a strong correlation between Hand length, hand breadth & Foot length which is coinciding with the findings of other Researchers [1, 2, 3, 11, 12, and 14]. The linear regression formulae as given for the various dimensions is found to be significant in estimating the stature of an individual from hand length (HL), hand breadth (HB) and Foot length (FL) which is as follows-

- Height = $65.90 + 0.57 \times \text{Hand Length (Point 1) L1}$
- Height = $65.60 + 0.54 \times \text{Hand Length (Point 2) L2}$
- Height = $103.28 + 0.90 \times \text{Hand Breadth (Point 1) B1}$
- Height = $104.03 + 0.76 \times \text{Hand Breadth (Point 2) B2}$
- Height = $64.81 + 0.42 \times \text{Foot Length}$

The comparison between studies shows that regression equation using various anatomical dimensions of one population do not apply to another. [13] Mean hand length at point 1 for Male is 179.50 ± 8.55 and for Female it is 163.45 ± 8.80 . By using Z test for the difference between 2 means statistically significant difference is found with Z value-14 & p-value-0.000 showing high significance at point 1 in both Males & Females. Similarly it is significant for all the dimensions i.e. Hand breadth at point 1 & 2 and Foot length.

Conclusion:

The stature of an individual can be predicted if either of the dimension of Hand, i.e., length or breadth or Foot length is known and vice versa. Foot length is the most reliable predictor for estimating the stature of an Individual as observed in our study. It is an important feature of identification of an Individual. It will be of great help to the Anthropologists and Forensic experts.

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Photo 1: Measurement of Height & Foot



Photo 2: Measurement of Foot Length



Photo 3: Measurement of Hand Length (L1)

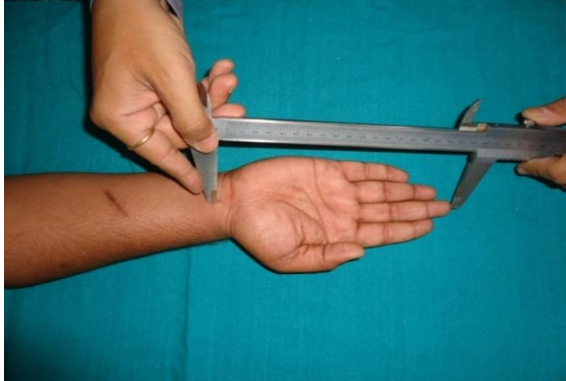


Photo 4: Measurement of Hand Length (L2)

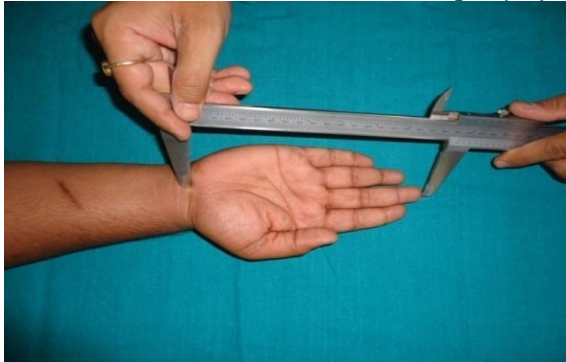


Photo 4: Measurement of Hand Breadth (B1)

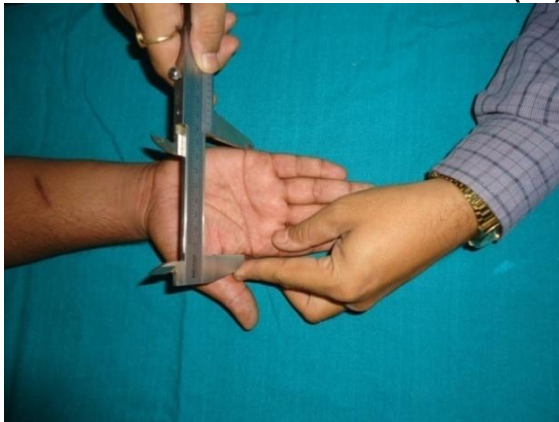
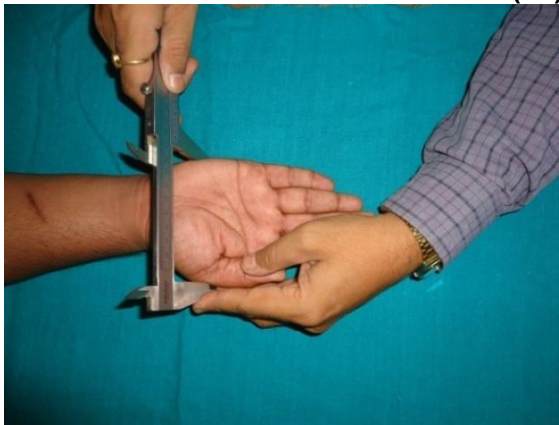
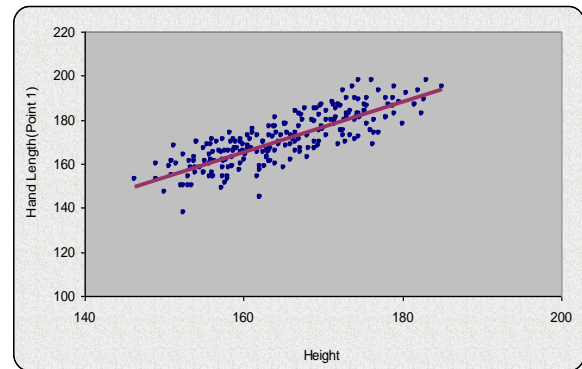


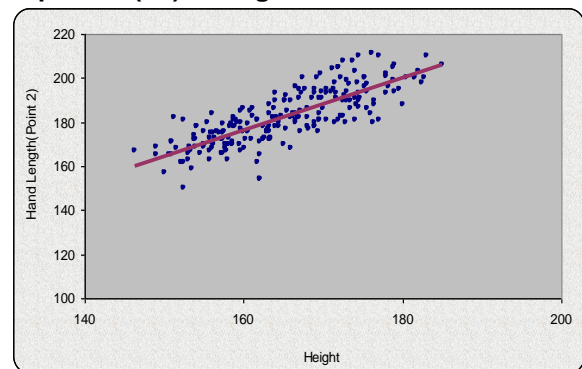
Photo 4: Measurement of Hand Breadth (B2)



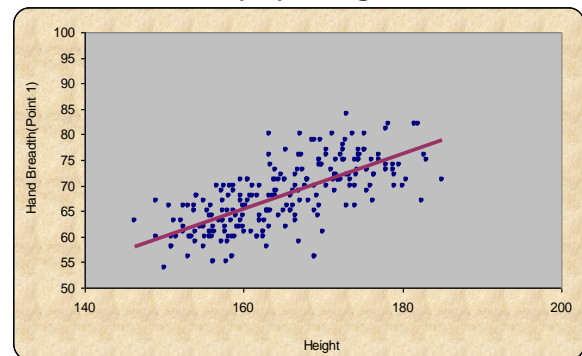
Graph 1.1: Correlation between Hand Length at point 1 (L1) & Height



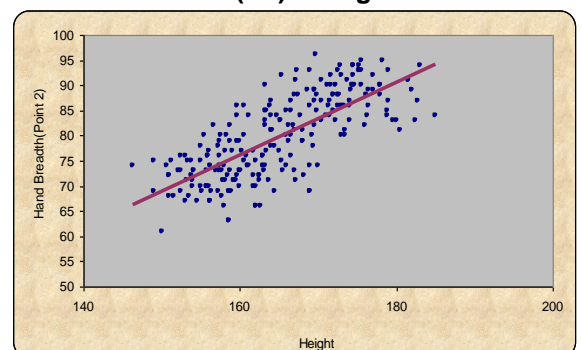
Graph 1.2: Correlation between Hand Length at point 2 (L2) & height

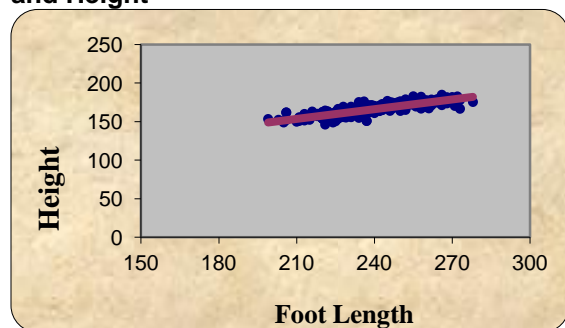


Graph 2.1: Correlation between Hand Breadth at Point 1(B1) &Height



Graph 2.2: Correlation between Hand Breadth at Point 2(B2) &Height



Graph 3: Correlation between Foot Length and Height**Table 1: Correlation between Hand Length and Height**

	Mean	SD	N	Correlation 'r'	p-value
Height	165.02	8.41	230	-	-
Hand Length – Point 1	171.13	11.81	230	0.35	0.000 S, p<0.05
Hand Length – Point 2	182.17	12.37	230	0.38	0.000 S, p<0.05

Line of Regression:

- Height = 65.90 + 0.57*Hand Length (Point 1) L1
- Height = 65.60 + 0.54*Hand Length (Point 2) L2

Table 2: Correlation between Hand Breadth and Height

	Mean	Std. Deviation	N	Correlation 'r'	p-value
Height	165.02	8.41	230	-	-
Hand Breadth – Point 1	68.04	6.47	230	0.69	0.000 S, p<0.05
Hand Breadth – Point 2	79.82	8.19	230	0.74	0.000 S, p<0.05

Line of Regression:

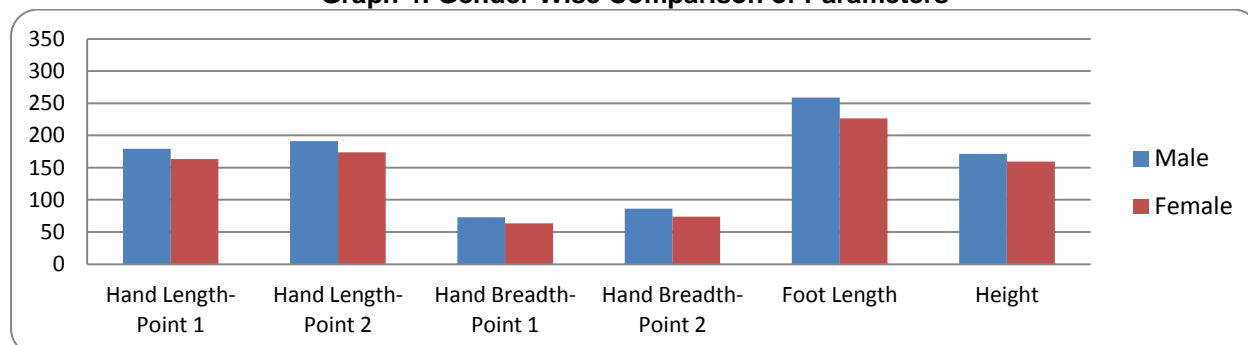
- Height = 103.28 + 0.90*Hand Breadth (Point 1) B1
- Height = 104.03 + 0.76*Hand Breadth (Point 2) B2

Table 3: Correlation between Foot Length and Height

	Mean	SD	N	Correlation 'r'	p-value
Foot Length	237.63	16.66	230	-	-
Height	165.02	8.41	230	0.83	0.0 S, p<0.05

Line of Regression: Height = 64.81 + 0.42*Foot Length**Table 4: Gender Wise Comparison of Parameters**

	Male	Female	z-value	p-value
Hand Length- Point 1	179.50±8.55	163.45±8.80	14.00	0.000,S, p<0.05
Hand Length-Point 2	191.10±9.21	174±8.70	14.43	0.000,S, p<0.05
Hand Breadth-Point 1	73.06±4.28	63.45±4.39	16.78	0.000,S, p<0.05
Hand Breadth-Point 2	86.45±5.09	73.74±5.24	18.64	0.000,S, p<0.05
Foot Length	258.62±70.30	226.72±11.14	4.70	0.000,S, p<0.05
Height	171.12±6.26	159.43±5.87	14.59	0.000,S, p<0.05

Graph 4: Gender Wise Comparison of Parameters

Original Research Paper

Study of Poisoning Cases in an Indian Tertiary Care Teaching Hospital

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Abstract

Morbidity and mortality as a result of poisoning, is a raging problem worldwide. The poignant part of the problem is that these are mostly preventable, if a basic treatment infrastructure facility is available with immediate accessibility. The present study was conducted from August 2013 to January 2014 in IMS & SUM Hospital, a tertiary care teaching hospital at Bhubaneswar, Odisha, India. In this prospective study we analyze, the various factors that play a role in the poisoning cases and the treatment outcome along with attempts to find solutions to prevent such tragic deaths and morbidity, in this part of the country. In this study incidence of poisoning cases are 40% out of all medico-legal cases registered. Most of the poisoning cases are males, aged between 20 to 30 years and unmarried. Suicide is the most common manner of poisoning. Home is the most suitable site for poisoning, followed by work place and remote place. Insecticides are the most common poison encountered in this region, followed by snake bite. Majority of the patients presented to the hospital within four hours of poisoning and most of them were completely cured after the treatment.

Key Words: Morbidity, Mortality, Poisoning, Treatment outcome, Solutions

Introduction:

Poison is any substance which if introduced in the living body by any route could cause ill health or death. Poisoning both accidental and intentional is a significant contributor to morbidity and mortality throughout the world. According to WHO, three million acute poisoning cases with 2, 20, 000 deaths occur annually. Of these, 90% of fatal poisoning occurs in developing countries particularly among agricultural workers. [1] It is estimated that more than 50,000 people die every year from toxic exposure in India. [2]

Acute poisoning forms one of the common causes of emergency hospital admissions. Pattern of poisoning in a region depends on variety of factors, such as availability of the poisons, socio-economic status of the population, religious and cultural influences and availability of drugs. [1]

The commonest agents of poisoning in India appear to be pesticides, sedatives, chemicals, alcohol, plant toxins, household poison and snake bite etc. Of late, Aluminium Phosphide has begun to emerge as a major player in the toxicological field, particularly in some northern Indian states.

Among children the commonest culprits include kerosene, household chemicals, drugs, pesticides and garden plants. [2, 3] Among the adults, females predominate in all age groups, with an evident preponderance in the second and third decades of life. Acute poisoning in children is almost entirely accidental, while in adults it is mainly suicidal. [1]

Mortality and morbidity of poisoning cases varies from country to country depending on the nature of poison and availability of facilities and treatment by qualified doctors. [1]

The treatments goals in poisoning and snake bite include support of vital signs, prevention of further poison absorption, enhancement of elimination, administration of antidote and prevention of re-exposure. Besides to achieve early treatment initiation which is utmost crucial, various first aid steps are quite significant in the treatment outcome. [4]

Clinical and toxicological diagnostic and treatment facilities are often inadequate due to lack of trained personnel thus requiring strengthening of national capabilities for prevention, diagnosis and treatment. Further the

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lack of information on the ingredients of various products available make it difficult to plan and develop national poison policies and control program and to provide timely and reliable source of information to doctors and other medical personnel and first responders on the appropriate treatment. [2]

Aims and Objectives:

The huge burden of poisoning and snake bite cases demands comprehensive strategies for reducing the morbidity and mortality. Hence this prospective observational study was conducted with an aim to deduct the demographic profile of poisoning in this region, identify factors related to outcomes in such cases and to suggest strategies for reducing associated morbidity and mortality.

Material and Methods:

The study was conducted prospectively in the casualty, indoor, I.C.U. and medical record section of IMS & SUM Hospital Bhubaneswar, Odisha, India. All patients who presented with any type of acute poisoning including snake bite from August, 2013 to January, 2014 were included in this study. Cases excluded from the study are those with improper history of poisoning and brought dead patients.

Data obtained included demographic details such as age, sex, marital status, socio-economic status. The time and place of poisoning and snake bite and arrival at the hospital were noted.

Manner of poisoning noted from history. The details of the first aid given, outdoor and indoor treatment received along with the treatment outcome was included in the study.

All the data were presented as numbers and percentage and the observation and results deducted and discussed with similar studies. Chi-square test was used to predict the strength of association between different variables. A 'p' value of <0.01 was considered highly significant, 'p' value of <0.05 was considered significant and 'p' value of >0.05 was considered insignificant.

Finally conclusion of the study found out after the discussion.

Observation and Results:

The number of poisoning cases found was n=78 (40%) among all medico-legal cases (n=195) registered during the study period. Males (57.69%) dominated over females (42.31%) as per the number of poisoning cases registered. Most common age group found was 21-30 year (34.61%), which is also same for the males (n=18); but for females (n=12) the most common age of presentation was in between 31-

40 years. However this result is not statistically significant (p value=0.09903).

Most of the poisoning victims belonged to middle class (61.53%), followed by lower (34.63%) and least was from the high socio-economic class (3.84%). Most of the victims found were unmarried (53.86%). However it was found that unmarried males (n=33) and married females (n=24) were more prone for poisoning. This result is statistically highly significant (p value<0.01).

Suicide was the most common manner of poisoning (65.39%), followed by accidental pattern (34.61%). No homicidal poisoning cases were detected during the study period. However accidental pattern was more common in males (n=21) (mostly unmarried, n=18) and suicidal pattern was more common in females (n=27) (mostly married, n=18) and this finding is highly significant statistically (p value=0.008988).

'Home' (46.15%) was the most suitable site for poisoning, followed by 'work place' (23.07%) and 'remote place' (15.39%). While for males, 'work place' (n=13) was the most common place for poisoning, in females 'home' (n=27) was the dominant place and it has high statistical significance (p value=0.002119).

Insecticides (26.92%) were the most common poison encountered in this region irrespective of sex, followed by snake bite (19.23%). Snake bite (n=12) and alcohol poisoning (n=9) were dominant in males while rat poison (n=6) and sedatives (n=6) were dominant in females.

These results are statistically significant (p value=0.0196). More than two third of the patients were presented to the hospital within four hours of incident. Most of the patients had been completely cured (76.92%) after the treatment. Least number of patients had been referred (3.85%). Case fatality rate was also low (only 3.84%). However there is a relation between the lag period of incident and hospital presentation to the outcome of the treatment.

Maximum patients were completely cured when the lag period was within four hours. With the increase in lag period there was increase in the number of complicated and fatal cases. The lag period when compared with the treatment outcome the results are statistically significant (p value=0.01631).

Discussion:

Incidence of poisoning cases found in the study was 40% of all the medico-legal cases, which is similar to the study of another author. [5] Poisoning cases are one of the major burdens of all the medico-legal cases in a

casualty probably due to easy availability of a wide range of domestic/household poisons to a range of agriculture and plant poisons and ignorance of general people regarding its handling. Male to female ratio in this study is equivalent to the study by others. [3, 6, 7]

This may be due to high male to female ratio and high male exposure to poisons in this part of country. However the study of two foreign authors showed female dominancy in poisoning cases. [8, 9] Age group 21-30 years was found most vulnerable in this study and is similar to studies of many others. [6, 7, 10-13] Active and productive life style makes the age group most vulnerable. Most poisoned patients belonged to middle class family in this study and it is supported by other studies [4, 7] as well.

Another group of authors found that most of the patients were of low socio-economic class [11, 12, 14] These variation depend on the locality, the affordability of the tertiary care hospital etc. In contrast to the present study the studies of many authors' showed that most of the poisoned victims are married. [4, 7, 14]

Local factors, unemployment and stress in unmarried persons may have caused such result in this region. Suicide was the most common manner than accidental than homicidal pattern in this study and this data is supported by authors. [11-14]

Unemployment, stress and family dispute may lead to such finding. Suicide was more common in females found in this study and also in other. [10] More emotional instability in females added with gender bias in our Country may be the cause. The data, accidental pattern was more commonly found among unmarried persons and suicide pattern among married person is supported by author. [10]

Love disputes, reckless behavior and fickle nature of unmarried may lead to such situation. Place of occurrence in most cases was 'home' in this study and it is similar to other study. [8] Availability of plenty of household poisons and secluded environment in home made it the ideal choice of place for poisoning.

Insecticides followed by snake bite were the prevalent form of poisoning found in this study and is supported by authors. [6, 7, 11]

This study group being largely agriculture based where the farmer applies pesticides to the crops, good crop attracts rodents, which inadvertently attracts snakes into the picture. Easy availability of pesticides, agricultural and outdoor habit probably makes this most common type of poisoning in this region. However, in some studies 'household

agent' dominates [3, 10] while in others medicinal drugs. [8, 9]

Lag period between incident and presentation to hospital is same as in other studies. [4, 6, 10] Most of the patients in this study had been completely cured and it is supported by other authors. [9, 10, 12]

Case fatality in this study was 3.84% and this is quite similar to other study where it is 3.4% [12] and lower as compared to others where they are 8.3% [6], 10% [13], 15.4% [11] and 18.6%. [4] It shows better efficiency of the hospital towards management of various poisoning cases. Mortality is still low in the other studies approaching nil [10] and <1%. [8]

Early presentation to the hospital resulted in better treatment outcome was concluded from this study and the result is supported by many other authors. [4, 6, 10, 11] Ideally the cases are better managed when the patient presented to the hospital early.

Conclusion:

The huge burden of poisoning cases encountered in emergency department in this part of the country may be attributed due to easy availability of insecticides and other household poisons and these resulted usually from self-inflicted action. Measures observed in this study include early presentation to hospital, awareness to handle the toxic materials and counseling.

Also, there is need to improve techniques for early and accurate diagnosis and treatment in poisoning cases with the help of various toxidromes, analytical tests and use of antidotes if available.

Further it clarifies the need to establish a poison information center in this region and manage a Clinical Toxicology Unit for the better management and prevention of such morbidity and mortality in poisoning cases. The study is more focused on acute poisoning and presentation, while chronic poisoning could have even worse effects are yet to be studied.

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Fig. 1: Incidence of Poisoning Cases among all Medico-legal Cases

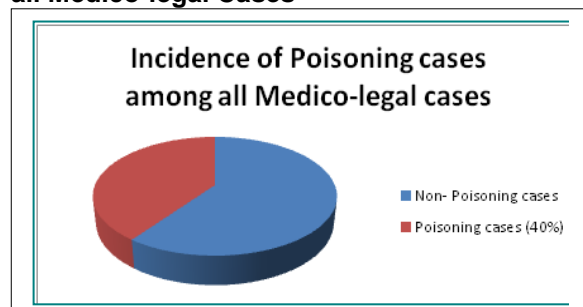


Fig. 2: Socioeconomic Status

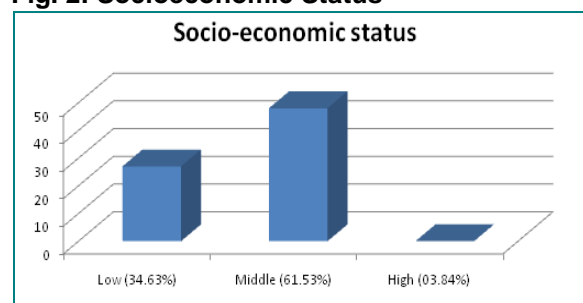


Fig. 3: Distribution of Place of Occurrence

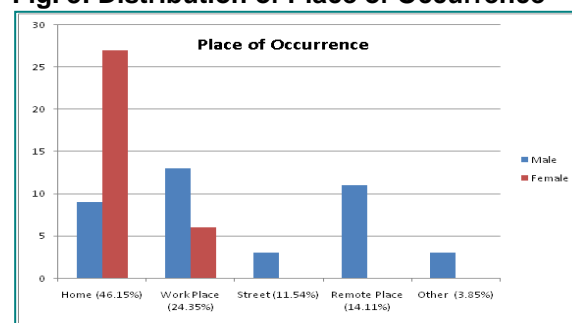


Fig. 4: Type of Poison

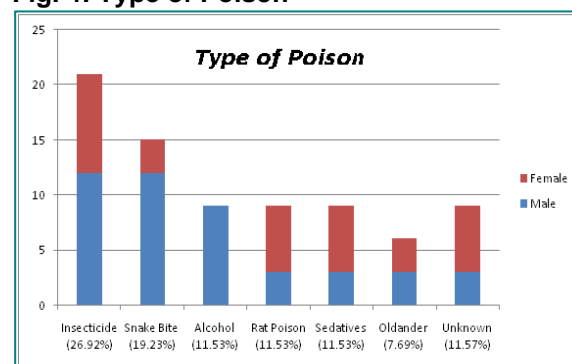


Table 1: Age and Sex wise Distribution

Age grps (Yrs)	Male	Female	Total
< 10	00	00	00 (0%)
11 – 20	12	06	18(23.07%)
21 – 30	18	09	27(34.61%)
31-40	09	12	21(26.92%)
41-50	06	03	09(11.53%)
51-60	00	00	00(0%)
>60	00	03	03(3.84%)
Total	45(57.69%)	33(42.31%)	78(100%)

Table 2: Sex wise Distribution of Marital Status and Manner

Manner	Male			Female			Total
	Married	Unmarried	Total	Married	Unmarried	Total	
Accidental	03	18	21	06	00	06	27(34.61%)
Suicidal	09	15	24	18	09	27	51(65.39%)
Homicidal	00	00	00	00	00	00	00(0%)
Total	12(15.38%)	33(42.3%)	45	24(30.76%)	09(11.56%)	33	78(100%)

Table 3

Lag Period between Incident and Hospital presentation compared with the Treatment Outcome

Lag period	Complete cure	Complication Develop	Referred	Death	Total
< 1 hour	06	00	00	00	06(7.69%)
1-2 hours	12	06	03	00	21(26.92%)
2-4 hours	24	00	00	03	27(34.63%)
4-6 hours	09	03	00	00	12(15.38%)
6-12 hours	09	03	00	00	12(15.38%)
Total	60(76.92%)	12(15.38%)	03(3.85%)	03(3.85%)	78(100%)

Original Research Paper

Age Estimation from Teeth with Critical Analysis of Gustafson's Method

¹P.C.Sarmah, ²Ashim Mishra, ³Abhishek Das, ⁴B.V. Subhramanyam

Abstract

In this era of evidence based medicine much of expertise in field of Forensic Odontology is drawn from basic research and experience. Teeth are better preserved than other material, so their use for identification of an individual's age at death is very important. Ever since its inception Gustafson's method for determination of age from permanent teeth is considered gold standard even though many workers have dealt with the topic extensively, and critically determined the error factors involved. The present study reveals that the central incisor is the best age indicator with a standard error of ± 6.35 years, and in combination of canine and first molar gives age estimation within an error of ± 5.35 years. The first molar alone being the first to erupt in permanent series is found less useful age indicator (error ± 8.15 years). In contradiction to many researchers and Gustafson himself, this study points that attrition constitutes the most reliable parameter.

Key Words: Gustafson's Method, Age, Central Incisor, Attrition

Introduction:

From time immemorial, a quest is there to determine age from various body parts. Out of these variables, teeth are very important owing to its less perishable nature. Age, race and sex determination together with dental identification and facial reconstruction on skeletal material are procedures that the Forensic Odontologist has to master. [1] Gustafson's criteria for age in adult life is based on the evaluation of ground sections of teeth where six age-related parameters are evaluated in the ground sections of teeth and are compared to a regression curve of age versus the age related changes. [2]

It comprises of six parameters, that are namely occlusal attrition of the tip of the tooth, secondary dentine deposition starting in apex of the pulp cavity, regression of the attachment of the periodontal membrane, increase in root transparency starting from below upwards, root resorption and accumulation of Cementum around the root.

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Even Gustafson himself gave more credit to root transparency and declared attrition as a highly erratic indicator of age. [3] The aging of the dentition when based on physiological attrition could correlate with age but factors such as bruxism, diet, environment and medication has limited the age estimation by examination of dental attrition. [4]

The present study done by the authors although done in recent past provides statistically significant regression co-efficient and correlation co-efficient with reasonable standard error in relation to central incisor, canine and first molar teeth, when the Gustafson's method has been applied, it shows that attrition constitutes the most reliable parameter in contrast to previous workers and pioneers in this field who have also researched extensively on confrontation of modification of Gustafson's method. [4, 5]

Newer modifications like Kilian's method uses subjective evaluation of six markers: the degree of attrition, the secondary dentine, the secondary cementum, the root resorption, the transparency of root and the position of epithelial attachment on neck of tooth where as Kashyap and Koteswara Rao attempted the quantitative evaluation of four markers: the attrition, the secondary dentine, the secondary cementum and the transparency. [1]

The author in his research work found out that the Gustafson's method is the gold standard for estimation of age from permanent teeth even though subjected to criticisms.

Material and Methods:

Our sample comprised of 73 freshly extracted permanent teeth collected from dead bodies of apparently healthy persons brought to Department of Forensic Medicine, Institute of Medical sciences, Varanasi for the autopsy. The teeth were extracted from both sides and also from upper and lower jaw randomly to exclude variation of focal aging changes depending on the chewing pattern/habit.

The exact age of the patient collected from the inquest reports and other records such as school certificates and horoscopes were noted. The teeth were first cleaned with pumice slurry and polishing brush in a slowly rotating hand piece and thoroughly washed under running water.

Each tooth was cut into longitudinal two halves using a carborandum disc rotating in high speed by electric motor. The sections were again rinsed under running water to clear them of debris and particles. Following grinding on hone up to 1mm thickness and after dehydration, tooth sections were placed on glass slide and covered with cover glass for microscopic observation.

The ground sections were evaluated by Gustafson's method using the light microscope with the possibility of image analysis. Individual changes were classified and noted. Score points of individual tooth are recorded first considering the degree of involvement of six criteria and then the average point values of two and also all three of them considered.

After completion of observations, the known age of each sample is compared. Point values of the samples are plotted and scatter diagrams obtained.

Statistical Analysis:

All the statistical analysis was performed using the Microsoft Excel. Equations for age prediction were derived using least squares regression analysis. Absolute mean error of estimation was counted from absolute values of residuals. The formula for age prediction was calculated from multiple regression analysis.

Correlation Co-efficient, r is calculated by using the following formula:

$$r = \frac{\sum xy - (\sum x)(\sum y)/n}{\sqrt{[\sum x^2 - (\sum x)^2/n][\sum y^2 - (\sum y)^2/n]}}$$

Regression co-efficient, b is found out with the help of the formula

$$b = \frac{\sum xy - (\sum x)(\sum y)/n}{\sum x^2 - (\sum x)^2/n}$$

Standard error of estimation of Regression co-efficient, S_{yx}

$$S_{yx} = \sqrt{\frac{[\sum y^2 - (\sum y)^2/n] - b[\sum xy - (\sum x)(\sum y)/n]}{n-2}}$$

Here 'x' represents the score points recorded in observations, 'y' represents known age in years and 'n' is number of cases studied.

After finding out the value of r and b , $S_{y,x}$ is estimated by the help of regression equation, $Y = bx + C$, where 'Y' is the estimated age of the individual, 'b' is the regression co-efficient, 'x' is score points of specimen observed and C is the constant which indicates the theoretical value of Y when x equals to zero.

Results:

The average error in the present work when central incisor, canine and first molar were taken together is ± 5.9 years. When central incisor and canine are taken together the error is ± 6.07 ; with canine and first molar it is ± 5.35 ; with central incisor and first molar taken together it is ± 6.35 years. The three teeth in combination give the estimated error of ± 5.95 years. When plotted as a scatter diagram it is found that the dispersion of the points (scatter) is less in case of canine and first molar together while it is more in case of first molar alone.

First average point value of the teeth of 73 samples projects the correlation co-efficient $r=0.87$ and regression co-efficient, $b=5.5$, standard error of regression coefficient $S_{y,x}=\pm 7.02$ and sample error (standard error of correlation co-efficient, $S_b=\pm 0.31$, the test for significance, $t=17.74$.

The p value is less than 0.001 at 60 degrees of freedom, which is highly significant. The regression line equation is $Y=5.5x-3.38$; where Y is the estimated age, x is the score points and -3.38 is a constant which indicates the theoretical value of Y when x is zero.

The reliability of this estimate is found to be 76 per cent. The difference between the regression co-efficient of two sexes is found to be insignificant.

The present study although done in recent past provides statistically significant regression co-efficient and correlation co-efficient with reasonable standard error in relation to central incisor, canine and first molar teeth when the Gustafson's method has been applied, and shows that attrition constitute the most reliable parameter in contrast to many authors.

Discussion:

Gustafson's proposition regarding the utility of human teeth in age estimation have been re-examined time and again by many workers. [6-8] The present study was aimed at

finding out the utility of central incisor, canine and first molar individually and in combinations. The average error in the present work when central incisor, canine and first molar are taken together is ± 5.9 years quite similar to Johanson study. [9]

While taken alone the central incisor has shown the standard error of ± 6.35 years and with canine alone the value is ± 7.48 and with the first molar it is ± 8.15 years.

When central incisor and canine are taken together the error is ± 6.07 ; with canine and first molar it is ± 5.35 ; with central incisor and first molar taken together it is ± 6.35 years. It differs from Gustafson study where he gave an error limit of ± 3.6 years in 33% cases and ± 7.3 years in 4.5% of cases while in 1% of cases the error limit was ± 9.1 years.

The present findings also differ from study of Sognanaes. [7] The findings are slightly higher than study by Rai *et al* results of age estimation which found absolute mean error of estimation 4.95 years.

Score points of observation are found to vary tooth wise even in the same sample and in some cases total points are found to be identical in two or in rare cases in three teeth. This variation in score points is not only limited to attrition and paradontosis but also to other age changes. [5]

Our study also states that the age changes are comparatively more advanced in the anterior teeth and also they are more uniform for which when considered alone, anterior tooth gives better results than the posterior one.

Age changes are also not same in teeth of the same individual even having uniform mastication (chewing habits). Central Incisor is the first permanent tooth replacing the deciduous tooth. It is the most frequently used teeth in biting and cutting habit, thus more prone to secondary changes.

Even Gustafson had been very categorical in refuting the importance of attrition. [3] A recent view even highlights the merits and demerits of attrition used as a sole indicator of age estimation. [4] While many authors have given more credence on the transparency of root as an important age indicator, it appears from the present study that attrition is more reliable and better indicator of age.

The point values obtained from central Incisor under attrition is found to be more consistent with age related changes, thus implying the reliability of correlation in case of attrition. The transparency of root itself is variable and not reliable especially in the case of

bicuspid and molar teeth whether as a whole or in fragmentary state. It varies in a single tooth in between the different roots and even in the same roots.

However the transparency of root is found better in higher age groups (above 25 years). This finding in our study somehow contradicts with the opinion of Gustafson. [3]

Our study also points the accuracy of observations depends on thickness of the samples which were made to 1mm by grinding manually on hone. The conception of using less thick up to 0.25 mm does not yield better results. It is also proved by other researchers. [10]

Conclusion:

The work done was entirely manual except use of carborendum disc for longitudinal section of teeth. Although amenable to human errors, the observations here by obtained is within narrow limits or similar to various authors.

Thus the usefulness of manual work in Forensic investigation cannot be refuted even in this era of technology. Extensive research is an integral part in evaluation and researchers are always welcomed to further analyze the study.

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Table 1: Comparative Results in 73 Cases in Individual Tooth and In Combination

Sample	R	b	Sy. x	Sb	t value
I ₁	0.87	4.52	6.35	0.31	14.58
C	0.81	4.55	7.48	0.39	11.67
M ₁	0.77	4.75	8.15	0.47	10.11
I ₁ +C	0.88	4.98	6.07	0.32	15.56
C+M ₁	0.91	5.72	5.35	0.31	18.45
I ₁ +M ₁	0.87	5.12	6.35	0.35	14.63
I ₁ +C+M ₁	0.88	5.39	5.95	0.34	15.85

$p < 0.001$, r = correlation co-efficient, b = regression co-efficient, Sy . x = standard error of regression co-efficient, Sb = Standard error of correlation co-efficient, I_1 = Central incisor, C = canine, M_1 = first molar

Table 3: Error Limits of Results Taking Average Points Values of I₁, C and M₁

Error limit (yrs \pm)	Cases	Percentage
± 1	7	9.58
± 2	13	17.8
± 3	8	10.95
± 4	7	9.58
± 5	9	12.32
± 6	7	9.58
± 7	7	9.58
± 8	3	4.1
± 9	1	1.36
± 10	2	2.73
± 12	5	6.84
± 15	4	5.47
Total	73	100%

**Fig.1: Ground section of Central incisor
A=2 P=2 S=0 C=1 R=0 T=1 Total score= 6**

Known age= 30 years Estimated age= 35.8 years

**Fig. 2: Ground Section of Canine
A=2 P=3 S=2 C=3 R=1 T=2 Total score= 13**

Known age= 65 years Estimated age= 66.2 years

**Table 2
Estimated Age in Different Age Groups in 73 Cases**

Age (yrs)	No. of samples (%)	C+M ₁		I ₁ +C+M ₁	
		Average point values	Estimated age	Average point values	Estimated age
16-20	4(5.4)	4.06	19.31	4.33	19.7
21-25	8(10.9)	5.15	25.54	5.43	25.63
26-30	13(17.8)	5.86	29.6	6.16	29.57
31-35	15(20.5)	6.65	34.12	6.98	33.99
36-40	8(10.9)	8.12	42.53	8.37	41.48
41-45	7(9.5)	8.67	45.68	9.25	46.22
46-50	8(10.9)	9.0	47.57	9.37	46.87
51-55	3(4.1)	9.33	49.45	9.88	49.62
56-60	3(4.1)	9.33	49.45	9.88	49.62
61-65	2(2.7)	10.25	54.72	11.16	56.52
66-70	1(1.3)	9.5	50.43	10.66	53.82
71-75	1(1.3)	11.5	61.87	12.33	62.82

Original Research Paper

Pattern of Injuries in Road Traffic Accidents at Chitradurga Karnataka: An Autopsy Based Study

¹Suresh Katageri, ²Ram Babu Sharma, ³Govindaraju HC, ⁴Amit Kumar Singh

Abstract

During twenty month study period a total of 161 cases of medico-legal autopsies were conducted out of which 52 cases were of fatal road traffic accident at the mortuary of Basaveshwara Medical College and Research centre, Chitradurga, Karnataka. Among the age group 31 – 40 years, highest number (25%) of road traffic fatalities occurred. Males predominated over the female by seven and half times. Most of the accidents (75%) occurred on highways. The NH-4, NH-13 alone claimed 75% of all the mishaps. Motor cyclist occupants formed the largest group (28.84%) followed by the pedestrians (25%). Majority of the road users (98%) sustained fracture followed by laceration (94.23%), abrasion (82.69%) contusion (76.92%) respectively. The heavy vehicles were found to be responsible for causing a majority of injuries, especially the skeletal injuries.

Key Words: Fatal RTA, Pattern of injuries, Diurnal variation, Highway, Heavy motor vehicle

Introduction:

First automobile accident was occurred in 1896, when a bicycle rider was hit by a car and first fatal accident occurred in London in the year 1899, in same year when a pedestrian was killed by a car in New York City. The important factors are human errors, driver fatigue, poor traffic sense, mechanical fault of vehicle, speeding and overtaking violation of traffic rules, poor road conditions, traffic congestion, road encroachment and drunken driving etc. [1]

Road traffic accidents are the only public health problem for which society and decision makers still accept death and disability among young people on a large scale. [2] The Global death rate from Road Traffic Accident was 19.0 per lakh population in the year 2002. It was more common in males those who were between 15-44 years age group and more than 1.8 lakh children under 15yrs of age die in Road Traffic Accidents. [3] The aim of present study was to assess distribution of road traffic accidents and pattern of road traffic injuries.

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Material and Methods:

Materials for the present study comprised of 52 fatal cases due to RTAs brought to the mortuary of the Department of Forensic Medicine and Toxicology, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka for medico-legal post-mortem examination. These cases were from various police stations of Chitradurga districts. The duration of the study was from November 2012 to June 2014.

Results and Discussion:

Every day as many as 140,000 people are injured on the world's roads. More than 3,000 died and some 15,000 were disabled for life. Each of those people has a network of family, friends, neighbours, colleagues or classmates who were also affected, emotionally and otherwise.

Families struggle with poverty when they lost a bread winner or had the added expense of caring for disabled family members. [4] Out of 161 medico-legal autopsied conducted during November 2012- June 2014, 52 cases (32.29%) were of RTAs. This has reflected major public health problem.

The common age groups involved in this study were between 31-40 years (25%) followed by 41-50yrs (19.23%). The deceased aged more than 71years were the least (5.77%). (Table 1)

In a similar study conducted at Manipal, majority (57%) of victims were young adults (11-40 years), followed by ages of 41-60years (29%) same as result of this study. Only 10% were

aged above 60 years and 4% were aged below 10 years. [5, 6] In a study at Allahabad, the principal age group involved in fatal RTA was 25-44 years, with cases of 33.68%.

Most of the victims in the present study were males. (Table 2) Males predominated over the female by seven and half times. The male predominance (89%) was seen in study conducted at Manipal. [5] In present study majority 28.84% of the victims were motor-cyclist followed by Pedestrians 25% and drivers 21.15% respectively. (Table 3)

Frequency of motorcyclist were more because of recent increase in over designed motor vehicles, rash and negligent driving by younger population, not wearing helmet, poor construction of highways, absence of street light, urgency to reach to the work place. Results of this study were similar with Manish K et al and Khade A. [7, 8]

Maximum number of accidents occurred in the evening hours and minimum in morning hours. (Table 4) Our study is similar to the observation made in study conducted at GTB hospital, New Delhi. [9]

Maximum number of accident in evening may be due to high rush hour traffic (people return home from work), tiredness after a day work, urgency to reach home, poor visibility due to insufficient street lightning, evening is the time to go and come from entertainment etc.

Minimum number of accident in the night can be explained by the fact that it is the quietest period of the day and most of the people remain indoors or go to sleep. Our study was in contrast to the observation made in the study conducted by Manish K et al at Chigateri general hospital, Davangere, in which maximum number of accidents occurred in the morning between 6 am-12pm (38.4%). [7]

Most of the deceased (75%) in this study met with accident at highways followed by state road. (Table 5) Our study was similar to observation made by Mandal B K et al and Sharma B R. [10, 11] High number of road traffic accidents on highways in Chitradurga could be attributed to high speed, rash driving and more number of heavy vehicles like, trucks indulge in the iron ore mining in this part of the country.

Motor cyclist mostly sustained fractures 36.53% followed by the abrasions and equal number of contusion and laceration. Among vehicle occupant equal number of fracture and laceration followed by abrasion 30.76% and contusion 23.07% respectively. (Table 6)

In pedestrian 23.07% fractures and laceration in equal frequency followed by

contusion 21.15% and abrasion 15.38%, fracture dislocation 11.46% respectively.

Fracture dislocation more frequent in motor vehicle occupants 17.53%, followed by pedestrian 13.46%, 11.53% in motor cyclist. It therefore, appears that motor vehicle occupant and motor cyclist were more vulnerable to the different type of injuries than other categories of the victims possibly due to a greater force of impact in the former and a longer distance of the fall in the latter. Our study was in contrast to Kumar S et al. [12]

In our study pedestrian got 84.61% head injuries, followed by vehicle occupant 82.35% and motor cyclist 73.68%. (Table 7)

But unknown occupant either fall from running vehicles got 100% head injuries. In the cases of other traumatic lesions of the brain, intra-cerebral haemorrhages may be primary (direct result of application of force) or secondary Camps. [13] Our study was in contrast to the study done by Inamdar P.I. [14]

Conclusion:

The present study highlighted the demography and pattern of injuries in RTA. More people have been killed in RTAs than the world wars. The all India road data showed that 83.5% of the accidents were due to the drivers fault. Other contributory factors were mechanical defects in vehicles, pedestrian fault, fault of the passenger, bad roads, and bad weather etc. [15]

Since the patterns of injury from man's interaction with the motor vehicles may be modified by protection devices, such as helmets, seat belts and air bags, but injuries due to road traffic related trauma were worsening each year because of scanty regard to all these.

The usage of motorized vehicles is growing day by day throughout the world. It is a particular concern in developing nations like India where increasing urbanization, overcrowding and scant regard for the rules of the road are seen. It is high time that the policy makers should take a look at these types of studies and do concerned modifications in the years to come.

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Table 1: Distribution of Age of Road Users' Victims involved in RTAs

Age (yrs)	Cases	(%)
< 10	04	7.69
11 – 20	06	11.54
20 – 30	11	21.15
31 – 40	13	25.00
41 – 50	10	19.23
51 – 60	01	1.92
61 – 70	04	7.69
71 – 80	01	1.92
81 – 90	01	1.92
>90	01	1.92
Total	52	100

Table 2: Distribution of Sex of Road Users Victims in RTAs

Sex	Cases	(%)
Male	46	88.5
Female	6	11.5
Total	52	100

Table 3: Types of Road Users involved in Accidents

Type of victim	Cases	Percentage
Pedestrian	13	25.00
Pedal-cyclist	1	1.92
Rider/Motor cyclist	15	28.84
Pillion rider	4	7.69
Driver	11	21.15
Front –Seater	3	5.76
Back -Seater	3	5.76
Not known	2	3.84
TOTAL	52	100.00

Table 4: Accidents In Relation To the Time

Time of RTA	Cases	Percentage
00:00 to 06:00(Night)	10	19.2
06:01 to 12:00(Morning)	9	17.3
12:01 to 18:00(Afternoon)	15	28.8
18:01 to 23:59(Evening)	17	32.7
Not known	1	1.9
Total	52	100

Table 5: Place of Road Traffic Accident

Place of accident	Cases	Percentage
National Highways (NH-4,NH-13)	39	75.00
State road	11	21.15
Others	2	3.84
Total	52	100

Table 7: Head Injuries amongst Different Types of Road Users

Type of Road Users	Cases studied	Cases injured (%)
Pedestrian	13	11(84.61)
Pedal-cyclist	1	-
Motor cyclist	19	14(73.68)
Vehicle occupants	17	14(82.35)
Others	-	-
Unknown	2	2(100)
Total	52	41(78.84)

**Table 6
Soft Tissue and Bony Injuries amongst Different Types of Road Users**

Nature of injury	Pedestrian (%)	Cyclist (%)	Motor-cyclist (%)	Vehicle occupants (%)	Unknown (%)	Total (%)
Abrasion	8(15.38)	-	18(34.61)	16(30.76)	1(1.92)	43(82.69)
Contusion	11(21.15)	-	16(30.76)	12(23.07)	1(1.92)	40(76.92)
Laceration	12(23.07)	1(1.92)	16(30.76)	18(34.61)	2(3.84)	48(94.23)
Fracture	12(23.07)	-	19(36.53)	18(34.61)	2(3.84)	51(98)
Fracture-dislocation	7(13.46)	-	6(11.53)	9(17.3)	1(1.92)	23(44.23)

Original Research Paper

Study of Medical Professional Liabilities in Bellary Region of Karnataka

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Abstract

The study of Medical Professional Liabilities was carried out in Bellary region of Karnataka state. Details of the cases were collected from the district consumer forum Bellary between January 2000-December 2009 (10 years). In each case, complaint of the complainant and response to a complaint by the opponent was studied and analyzed. Date of filing and date of judgment was noted in each case. In our study out of ten cases, general practitioners were more prone for professional liabilities. Six cases were compensated monetarily. In our study the most common cause for litigation was found to be breach of practice guidelines, which can be prevented by attending continuous medical education (CME) programs and workshops, followed by misguided allegation which can be prevented by proper communication to the patient at first consultation. The lawsuits not only have heavy emotional toll on doctors and patients but on the society as a whole. Medical professionals should opt for medical indemnity insurance, which defends his or her case in all aspects and may even pay compensation on his behalf in case of professional liabilities.

Key Words: Professional liability; Medical negligence; District consumer forum

Introduction:

Professional liability is defined as legal obligations arising out of a professional's errors, negligent acts, or omissions during the course of the practice of his or her professional practice.

Medical negligence is absence of reasonable care and skill, or willful negligence of medical practitioner in the treatment of patient which causes bodily injury or death of the patient. Negligence is an integral part of human nature and doctors are no exception to this.

Consumer Protection Act (CPA) 1986 was enacted by parliament to provide for better protection of the interest of consumers in the background of guidelines contained in the consumer protection resolution passed by U.N. General Assembly on 9th April 1985.

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Medical profession was not included in this act at the beginning. However, due to the landmark judgment of Supreme Court in Nov 1995 (IMA v/s V.P. Shantha) the medical practice, barring some minor exception came within the ambit of CPA. [1] In medical practice, professional liability arises when there is medical negligence of civil nature, the patient claims compensation for the damages suffered by him in terms of money.

This compensation can be sought by a lawsuit either in a civil court or in a consumer redressal forum / commission in India.

Defendant physicians may experience wide range of distressing emotions and increased stress, which can disrupt their personal lives, lives of their family, their relationship with patients and their medical practice. Medical professional liability cases usually take several years to get resolve and this stressful period can be seemed as interminable.

According to ACOG (American College of Obs. & Gynae.) 1999 survey on professional liability conducted by Princeton Survey Research Association, 76.5% of its members had at least one professional liability claim, filed against them during their career. [2]

Material and Methods:

Cases which were filed and judgement given in the District consumer forum, Bellary between January 2000-December 2009 (i.e. 10

years) were included in the study. Details of the cases were collected from the district consumer forum Bellary. In each case, complaint of the complainant and response to the complaint by the opponent was studied and analyzed.

Date of filing and date of judgment was noted in each case. If needed complainant and opponent were consulted personally for details about the case. Details about the professional liability claims for various specialties were received from the Oriental Insurance Company [3] and New India Insurance Company Limited. [4] In each case following points are noted, such as

1. Misguided allegations
2. Communication failure
3. Documentation defects
4. Practice guidelines
5. Consultations and
6. Administrative incompetence.

Case Reports:

We studied 10 cases which were filed under medical negligence in Bellary district forum (Consumer court) from January 2000 to December 2009 (10 years), out of which general practitioners were more prone to professional liability (PL). This is followed by Pathologists, Pediatrician, Orthopedician, Physician, Urosurgeon and ophthalmologist.

Out of the total ten cases, 4 cases were dismissed and 6 cases were compensated monetarily. According to Bellary branch of Oriental Insurance Company, United Insurance Company, National Insurance Company and Indian Insurance Company, Bellary PL claims vary with the type of specialization.

We studied 10 cases, which were ordered (judgement given). Out of 10 cases general practitioners were more prone to PL (Four cases - 40%) followed by diagnostic labs i.e. pathologists (Three cases-30%), Paediatrics (One case-10%), Urosurgery (One case - 10%), Orthopaedics (one case - 10%), Ophthalmology (one case - 10%).

Out of 10 cases, six were compensated monetarily. Among these cases, major causes for PL claims, failure of communication (30%), breach of practice guidelines (30%), consultation factor (20%), misguided allegations (10%), and administrative incompetence (10%).

According to our study, professional negligence has caused mental agony and unnecessary sufferings and loss to the patients (public). Here we have mentioned six ordered cases:

Case One:

With false diagnosis report, HIV negative patient was declared as HIV positive; which lead to the damage of patient's reputation in the society, mental agony to the patient and his family members and finally death of patient occurred.

Case Two:

Due to negligence in taking reference from concerned specialist (here gynaecologist) has led to severe organ damage (perforation of bladder) in the patient who had a history of caesarean section and appendectomy during surgery of fibroid uterus.

Case Three:

Prolonged use of medications for temporary symptoms without diagnosing the root cause of the disease and not referring the patient or suggesting him to consult specialists has left the cancer undiagnosed till the end stage.

Case Four:

Simply guaranteeing patients for the 100% solution for infertility, which lead to mental depression, loss of trustfulness towards doctors?

Case Five:

Failure in giving the immediate lifesaving treatment to the patient. Here a severely dehydrated child passing loose stools and with severe vomiting was referred to diagnostic centre instead of starting intravenous fluid. By the time the diagnostic report has arrived the child was dead.

Case Six:

Negligence to consult radiologist has led to development of complication in tubal ectopic pregnancy.

Discussion:

Professional negligence is defined as absence of reasonable care and skill, or willful negligence of medical practitioner in the treatment of a patient, which causes bodily injury or death of patient. [5] Negligence is of two types; one is civil negligence and second is criminal negligence. Civil negligence comes under the purview of consumer forum, whereas criminal negligence is trialed in criminal court.

Liability for negligence arises if the following conditions are satisfied:

1. Duty; existence of duty of care by doctor,
2. Dereliction; the failure on the part of doctor to maintain applicable standard of care and skill,
3. Direct causation; the failure to excise a duty of care must lead to damage,

4. Damage; damage should be of a type that would have been foreseen by a reasonable physician. [5]

Out of ten cases studied, six were compensated monetarily. Among them, major causes for PL claims are breach of practice guidelines (30%), failure of communication (30%), consultation factor (20%), misguided allegations (10%), and administrative incompetence (10%).

In 10 years only few cases were filed, this is because of ignorance of the people about the consumer protection act in India and many cases were solved outside the court, when there is clear negligence by doctor (these cases were not filed in court).

The study by Ward CJ [6] showed that 25% of the total lawsuits were indefensible due to the reason such as

- a) Breach of standard (17%).
- b) Lack of documentation (3%).
- c) Combination of both (5%).

Lynch [7] and others in their analyses described that 46% claims were mere misguided allegation, while 19% of cases were due to incompetent care, in 12% there was error of judgments, and 7 % of cases resulted due to failure of communication.

According to The New India Insurance Company Ltd, maximum annual premium was paid by the General Surgery, followed by Urosurgery, Obstetrics and Gynecology, Orthopedics, Ophthalmology, and Pathology.

If we look into annual premium in US [8] (1998-1999), maximum annual premium was paid by Obstetrics and Gynecology (35,200(\$)), followed by orthopedic (27,300(\$)), General Surgery (19,700(\$)), Pediatrics (12,300(\$)), General medicine (9,400(\$)), and Psychiatry (5,500(\$)).

Conclusion:

The major causes observed under different cases of Professional Liability Claims can be enumerated as.

1. Practice guidelines
2. Communication failure
3. Consultation.
4. Misguided allegations
5. Administrative incompetence

Among these the commonest cause in our present study was breach of practice guidelines, which can be prevented by attending continuous medical education (CME) programs and workshops. Misguided allegation can be prevented by proper communication to patient and their attenders at first consultation. So it is important to spend more time at first consultation. The lawsuits not only have heavy emotional toll on doctors and patients but on the society as a whole.

According to New Indian Insurance Company, total annual premium and total sum assured is almost doubled from the year 2001-02 to 2007-08. Escalating liability premiums and awards drive up the cost of medical care.

This can result in limited access to good medical care and when the care is available, it is more expensive. Thus, efforts must be made to avoid such a situation by taking preventive steps. It is important to have comprehensive approach in order to minimize professional liability claims. By taking care of patient clinically / legally and administratively, we can minimize the professional liability claims to large extent.

Medical professional should opt for Medical Indemnity Insurance scheme, which defends his case in all respect and may even pay the compensation on his behalf in case of professional liabilities.

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Original Research Paper

Pattern of Internal Neck Injuries in Strangulation Deaths With special reference to Laryngeal Fractures

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Abstract

One of the important finding in strangulation death is injury to laryngeal appendages. A cross sectional study was done to know the incidence of injury to laryngeal cartilages in strangulation deaths autopsied at our department from year 2010 to 2012.

A total of 31 cases studied in which ligature strangulation accounted for 18 cases (12 male, 06 female) and manual strangulation 13 cases (7 male and 6 female). Fractures of the hyoid and/or thyroid cartilage were present in 23 cases. Out of 23 cases, hyoid bone fractures noted in 9 cases (23%) and thyroid cartilage fractures found in 17 cases (54%). In ligature strangulation cases hyoid bone fracture present in 5 cases (28%) and thyroid cartilage fracture present in 9 cases (50%). In manual strangulation cases hyoid bone fracture noted in 4 cases (31%) and thyroid cartilage fracture were seen in 8 cases (62%). Cricoid cartilage fracture was not found in our study. Among external features sub-conjunctival hemorrhage was seen in 19 cases and nasal bleeding in 10 cases. Hemorrhage in strap muscles seen in all cases. Thyroid cartilage fracture is more common than hyoid bone fracture in both Ligature and Manual strangulation deaths.

Key Words: Strangulation, Laryngeal fractures, Hyoid and thyroid cartilage

Introduction:

Gonzalez's scientific research paper, relying on European references from the 19th century about examination of strangulation victims is considered as best till date. [1] Pattern of neck injuries distinguishes strangulation from other types of blunt injuries including hanging, traumatic blow to the neck, and artifacts of decomposition. [2-8]

Abrasions and contusions of the skin of the anterior neck are typical of strangulations cases. In some cases, external injury may not be evident or seen especially in cases of manual strangulation.

In some cases of manual strangulation where extensive force is applied by the assailant, classical fingernail marks are seen which are superficial, curvilinear abrasions occurring singly or in sets.

In addition to the blunt force injuries of the neck, strangulation produce the signs of asphyxiation, such as pinpoint hemorrhages (petechiae) in the skin, conjunctiva of the eyes, and visceral pleura of deep internal organs. [9, 10] Petechiae are non-specific findings that can develop from any cause of asphyxia including strangulation, hanging, drowning, and some natural diseases.

The presence of petechiae does not prove strangulation, and the absence of petechiae does not disprove strangulation. [11]

Pollanen studied histopathology of larynx in eight manual strangulation cases, in all cases; he found intra-cartilaginous laryngeal hemorrhages associated with sub-epithelial laryngeal hemorrhages, and intra-laryngeal muscular hemorrhages forming a "triad of hemorrhages."

Triad of hemorrhages has diagnostic value as an independent morphological criterion for the postmortem diagnosis of strangulation.

Mechanism of laryngeal, epithelial, subconjunctival and petechial hemorrhage over face is due to increased venous pressure

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draining the territory of the jugular venous system which is compressed in strangulation. [12] A common cited injury is fracture of the hyoid bone, actually only found in a minority (no more than one third) of all fatal strangulations. [13-18] Hyoid bone fracture is considered as a pathognomic feature of strangulation according to most of the literatures.

Aims and Objectives:

- To study the pattern of internal neck injuries with special reference to laryngeal cartilage fractures.

Material and Methods:

A cross sectional study was undertaken at our mortuary during period from 2010 to 2012. Out of 1450 autopsied cases, 31 cases of Strangulation were selected for study. All ligature and manual strangulation deaths were included in the study. Advanced decomposed bodies, deep burns and charred bodies were excluded from study.

Results:

In our study total 31 cases of strangulation deaths were studied which included 18 cases of ligature strangulation and 13 cases of manual strangulation.

Male accounted for 19 cases (61%) and female 12 cases (38%). Most common age group involved is 21-30 (32 %) followed by 31-40 (22%) in this study. (Table1)

General pathological signs of asphyxia observed most commonly were bluish discoloration of lips and petechial hemorrhage over heart and lungs which were found in all 31 cases, followed by bluish discoloration of nails 28 cases (67%) and Subconjunctival hemorrhages in 19 cases (61.2%).

Most common General body injuries present were abrasions and contusions. Injuries were absent in 10 cases. In manual strangulation cases, head injury was present in five cases, smothering in two cases and sexual assault in one case. In ligature strangulation cases head injury was present in four cases and smothering with head injury in one case.

Most common motive for murder in our study was revenge in nine cases, followed by five cases each accounted for property disputes and dowry harassment. In seven cases motive was not known.

In Manual strangulation (13 cases) local external neck injuries were scratch abrasions present in 10 cases and contusions in 9 cases. In all Manual strangulation cases external injuries were present except in one post-mortem burn case where external injuries were not made out due to superficial burns.

Most consistent internal neck injuries in Manual strangulation cases was contusion of strap muscles present in all 13 cases followed by laryngeal mucosal hemorrhagic spots in five cases and hemorrhage into sternocleidomastoid muscle in 4 cases. (Table 2)

Ligature mark was complete in 15 cases and incomplete in three cases. Course of ligature mark was transverse in 16 cases one sided transverse and other side oblique in one case and bilateral oblique in one case.

Ligature Mark was situated above thyroid cartilage in 9 cases, over thyroid cartilage in seven cases and below thyroid cartilage in two cases. Ligature material was found in 15 cases and not found in three cases.

In ligature strangulation cases internal neck injury most commonly encountered was contusion of strap muscles which was noted in all 18 cases followed by laryngeal mucosa hemorrhagic spots in 6 cases. (Table 2)

Out of 13 manual strangulation cases hyoid bone fractures were present in four cases (31%) and thyroid cartilage fractures were seen in eight cases (62%). In ligature strangulation cases hyoid bone fractures were present in five cases (28%) and thyroid cartilage fractures were present in nine cases (50%).

Inward fractures were seen in all 5 cases of hyoid fractures. Bilateral superior horn thyroid fractures were most commonly found (6 cases) in our study. (Table 3)

In age group less than 40 years (20 cases) laryngeal fractures were present in 12 cases and absent in eight cases and in age group more than 40 years (11 cases) laryngeal fractures were present in eight cases and absent in three cases. (Table 4) In our study cricoid cartilage fractures were not found.

Discussion:

Though the hyoid bone has received most attention in publication as being the marker of violence to the larynx, in fact the thyroid horns are far more vulnerable. Simpson found that, in 25 successive deaths from manual strangulation, there were 22 fractures of thyroid horns but only one hyoid bone fracture. Although fractures of the horns are more common with advancing age, they can on rare occasions be found even in teenagers. [19]

In ligature strangulation, injuries to deeper tissues of neck are more common than in cases of hanging, as considerable force is used to constrict the neck in cases of strangulation. The superior horns of the thyroid cartilage being slender and is present below the hyoid bone are prone for fracture. Also the

indirect force exerted by the thyro-hyoid membrane causes the fracture of thyroid cartilage. [20]

According to Polson, thyroid cartilage fracture more than hyoid in cases of hanging. In strangulation injury to the hyoid bone is uncommon since the level of constriction is relatively low and well below the bone. [21]

Our study findings were consistent with these studies. 48 deaths by ligature strangulation (21 male, 27 female) and 41 deaths by manual strangulation (27 female, 14 male) studied by Di Maio VJ. [22]

In ligature strangulation cases, petechiae were present in the conjunctivae and/or sclera in 86% of the cases; fractures of the hyoid and/or thyroid cartilage were present in 12.5%. In manual strangulation cases petechiae were present in 89% of the cases.

In cases of manual strangulation, fractures of the hyoid, thyroid, or cricoid cartilage were found in all the male victims and slightly more than one half of the female victims. Rape was the motive in 66% of the female victims of ligature strangulation and 52% of those due to manual strangulation. [22]

The hyoid is the U-shaped bone of the neck that is fractured in one-third of all homicides by strangulation. The reasons why some hyoid fracture and others do not may relate to the nature and magnitude of force applied to the neck, age of the victim, nature of the instrument (ligature or hands) used to strangle, and intrinsic anatomic features of the hyoid bone.

In Xeroradiographic study by Pollanen it was found that fracture of hyoid occur commonly in older victims of strangulation (39 +/- 14 years) than when compared to the victims with unfractured hyoids (30 +/- 10 years). The age-dependency of hyoid fracture correlated with the degree of ossification or fusion of the hyoid synchondroses. The hyoid was fused in older victims of strangulation (41 +/- 12 years) whereas the unfused hyoids were found in the younger victims (28 +/- 10 years).

In addition, the hyoid bone was ossified or fused in 70% of all fractured hyoids, but, only 30% of the unfractured hyoid was fused. The shape of the hyoid bone was also found to differentiate fractured and unfractured hyoid. Fractured hyoids were longer in the anterior-posterior plane and were more steeply sloping when compared with unfractured hyoids. [18]

In our study age group less than 40 years (20 cases) laryngeal fractures were present in 12 cases and absent in 8 cases and in age group more than 40 years (11 cases)

laryngeal fractures were present in eight cases and absent in three cases.

Cricoid cartilage fractures were not found in our study. In cases of death by ligature strangulation thyroid cartilage fracture was present in seven (35%) cases, fracture of the hyoid bone in three cases (15%), fracture both of the thyroid cartilage and hyoid bone in one case (5%), only ecchymosis in soft tissues in seven cases (35%). [23] The fracture was noted in cases when the victims were strangled by using a thick, broad material.

In a recent study, Ubelaker reported that only 34% of all cases of manual strangulation have a fractured hyoid bone. It is likely that many variables like magnitude and precise position of the force applied to the neck; rigidity of the hyoid bone; age of the victim; nature of the instrument used to strangle (for example, hands or ligature) and possibly the shape of the hyoid determine whether hyoid bone will fracture during strangulation or not. [24]

However in recent study by Lebreton chakour and his fellow researchers found no significant association between gender and type of fracture, or between fusion or non-fusion of the horn ($p>0.05$). Fused bones were not more susceptible to fracture than non-fused bones. [25]

Conclusion:

Thyroid cartilage fracture is more common than hyoid bone fracture in both types of strangulation deaths. Though age of ossification of hyoid bone influences to some extent its situation in upper neck makes it less likely to involve whereas thyroid cartilage being slender easily fracture.

In cases of strangulation deaths importance should be given to fractures along with the extravasations of blood into the surrounding tissues which can gauge the amount of pressure applied to the neck structures.

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Table 1: Age and Sex wise Distribution

Age Grp (Yrs)	Cases (%)	Male (%)	Female (%)
1-10	2(6.4)	1(3.2)	1(3.2)
11-20	2(6.4)	1(3.2)	1(3.2)
21-30	10(32.2)	5(16.1)	5(16.1)
31-40	7(22.5)	5(16.1)	2(6.4)
41-50	6(19.3)	5(16.1)	1(3.2)
51-60	2(6.4)	1(3.2)	1(3.2)
61-70	3(9.6)	1(3.2)	1(3.2)
Total	31(100)	19(61.3)	12(38.7)

Table 2: Internal Neck injuries

Hemorrhage in Neck Structures	Strangulation		Total
	Manual	Ligature	
Platysma	2	1	3(9.67)
Contusion of strap muscles	13	18	31(100)
Sternocleidomastoid	4	2	6(19.35)
Retrolaryngeal hemorrhage	3	3	6(19.35)
Retrotracheal hemorrhage	3	2	5 (16.12)
Scalene muscle	1	2	3(9.67)
Laryngeal Mucosa hemorrhage	5	6	11(35.48)
Base of tongue hemorrhage	2	1	3(9.67)

Table 4: Relation between Age and Laryngeal Fractures

Fracture Cartilages	Laryngeal	Age		Total (%)
		<40 yrs	>=40yrs	
Present		12	8	20(64.5)
Absent		8	3	11(35.4)
Both hyoid and thyroid cartilage fracture		2	4	6 (19.3)

**Table 3
Laryngeal Fractures in Strangulation Cases**

Laryngeal Cartilage	Fracture Site	Ligature Strangulation	Manual Strangulation	Total Cases
Hyoid bone fracture	Greater cornu Unilateral	2	3	5
	Greater cornu Bilateral	3	0	3
	Greater Cornu Unilateral and body	0	1	1
	Inward fracture	5	3	8
	outward fracture	0	1	1
Total		05	04	9(29.03%)
Thyroid cartilage fracture	Superior horn Unilateral	2	4	06
	Superior horn Bilateral	6	4	10
	Superior horn Bilateral with Body	1	0	01
Total		09	08	17 (54.83%)

Original Research Paper

A Forensic Approach for Data Acquisition of Smart Phones to Meet the Challenges of Law Enforcement Perspective

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Abstract

As the mobile devices grown popularity in everyday life, they are often vulnerable in security and privacy. Mobile device such as Cell Phones, Personal Digital Assistance (PDA) and Satellite phones have become essential tool in our personal and professional lives. These devices serves for user as Target, Storage and Communication medium by which user can able to perform various tasks such as send and receive SMS, MMS, Email, multimedia files, storing audio, video, text, image files and also make and receive calls. When mobile phone involved in criminal activity extraction of this Electronic/Digital evidence becomes 'Gold Mine' of intelligence and evidence about 'Who knows Who, What has Happened, What is being discussed and even what may happen in the future and the right use of this extracted evidence become important in judicial process that significantly helps in case hearing.

This paper studies extraction of digital evidence from, Nokia Lumia 520, Blackberry Curve 8520 and Samsung Galaxy GT-19082 mobile phones through three widely used mobile forensic devices (Device A, B & C), and it was concluded that no single tool can be exclusively relied upon to collect and present every item of potential evidence from a smart mobile device.

Key Words: Mobile Forensics, Electronic/Digital evidence, Mobile Forensic devices

Introduction:

A great number of mobile phones worldwide used in everyday life & much of them involves in criminal activity and possesses important evidences.

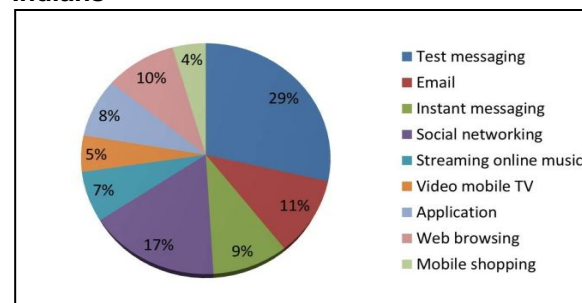
Mobile phones with cellular capability provide users with the ability to perform additional task such as creating phonebook, calendar, Short Messaging Services (SMS), Instant Messaging (IM), Electronic mail (Email), Web browsing, Storing videos, audios, text files, Portable Document Files (PDF), JPEG files etc.

Now days smart phones inbuilt with Global Positioning System (GPS) which is useful for providing location information and extraction of such information is useful by Law Enforcement Agencies to track down kidnappers, criminals and terrorist in real time.

When mobile devices are involved in a crime or other incidents, Mobile forensic analyst assembles this evidence from the crime scene, evaluates and analyse it and present the data in the court. According to the Nielsen Company database (2013) out of 100 Indians 81 Indians use mobile phones in which 80% Indians use feature phone, 10% smart phone and 9% multimedia phone. They further provide a dataset for mobile activities and applications used by Indians. (Fig. 1 and 2)

This paper provides a comparative experimental overview of three famous mobile forensic tools on Window, Android and Blackberry OS (Operating System) phones. The technical specifications of both mobile forensic tools and mobile phones are respectively explained in Testing environment and requirement section.

Fig. 1: Dataset of mobile activity uses by Indians



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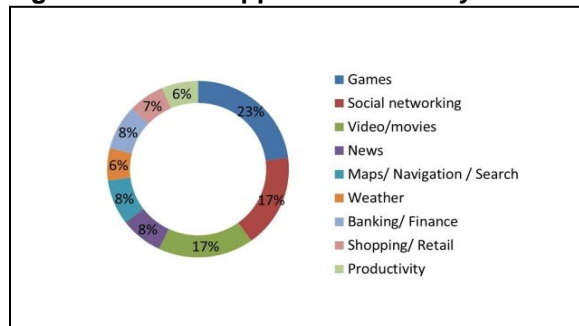
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Fig 2: Dataset of Application uses by Indians

Digital/ Electronic Evidence and Its Present Scenario According to Indian IT Act 2000:

Digital evidence is also known as electronic evidence or E-evidence. After implementation of the Information Technology Act 2000 (IT Act 2000) in India, E-evidences are admissible in the court as Documentary evidence (Section 3, 65A and 65B).

The definition of "Documentary Evidences" has been amended to include all documents including electronic records produced for inspection by the court.

An amendment to the India Penal Code (IPC), 1860, Indian Evidence Act (IEA), 1872 and Banker's Book Evidence Act, 1891 provide the legislative framework for transaction in electronic world.

Section 3 of Indian Evidence Act, 1872 define Evidence as under-

Evidence means and includes:

1. All statement which the court permit or requires to be made before it by witnesses in relation to matters of fact under inquiry, Such statement are called "Oral Evidence"
2. All documents including electronic records produced for the inspection of the court. Such documents are called as "Documentary Evidence".

Testing Requirements:

The purpose of forensically sound evidence is admissibility in a court of law. This is only possible when the testing environment will fulfil a crucial rule of digital forensics, which is to preserve the integrity of the original data and it to prevent from any contamination thus the mobile forensic workstation is designed to capture and process extremely high volume of digital data quickly and efficiently with obsolete assurance data integrity. The required hardware and software for experiment are mentioned below with their specifications.

- **Computer Workstations:** The configuration of workstation is mentioned in Table 1.

- **Mobile phones:** Nokia Lumia 520, Blackberry Curve 8520, Samsung Galaxy GT-19082. The specifications of mobile phones are mentioned in Tabular form. (Table 2)
- **Mobile Forensic Tools:** In the proceeding with above experiment we have used 3 Mobile Forensic Devices, namely Device A, B and C. (Due to some legal issues we didn't mention the name of Mobile Devices used).

Analysis and Results:

Analysis of all three mobiles is done on three Mobile Forensic Devices under forensically sound condition. In this research we carried Logical and Physical extraction of mobile phones.

Logical Extraction:

It includes a bit-by-bit copy of logical storage objects such as call logs, SMS, contacts, pictures etc.

Physical extraction:

It implies a bit-by-bit copy of an entire physical storage. A physical extraction has the advantage of allowing deleted files to be examined. (Table 4)

Conclusion:

In both the extraction we have taken the 13 parameters as mentioned in the table.

Logical Extraction:

The logical extraction appears to be mildly supported across all the mobile forensic devices tested. All the Mobile Forensic Devices A, B and C equally support for the Nokia Lumia 520 and Blackberry Curve 8520 for the extraction of parameters like contacts, call logs, SMS/MMS, image, audio, video etc. But for the Samsung Galaxy 19082 all the three devices are less supportive or we can say it did not support at all. (Table 3)

Physical Extraction:

The physical extraction didn't seem to be strong across all the three mobile forensic devices tested. Device A appears totally unsuccessful for all the parameters of Nokia Lumia 520, whereas for Samsung Galaxy GT-19082 it is somewhat support the physical extraction leaving 4 parameters unsupported. (Table 4) But for Blackberry Curve 8520 it is fully supported for all the parameters except one. Device B is supported only for the Blackberry Curve 8520 for all the parameters but not for the other two mobile phones. Device C results as totally unsupported for physical extraction of all the parameters of all three mobile phones.

Hence, in this analysis both inventive features and limitations were found. These mobile devices represent the three most popular operating systems (Windows, Android & Blackberry).

On the basis of three mobile forensic devices it is concluded that no single tool can be exclusively relied upon to collect and present every item of potential evidence from a smart mobile device.

It should be noted that new releases of forensic tools and mobile operating systems may change the way the data is acquired and the result may vary.

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Table 1: Specification of Mobile Forensic Workstation

CPU	Intel Core i5
RAM	8 GB
OS	Window 7 Home Basic Service Pack 1 32bit
GPU	NVIDIA 512M 1GB
HDD	500 GB @ 5400 RPM

**Table 2
Specification of Mobile Phones**

Manufacturer	Nokia	Samsung	Blackberry
Model	Lumia 520	Galaxy GT-	Curve 8520
Operating System	Microsoft window	Android 4.1 (jelly bean)	Blackberry
RAM	512 MB	1 GB	256 MB
Internal Memory	8 GB	8 GB	256 MB
Expendable Memory	84 GB	64 GB	16 GB
CPU	1 GHz Dual core	1.2 GHz Dual core	512 MHz

**Table 3
Logical Extraction**

S. N.	Data Type	Mobile Forensic Tool (A)			Mobile Forensic Tool (B)			Mobile Forensic Tool (C)		
		Nokia Lumia 520	Blackberry Curve 8520	Samsung Galaxy GT-19082	Nokia Lumia 520	Blackberry Curve 8520	Samsung Galaxy GT-19082	Nokia Lumia 520	Blackberry Curve 8520	Samsung Galaxy GT-19082
1	Contact	250	120	180	250	120	UnSup	250	120	UnSup
2	Call history	133	51	88	133	51	UnSup	133	51	UnSup
3	SMS	44	23	70	UnSup	23	UnSup	44	23	UnSup
4	MMS	0	0	0	0	0	UnSup	0	0	UnSup
5	Email	UnSup	UnSup	UnSup	12	14	UnSup	8	6	UnSup
6	Calendar entry	UnSup	UnSup	0	UnSup	0	UnSup	UnSup	UnSup	UnSup
7	Web history	UnSup	UnSup	UnSup	UnSup	27	UnSup	UnSup	UnSup	UnSup
8	Bookmarks	UnSup	UnSup	UnSup	UnSup	0	UnSup	UnSup	UnSup	UnSup
9	Image	15	25	12	15	25	UnSup	15	25	UnSup
10	Audio	67	157	152	67	157	UnSup	67	157	UnSup
11	Video	2	8	4	2	8	UnSup	2	8	UnSup
12	User PW Extraction	UnSup	UnSup	UnSup	Yes	Yes	UnSup	UnSup	UnSup	UnSup
13	Doc	UnSup	UnSup	UnSup	UnSup	5	UnSup	2	5	UnSup

Unsupported: UnSup, Document: Doc. Password: PW

Table 4
Physical Extraction

S. N.	Data Type	Mobile Forensic Tool (A)			Mobile Forensic Tool (B)			Mobile Forensic Tool (C)		
		Nokia Lumia 520	Blackberry Curve 8520	Samsung Galaxy GT-19082	Nokia Lumia 520	Blackberry Curve 8520	Samsung Galaxy GT-19082	Nokia Lumia 520	Blackberry Curve 8520	Samsung Galaxy GT-19082
1	Contact	250	120	180	250	120	UnSup	250	120	UnSup
2	Call history	133	51	88	133	51	UnSup	133	51	UnSup
3	SMS	44	23	70	UnSup	23	UnSup	44	23	UnSup
4	MMS	0	0	0	0	0	UnSup	0	0	UnSup
5	Email	UnSup	UnSup	UnSup	12	14	UnSup	8	6	UnSup
6	Calendar entry	UnSup	UnSup	0	UnSup	0	UnSup	UnSup	UnSup	UnSup
7	Web history	UnSup	UnSup	UnSup	UnSup	27	UnSup	UnSup	UnSup	UnSup
8	Bookmarks	UnSup	UnSup	UnSup	UnSup	0	UnSup	UnSup	UnSup	UnSup
9	Image	15	25	12	15	25	UnSup	15	25	UnSup
10	Audio	67	157	152	67	157	UnSup	67	157	UnSup
11	Video	2	8	4	2	8	UnSup	2	8	UnSup
12	User PW Extraction	UnSup	UnSup	UnSup	Yes	Yes	UnSup	UnSup	UnSup	UnSup
13	Doc	UnSup	UnSup	UnSup	UnSup	5	UnSup	2	5	UnSup

Unsupported: UnSup, Document: Doc. Password: PW

Original Research Paper

Abnormal Anatomical Position and Number of Renal Artery at the Renal Hilum

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Abstract

The development of the renal vessels, account for the fact of the complicate development of the kidney. The present study was under taken in 20 embalmed cadavers. Careful dissection of renal hilar structures was carried out to observe antero-posterior relationship of structures at the hilum of the kidney. In majority, the arrangement was according to the normal textbook description i.e. renal vein, renal artery and renal pelvis arranged antero-posteriorly. In 5% of cases renal artery was seen in front of renal vein and renal pelvis at the hilum. In present study, two cadavers showed one Lt Accessory renal arteries and bilateral abnormal arrangement of hilar structure at hilum.

The knowledge of variations of the renal vessels forms and its abnormal arrangement at hilum are essential guideline for Urosurgeon during the kidney transplantation and segmental resection for hilar mass. It is also helpful for physician in diagnosis of different renal disease caused by compression of ureter by renal vessels; the wrong diagnosis of which may create problem in the court of law when a case of negligence is brought against a treating physician.

Key Words: Accessory renal artery; Segmental resection; renal hilum; Variations, court of law, Negligence

Introduction:

Usually a single renal artery arises from lateral side of abdominal aorta just below the origin of the superior mesenteric artery and supplies the respective kidney on each side. Near the hilum of the kidney each renal artery divides into anterior and posterior branches, which in turn divide into segmental arteries supplying the different renal segments. [1]

The anterior division gives four segmental arteries and posterior division gives one segmental artery. In the hilum the structures are arranged from anterior to posterior as renal vein, renal artery and renal pelvis.

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The right renal artery (RRA) is longer and often higher, passing posterior to the inferior vena cava (IVC) and right renal vein.

In this we emphasize the importance of accessory renal artery on left side and the abnormal arrangement of hilar structure at the hilum of the Right and left kidney.

Materials and Methods:

The present study was undertaken to observe the arrangement of structures in prehilum and hilar regions.

Twenty (20) embalmed cadaveric kidneys of the department of anatomy at IGIMS, Patna and PMCH & NMCH Patna were utilized. Hilar dissection was carried out to observe the arrangement of structures entering or leaving the hilum of the kidney. Antero-posterior relations of the structures within one inch of the hilum were recorded.

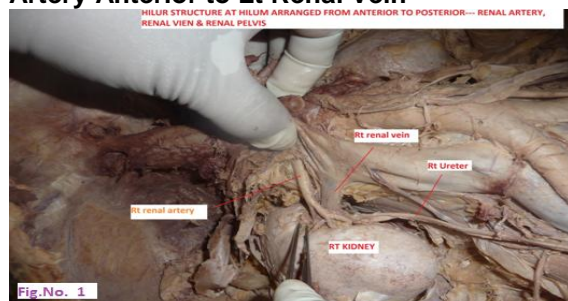
Observations:

During routine dissection of the cadaver, we encountered following architectural variations at the hilum of both Kidney. In the hilum we found, the structures were arranged from anterior to posterior as renal artery, renal vein and renal pelvis which was not inconsonance to normal arrangement described in text book.

On the Right Side:

The right renal artery took origin from the abdominal aorta just below the origin of superior mesenteric artery. At about 2cm from its origin, it divided into anterior and posterior divisions in the prehilum region in front of the right renal vein. The anterior division gave 3 segmental arteries and the posterior division gave one segmental artery in the hilar region.

Fig 1: Lt. Renal Hilum Showing Lt Renal Artery Anterior to Lt Renal Vein

**On the Left Side:**

The hilum was normal in size and situated on the medial border. Two Left renal artery arose from side of abdominal aorta, 1st left renal artery which was anterior and 2nd left renal artery which was posterior to the left renal vein, in relation. The second left renal artery entering the hilum directly without branching into divisions. The following variations found in:

- i. Two cadavers showed the accessory renal arteries.
- ii. An elderly male cadaver showed the following variations.

Accessory renal artery on left side and right renal artery arising from the abdominal aorta entering at the hilum of the kidney in front of the renal vein and renal pelvis.

Discussion:

In our case, accessory renal artery is passing to the hilum of the kidney in front of the renal vein and renal pelvis. Accessory renal arteries are not uncommon they are derived from the persistence of embryonic vessels that formed during the ascent of kidney.

Kidneys develop in three stages of development pronephros, mesonephros and metanephros during this process the kidneys ascend from pelvic to the lumbar region. When the kidneys are situated in the pelvic cavity, they are supplied by the branches of common iliac arteries. While the kidneys ascend to lumbar region, their arterial supply also shifts from common iliac artery to abdominal aorta.

Accessory renal arteries arise from the abdominal aorta either above or below the main renal artery and follow it to the hilum. It is important to be aware that accessory renal

arteries are end arteries; therefore if an accessory is damaged, the part of kidney supplied by it is likely to become ischemic. [2]

Fig 2: Lt Renal Hilum Showing Lt Accessory Renal Artery Posterior & Lt Renal Artery Anterior to Lt Renal Vein

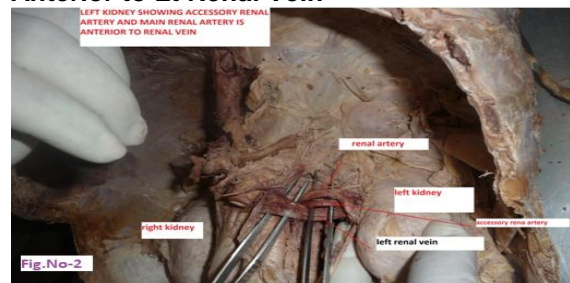
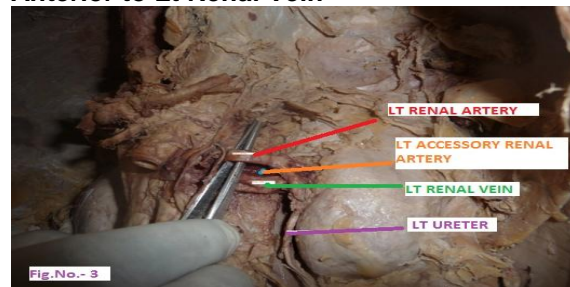


Fig 3: Lt Renal Hilum Showing Lt Accessory Renal Artery Posterior and Lt Renal Artery Anterior to Lt Renal Vein



The various types of accessory renal arteries, their positions, method of entry to the kidney and its segmentation were studied extensively by Sykes. [3]

When there are two or more renal vessels, the vessels do not anastomose within the substance of kidney. Each artery supplies a separate part of kidney; hence none of the multiple arteries can be regarded as accessory.

Obstruction of any renal artery leads to cessation of function and death of the part of kidney supplied by it; hence the term accessory is misleading because they are not extra but essential tissue sustaining arteries without anastomosis between them, which correspond to the segmental branches of a single renal artery. [4, 5] Bordei, Sapte and Iliescu reported 54 cases of double renal arteries supplying one kidney originating from aorta. [6]

Out of 54 cases, 6 cases were bilateral. In about 28 cases supplementary renal artery entered the kidney through the hilum, in 16 cases it was inferior polar and in 5 cases it was superior polar. [6] Embryological explanation of these variations has been presented and discussed by Felix. In an 18 mm fetus, the developing mesonephros, metanephros, suprarenal glands and gonads are supplied by nine pairs of lateral mesonephric arteries arising from the dorsal aorta.

Felix divided these arteries into three groups as follows: the 1st and 2nd arteries as the cranial; the 3rd to 5th arteries as the middle, and the 6th to 9th arteries as the caudal group.

The middle group gives rise to the renal arteries. Persistence of more than one artery of the middle group results as multiple renal arteries. [7] Thus the multiple renal arteries in our study are a result of persisting lateral mesonephric arteries from the middle group. [7]

These variations reported different regions of abdomen and pelvis are important not only in the view of development but also important for the surgeons dealing with kidney transplantation, obturator hernias and urogenital surgical procedures. [8]

We observed cases of single renal artery in 19/20 (95%) on right side and 18/20 (90%) on left side, (Table 1) originating from abdominal aorta. Multiple renal arteries originating from abdominal aorta were present in 1/20 (5%) cases on right side and 2/20 (10%) cases on left side, these arteries include double hilar arteries (DHA). (Fig. 1)

The classical arrangement (V-A-P), as is given in the standard text books, was observed in 18 out of 20 cases, which accounted for the highest (90%) incidence in our study. It was followed by the next highest incidence (10%) which was seen as the (A-V-P) type of arrangement. (Fig. 2)

Conclusion:

An anatomical knowledge on the patterns of the structures in the renal hilum is of paramount importance for various urological surgical procedures, such as in laparoscopic nephrectomies, anastrophic nephrolithotomies and renal transplantations, segmental nephrectomies for hilar mass in which clamping of the hilar vessels is the prerequisite and also helpful for radiologist and physician to understand pathophysiology of renal disease.

Out of 20 specimens, two cadavers showed left accessory renal arteries and a right renal artery arising from the abdominal aorta entering at the hilum of the kidney in front of the renal vein and renal pelvis.

Table 1: Percentage Distribution of Renal Arteries for Right and Left Kidney

Arterial features	Rt. kidney (%)	Lt. kidney (%)	Total (%)
Single renal artery	19/20 (95)	18/20 (90)	37/40 (92.5)
Multiple renal arteries	1/20 (5)	2/20 (10)	3/40 (7.5)
Double hilar arteries	1/20 (5)	2/20 (10)	3/40 (7.5)

Table 2: Comparison of Pattern of Arrangement of Renal Structures

Hilar structure arrangement pattern (antero-posterior)	Present study	Study by Trivedi S et al., (MP, India)	Study by Joao A et al., (Brazil)
V-A-P	90%	19%	83%
A-V-P	10%	NA	3%

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Fig.1: Percentage Distribution of Renal Arteries

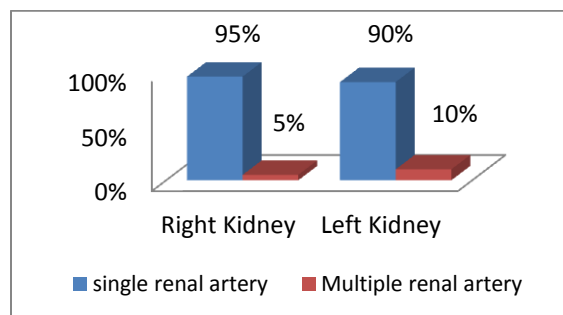
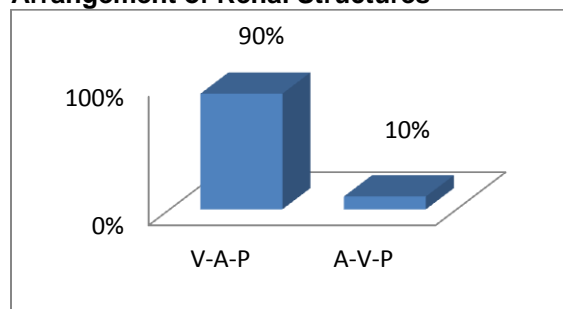


Fig. 2: Comparison of Pattern of Arrangement of Renal Structures



Review Research Paper

Mass Disaster: Identification of Victims with Special Emphasis on Dental Evidences

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Abstract

Mass disaster is a destructive episode in which so many persons are injured and or/died that it become beyond the management of local emergency medical services. The mass disaster is primarily investigated to establish identity of the victims. The investigation starts with the photography of the site and collection of evidences. Attempt should be made to identify the dead bodies first by their relatives and friends and if not identified, fingerprints and clothing & personal belongings should be collected and preserved. In autopsy features such as sex, age, race, stature, complexion & features, moles, birth mark, scars and dental peculiarities etc. should be noted in the post mortem report or in pink DVI form. In identification from teeth by comparative method, postmortem dental records are compared with ante mortem records of suspected person from their dentists either manually or through certain computerized programs such as WinID4, Plass Data, CAPMI etc. Age, sex, race, socioeconomic status, occupation, habits etc. can also established by teeth that also help in identification. If identity is still not established teeth are sent for DNA profiling and skull for superimposed photography.

Key Words: Mass disaster, Identification, Dental profiling, DVI form

Introduction:

Mass disaster is an unexpected event that causes serious injury and death to a large number of people. Webster's New International Dictionary defines disaster as a "sudden calamitous event producing great material damage, loss & distress".

The term "disaster" originated from French words, 'des' means bad or evil and 'astre'-star. The word disaster denotes bad star or bad luck, act of God as most of the disasters such as floods, earthquakes; volcanoes, tsunami etc. are natural. [1]

But now large numbers of disasters are also caused by human beings accidentally as air-crash & transportation accidents or willful riots, terrorist attack etc.

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WHO defined it as an event, natural or manmade, sudden or progressive, which impacts with such severity that the affected community has to respond taking exceptional measures? When a death of 12 or more persons occurs in a single episode, it is accepted as a mass disaster. Natural disasters are usually more enormous, killing hundred to thousand or more of the people, sometimes whole of the communities are wiped out.

Millions of the people are affected every year. It is estimated that approximately 250,000 deaths occur globally every year in disastrous events costing about 50,000 million US dollar. Most of the countries have "Mass Casualty Plan" which includes medical and hospital services, fire service and police to deal the cases of mass disaster. These plans are mostly clinically orientated; often ignore provision for dead persons. In this paper, attempt is made to discuss the methodology and problems in investigation of deaths in mass disaster.

Investigation of Mass Disaster:

The objects of investigation of death in mass disasters are:

- To retrieve and reconstruct bodies and fragmented bodies decently
- To establish personal identity
- To conduct autopsies and establish the cause of death to some or all and to assist in reconstructing the cause of disaster

- To collect evidences and materials for toxicological analysis (especially alcohol and carbon monoxide) to establish cause of the disaster. [2]

Investigation of mass disaster is a team work usually consists of Police officer, Forensic Pathologist, Photographer and Technical Assistants. Norway was probably the first country to develop a model of investigation procedure in mass disaster and included dentist also in the team for identification of victims.

This is now practiced in all Scandinavian countries, Europe, USA, and Australia. In India, no such practice is followed; collection of evidence at the site of disaster and shifting the dead bodies to the morgue for autopsy is done by the police officials. Post-mortem examination is conducted by General duty medical officers.

Medico-legal autopsy may not require in all the cases of mass disaster especially where the bodies are identified and their cause of death is apparent. Investigating officer, after summarizing the case, hands over the dead body to relatives for last rituals. The service of dentist is generally not taken in investigation.

Investigation/management of mass disaster is conducted in three phases;

- First at the site of accident for collection of evidences,
- Second in mortuary for medico-legal autopsy and
- Third, the last one in the laboratory for comparison of records and reconstruction of events. [3]

First Phase (At the Site of Accident):

Priority should be given to the survivors. All efforts should be made to save the life of injured person first, without unduly endangering rescuers from the various continuing dangers e.g., fire, explosion etc. The place should be barricaded with rope and do not allow outsiders inside the covered area.

The dead bodies should be located, photographed in situ and tagged with a number. Sketch the plan of disaster site showing main spot of destruction and exact position of bodies.

If bodies are mutilated, separate them by matching dismembered parts. Make sure that things belong to one body should not mixed to others. Place individual body in a suitable container preferably in a transparent polythene sheet & transfer them in the mortuary for medico-legal autopsy.

A temporary media room should be started close to the site of disaster for news regarding the victims injured/dead for relatives and to the press and these information should

be flashed at regular intervals. An arrangement for counseling of relatives of the victims should also be started at the site and if not feasible, it should be near the mortuary.

Second Phase (In the Mortuary):

Problem arises in keeping large number of dead bodies and in conducting post-mortem examination especially in major disasters. It is better to assign a building of suitable size as temporary mortuary and if feasible, arrange refrigerated cooling chambers.

For early disposal, a number of autopsy booths can be made temporarily in a hall so more post mortems can be conducted at a time.

The arrangements of embalming and casketing room for interviewing relatives and viewing bodies should also be made in the mortuary.

Post-mortem Examination:

Identification of deceased is the first and foremost objective of investigation of mass disaster. The dead body, in India, is usually identified by police with the help of local people/relatives present at the site of accident or in the mortuary. If body is mutilated, arrange all the pieces of packet in anatomical position and look for any duplication or misfit of the part /organ and photograph them. In unknown cases, all attempts should be made to record fingerprints of all the ten fingers before medico-legal autopsy.

Clothing, Jewelry & Other Personal Belongings should be removed from the body, examined for brand, size, color & design, laundry mark, tear and stains; photographed them, make a bundle and handed over to accompanying police constable for future identification. Stains if present should be collected and send to FSL for investigation.

External Examination:

If the dead body is not identified, features helpful in establishing identity such as sex, probable age, stature, weight, complexion & features, length & color of hair, color of eyes; moles, birth mark, tattoos, scars, occupational mark, habit, congenital or acquired abnormalities such as super-numeric fingers or toes, cleft lip &/or palate, amputation, polio, diseases etc. and noted in the post-mortem report.

All the injuries should be examined to find out the cause of death and cause of the disaster. If there is any bullet or splinters in the wound, it should be collected, preserved and sent them to FSL for investigation.

Ideally, complete radiological examination should be done for each victim to find out any clue for new/old bony injuries or

sabotage. Radiographs are also helpful in identification in case of extremely burnt body and in revealing the presence of articles embedded deeply in charred muscle that may be overlooked otherwise.

If identification of victims is established and bodies are not contributing in any way in the reconstruction of the accident, only external examination is sufficient.

Internal Examination:

No post-mortem is complete without internal examination. It not only helps to find out cause of death and in collection of organs and tissue for histological, bio-chemical and toxicological analysis but also in collection of evidences relevant to identification such as preexisting disease, surgical absence of internal organs, presence of postsurgical states like gastroenterostomy etc. All the details of post mortem are recorded on the prescribed format.

Dental Examination:

At the end of the autopsy, jaws and teeth are examined to collect dental evidences.

Being one of the hardest substance teeth are very helpful in establishing identity of unknown victims of mass disaster especially when other parameters of identification such as stature, finger prints, clothing and personal belongings etc. are damaged due to fire, explosion, corrosives etc. or in advanced decomposition. [4]

In mass disaster identification of the victims from teeth can be established either by [5]:

1. Comparative dental identification or
2. Reconstructive postmortem dental profiling

1. Comparative Identification:

When dental records such as dental chart, model, radiograph & photograph of suspected/ missing person is available with his/her dentist, dental characteristics of the deceased is collected from the remains & matched with the ante mortem dental records in comparative identification. To facilitate dental examination, bilateral incision is made from upper anterior neck to the back of the ears.

The skin and underlying tissues are then reflected upward over the face to expose the mandible and maxilla. The teeth are brushed to clean and photographs are taken, one from frontal view of anterior teeth, and two occlusal views of the upper and lower jaws.

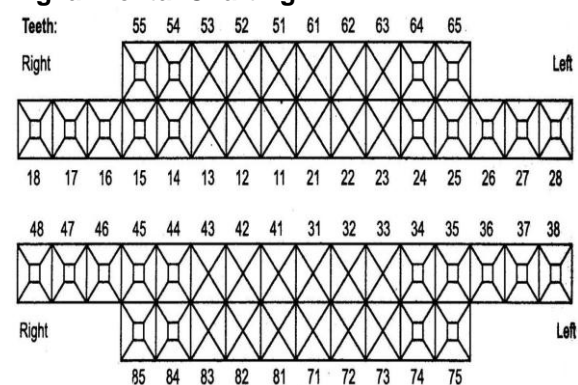
The peculiarities of teeth are inspected in both upper and lower jaws. All the teeth are examined individually for size, shape, color & stains, diseases & treatment such as caries, cavity, filling, RCT, fracture, crown, bridge, implant, artificial denture etc. and developmental

anomalies like impacted or un-erupted third molar, retained deciduous teeth and supernumerary cusps/teeth. (Fig. 1)

Jaws are also looked for its size & shape, protrusion or reversion; teeth are crowded or widely spaced and missing of teeth.

If any tooth is missing, note down their number and situation; approximate time of missing, recent or old; ante mortem or postmortem and cause of missing, trauma, extraction or natural fall etc. should also be noted. Artificial denture, if present, looked for full or partial; upper, lower or both; base, material, technical mark and presence of any personal dental identifier or encoded information chip. All the characteristics are recorded on dental chart using International Dental Charting System.

Fig. a: Dental Charting



X-ray of both jaws & teeth are taken and information revealed by these radiographs is further added in the chart. Numerous Disaster Victim Identification (DVI) protocols such as US Department of Health & Human Services (DMORT), National Crime Information Center USA (NSIC data collection entry guide) are available to record ante-mortem and postmortem dental records.

Australian Police and Interpol have prepared colored (pink, yellow & white) Disaster Victim Identification (DVI) forms. [6] (Fig. 2) Pink DVI form is for the post mortem records of victims of mass disaster and yellow form for ante mortem record when he was living.

All the data collected from autopsy are recorded in pink DVI form.

Reconstructive PM Dental Profiling:

When ante-mortem dental records of deceased are not available, the person can be segregated from the population on the basis of post mortem dental profiling i.e. information of age, sex, race & geographical distribution, socioeconomic status occupation, habits etc. from the teeth. This is more helpful when victim has to identify in a group of known persons as in

house fires; rail or aircraft accidents etc. from the list of person/ passengers.

Age of the victim is usually accessed by eruption of teeth and calcification of root. But, by this method, age can be estimated only up to 25 years. Age, in older person, can be estimated by patho-physiological changes in teeth such as attrition, secondary dentine formation, incremental lines, root transparency etc. in ground sectioning of teeth. [7-10]

Age can be also estimated by racemization of Aspartic acid from human dentin [11] and radioactive C14. [12]

Sex can be determined by Barr bodies in pulp tissue, Davidson bodies in polymorphs and Y chromosomes. DNA examination of pulp tissue using PCR analysis of the amelogenin gene is also a reliable method of sex determination.

Race and Continental affiliation can be ascertained from teeth as Carabell's cusp (ranges from a slight groove to a full size cusp on the mesiolingual cusp of the maxillary first molar tooth) (Fig. 3), bilobate chin, undulating mandibular border and deep canine fossae in Europeans; multicusped and multiple premolars, maxillary midline diastemas, straight mandibular border and prognathism in Africans and shovel-shaped incisors (Fig. 4), buccal pits & extension of the enamel below the general contour of the enamel border on the buccal surface of mandibular molars in Asians are commonly present. [13]

As to the socio-economic, poor oral hygiene and/or inferior dental restorative quality indicates low socio-economic status and gold filling of solvent class. Silver or gold color metal crowns on anterior teeth seen in Mexico and Central America, mottled teeth due to dental fluorosis seen in SW Texas, SE New Mexico, Rural United States, China & Africa; Black teeth in Japanese and Southeast Asians, black or brown stains of betel leaf & nut chewing in Indian subcontinent; frequent caries & acidic erosion, tooth fracture & advanced periodontal disease seen in addicts of cocaine, heroin, methadone or methamphetamine and unilateral attrition and staining seen in pipe smokers.

Attrition of anterior teeth is seen in traffic police & flute players; notched incisors in carpenters, cobblers, electrician & hairdressers (Fig. 5); blue lines in gum in printers, painters & goldsmiths etc. green, yellow or black stains in metal workers using copper, nickel, tin or iron due to chronic inhalation and phossy jaw in chronic phosphorus poisoning.

Mulberry molars and Hutchinson's incisors are seen in congenital syphilis, multiple

supernumerary teeth in Cleidocranial dysplasia, endogenous brownish-blue discoloration of dentin in Dentinogenesis imperfecta, endogenous brown yellow, white "snowcapped" discoloration of enamel in Amelogenesis imperfecta, congenitally missing teeth, peg teeth, sparse hair in Ectodermal dysplasia and endogenous discoloration of the dentin which appears as yellow/brown/green bands in ingestion of tetracycline during tooth formation.

For DNA profiling teeth preferably molars are extracted, placed in sterile plastic containers and sent to a DNA laboratory.

All these information are recorded on pink DVI form. If skull and photograph of suspected person is available superimposition technique can be used to establish identity.

Third Phase (Comparison of Records and Reconstruction of event):

In certain countries there is a separate team for collection of ante mortem information of victims of disaster and missing person.

They collect the information regarding victim's age, sex, stature, complexion & features, mole, birth mark, tattoos, scar, occupation, habit, clothing, diseases including dental history etc. from their family members and friends just after the incident.

The member of the team especially a dentist contact all the dentists whom the person visited in their lifetimes for treatment and gathers all the radiographs, charts, photographs, notes, and anything generated through the course of their treatment. They also collect a recent photograph of the deceased; fingerprints if available and buccal smears or blood sample of next-of-kin for his/her DNA profiles and all this information are recorded on yellow DVI form.

The comparing ante-mortem records to post-mortem data manually may take weeks to months in major disaster. Now matching is easy & time saving through certain computer software programs. The first dental software program "Computer Assisted Postmortem identification" CAPMI was developed by Lorton, Langley and Weed in 1980 and used by US Military and other agencies in many disasters.

Other computer-assisted applications are WinID3 developed by Dr. James McMivney and widely used in the United States, Plass Data developed by DVI System International and used by INTERPOL and UVIS/UDIM developed by Dr. Kenneth Aschheim in consultation with New York City Office of the Chief Medical Examiner in 2007. [13]

These programs narrow down the area of comparison by exclusion method and the final identification is done by a qualified dentist.

If more than 7-8 points of deceased matched exactly with ante mortem dental records of a missing person, the identity can be established with certainty. In India no such programs are used and all the information related to dental examination is also recorded in postmortem report and matched with ante mortem records if available.

Record Keeping:

Although computers can be used to maintain the files and records of victims of mass disaster and to track human remains, there must also be a paper trail in which the data and information are taken from and put into a data management system.

All files and records, both ante-mortem and postmortem, become the property of the investigatory agency after the incident. These records are important because in some situations individuals are being identified by DNA and it will take days, months, or years before all of samples are identified. All records and files should be handled properly, and the chain of custody should be followed on all reports, photographs, and specimens.

Conclusion:

Teeth are the hardest substance in the body and no two sets of teeth are exactly alike. When other organs and identifying features such as stature, finger prints, clothing and personal belongings etc. are destroyed due to advanced decomposition, mutilation, fire, explosion or by corrosives, teeth are well preserved. That's why teeth are an important tool for establishing identification especially in mass disaster.

The services of dentists are now used in large number of countries in investigation of mass disaster but not in India and developing world. For better results, it is advised that the dentists must preserve dental records of their patients and make them available to investigation agencies for identification purposes. The services of dentist should be taken in investigation of mass disaster or doctors should be trained in collection and charting of dental evidences and in matching with ante mortem dental records.

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Fig. 1: Super-numeric Cusps in Molar



Fig. 3: Carabell's Cusp in Maxillary Molar



Fig. 4: Shovel-shaped Incisors



Fig. 5: Notched Incisors



Fig. 2: Disaster Victim Identification (DVI) Forms

P.M. (pink) VICTIM IDENTIFICATION FORM DEAD BODY No: _____ F2	
Nature of disaster : _____	
Place of disaster : _____	
Date of disaster : ____ Day ____ Month ____ Year Male <input type="checkbox"/> Female <input type="checkbox"/> Sex unknown <input type="checkbox"/>	
86 DENTAL FINDINGS in permanent teeth (Notify temporary teeth specifically)	
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Review Research Paper

Autopsy Practice, Potential Sources of Occupational Hazards: A Review for Safety and Prevention

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Abstract

The mortuary can be a dangerous place. At greatest risk in this environment is the individual who is ignorant of or ignores the potential hazards at necropsy. Such people are a liability to themselves as also to colleagues working in the mortuary, visitors to the mortuary (clinical staff and students), and those involved in handling the body (relatives, undertakers, embalmers and crematoria staff), or material derived from it (laboratory workers) after necropsy. The hazard posed by some material or situation is its potential to cause harm. Risk is the probability or chance that it will actually harm someone. In India, both the mortuaries and their safety norms are lagging behind the expected international standards. The autopsy surgeons are prone to a myriad of occupational risks in the form of contagious diseases which may be due to the faulty mortuary infrastructure like drainage systems, ventilation and biomedical waste disposal. Added to these are the lackadaisical administrative approach and the pathetic implementation of mandatory safety guidelines. This review article focuses on commonly encountered occupational risk in autopsy practice and guidelines to minimize them.

Key Words: Autopsy room, Mortuary, Occupational hazard, Occupational safety & health

Introduction:

The world over autopsy retains its value for determining the cause of death, detecting clinically unknown lesions, identification of unknown/mutilated/decomposed bodies. [1]

The autopsy room has always been a potential source of infection and the autopsy surgeon/Forensic pathologist and other persons engaged directly or indirectly in conducting postmortem examination are at greater risk of exposure to biological hazards like blood borne viruses and other infections including HIV, Hepatitis (A, B, non-A & non-B), Tuberculosis, Creutzfeldt Jakob disease, HTLV-1. [2-6]

With death, there are neither the reticulo-endothelial cells nor the blood-brain barrier to restrict the translocation of microorganisms within the dead human remains. [6] Dead-bodies are often brought for postmortem examination prior to completion of testing, which may reveal advanced infections and deadly diseases or syndromes.

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Apart from this routine risk of exposure, a forensic pathologist frequently works on dead bodies that are in various stages of decomposition. [7]

Hazard and Risk:

'Hazard' is the intrinsic capacity of an agent, a condition or a situation to produce an adverse health or environmental effect. 'Risk' is the probability that a particular adverse event occurs during a stated period of time or results from a particular challenge. An agent may be hazardous but not necessarily result in a risk until exposure occurs and a dose is delivered to target organs. [8]

Transmission of infection requires the presence of an infectious agent, exposure to that agent and a susceptible host, which indisputably is fulfilled by autopsy rooms.

Routes of Infection:

Infections in the autopsy room may be acquired by any one of the following routes:

1. Wound resulting from needle stick injury (e.g. sharp objects) contaminated with blood or body fluids.
2. Splashing of blood or other body fluids onto an open wound or area of dermatitis.
3. Contact of blood or other body fluids with mucous membranes of eyes, nose or mouth.
4. Inhalation and ingestion of aerosolized particles. [9]

Commonly Acquired Pathogens at Autopsy:

The infectious agents are categorized into 4 hazard groups, based on their:

- Virulence as infections.
 - Transmissibility & ability to cause epidemics.
 - Preventability (by vaccine or prophylactic chemotherapy) and
 - Treatability.
1. **Hazard Group 1:** An organism most unlikely to cause human disease.
 2. **Hazard Group 2:** An organism that may cause human disease, which might be a hazard to a laboratory worker but is unlikely to spread to the community, exposure rarely producing infection with availability of effective prophylaxis and treatment.
 3. **Hazard Group 3:** An organism that may cause severe human disease & present a serious hazard to laboratory workers. It may present a risk of spread to the community but there is usually effective prophylaxis and treatment available.
 4. **Hazard Group 4:** An organism that causes severe human disease & is a serious hazard to laboratory workers. It may present a high risk of spread to the community & there is usually no effective prophylaxis and treatment available. [10]

The significant group for mortuary workers is "Hazard group 3" (HG3), caused by biological agents tuberculosis (TB), human immunodeficiency virus (HIV), hepatitis B & C viruses (HBV, HCV) which can cause serious human disease & present a serious risk to employees. In HG4 there is usually no effective prophylaxis or treatment available. This group includes viral haemorrhagic fevers (VHF): Marburg, Ebola, Lassa fever, Congo Crimean haemorrhagic fever & Small pox. [11]

Mycobacterium Tuberculosis:

It has long been known that staffs working in the mortuary are at risk of occupational infection with *M. tuberculosis*. Literature abounds with reported cases of acquired pulmonary and cutaneous infection. Indeed, René Laennec (1781–1826; inventor of the stethoscope) died of the disease, having acquired it from the dissection of tuberculous cadavers. Xavier Bichat (1771–1802), regarded as the "Father of Histology" and performer of some 600 necropsies in the year of his death, also succumbed to the disease.

Pulmonary tuberculosis accounts for approximately 90% of cases and is acquired by inhalation of aerosol or dried material. [12]

Aerosols are generated by aspirators, oscillating saws and water hoses applied to the dead bodies while even compressing and dissecting lungs can give rise to infectious aerosols. [13] Cutaneous infection (paronychia, wart, or verruca) accounts for 5–10% of cases, the bacillus being introduced into previously traumatized skin or via a skin puncture. Mucocutaneous transmission of tuberculosis at necropsy has not been reported.

The resurgence of tuberculosis, especially in HIV positive patients, and the emergence of multidrug resistant strains reinforce the importance of this disease in any consideration of necropsy health and safety. [11] The increase in cases of multidrug resistant tuberculosis recently is an alarming call for autopsy room workers as well as those who are exposed to it in a professional capacity. Embalmed bodies have yielded active *M. tuberculosis* for as long as 60 hours after fixation. [14]

Hepatitis:

Hepatitis B virus is the most highly transmissible of all the blood-borne viruses. Infection with hepatitis B can produce a chronic infection that places the individual at risk of death from chronic liver disease or primary hepatocellular carcinoma. The long incubation period of 6 to 24 weeks often masks the association between the event of infection and the onset of symptoms. [15] Among physicians, pathologists have been recognized as high-risk group for occupationally acquired hepatitis B, because of their exposure to blood. [16]

The prevalence of infection is highest in forensic autopsies as they involve bodies of drug addicts, particularly intravenous users. Surveillance of Forensic medicine personnel or staff workers suffering sharp injuries suggests that the overall chance of acquiring infection by this route is about 5%, although if the contaminating blood contains HBeAg, the risk of infection may be up to 30%. [17]

HIV:

The National AIDS committee was constituted in January 1986 after the first AIDS case was registered in the state of Tamil Nadu; The first case of occupationally transmitted HIV infection was reported in medical literature in 1984. [18] HIV serophobia has been documented among staff working in mortuaries handling high risk cases since the 1980s, although there is no evidence that HIV is readily acquired in the mortuary.

Most documented cases of HIV seroconversion after occupational exposure occurred

after needle-stick injuries. The estimated HIV transmission rate after a single percutaneous inoculation is 0.1 to 0.36 %; this may be underestimated in comparison with the risk associated with accidental deep scalpel injuries. The risk of sero-conversion after occupational exposure will depend upon the viral load, amount of fluid inoculated and susceptibility of the health care worker.

Most health care workers found to be HIV seropositive have a history of behavioral or transfusional exposure. [11] The greatest concern however is the dead body with an undiagnosed disease. According to a report, viable HIV was isolated from blood obtained 16 days after death. [19]

Apart from the above commonly encountered infections an autopsy worker is likely to be exposed occasionally to Hazard Gr.4 infections, Rabies, Dangerous Foreign bodies (hidden sharp objects, exploding bullets), cyanide poisoning, radioactive contaminants.

Autopsies on bodies with Hazard Gr.4 pathogens should only be performed where absolutely necessary. [12] Formaldehyde is a toxic agent to which an autopsy worker is regularly exposed to. Long term exposure has also been associated with increased risk of lung cancer. [20] Mentioned above are the potentially dangerous factors in the mortuary setting. Added

to these are the currently increasing outbreaks of SARS and Ebola the world over, which our mortuaries are not yet adequately equipped to handle.

Prevention/ Precautions:

Every dead body should be considered potentially infectious and dealt accordingly as per the recommended precautions, procedural techniques and knowing the principles of pre-exposure prophylaxis. The entire autopsy area and its contents should be designated as 'Biohazard' and appropriate warning signs placed in the mortuary premises. Therefore safety awareness in the mortuary premises is an effective preventive step. [21]

Six categories of potential risks are encountered by the autopsy staff during performing an autopsy and these are; (Table 1, 2 & 3 enlists the risk categories, activities leading to risks & preventive measures.) [21]

1. Mechanical injuries sustained by falling or slipping on the floor.
2. Sharp cutting injuries.
3. Electrocution.
4. Exposure to toxic chemicals (Formalin, Cyanide etc.)
5. Infections.
6. Radiation exposure.

Table 1: Risks and Hazards in Mortuary

Risk Category	Activity	Risks
Physical Risks	1. Use of heavy equipment/loads. 2. Lifting and dragging bodies on a slippery floor	Accidental injuries. Musculoskeletal injury - particularly back strain. Slipping and falling.
Sharp Force Injury	During autopsy, mishandling of a. Scalpel / needle, fragmented bullets with jackets b. Pointed ends of fragmented long bones c. Medical devices such as surgical staples d. Needle fragments in drug-addicts.	Cuts or puncture wounds. Distal thumb, index and middle fingers, are the most frequent injuries sustained by pathologists.
Electrical Injury	1. Electrical instruments (saws) are routinely handled with wet gloves 2. Poorly maintained electrical fittings and connections. 3. Often implanted cardioverter-defibrillator in dead bodies.	Shock and Electrocution
Chemical Exposure	1. Formaldehyde 2. Use as a fixative to preserve tissues for histo-pathological examination. 3. Handling formalin- fixed organs/specimens that have not been thoroughly washed. a. Working in poorly ventilated areas. b. Exposure to highly poisonous aerosol, gases or volatile substances e.g. Organo-phosphates (malathion, parathion) poisoning deaths, hydrogen sulfide, cyanide poisoning while opening stomach/other body cavities.	Irritant effect on mucous membranes of eyes, respiratory tract and skin. Menstrual reproductive disorder, sexual dysfunction. Long-term exposure to the substance has also been associated with an increased risk for all cancers particularly the cancer of lung.
Radiation Exposure	1. Implanted radioactive materials for cancer treatment. 2. X-ray exposure before and during an autopsy taken routinely and frequently.	Potential risk for radiation injuries. Malformation and congenital anomalies in pregnant mortuary workers.
Infectious Disease	Splashing/ Close contact Broken skin Mucosal surfaces. Blood, body fluids and tissues of dead body with infectious diseases, drug addicts etc.	Aerosol: Mycobacterial agents. Blood/body fluid: HIV, Hepatitis B, Hepatitis C & parasitic infections. Intravenous drug abusers: Pose the greatest risk of transmitting viral, bacterial agents like staphylococcus, streptococcus and salmonella.

Table 2: Preventive Guidelines at Mortuary

Injury Category	Prevention or Remedy
Physical Injuries	Proper lifting techniques: 1. Rolling the body instead of lifting. 2. Wearing proper back supports. 3. Hardwearing, impervious, non-slippery floor is essential: a. Mopping the floor to keep surfaces dry. b. Wearing protective shoes. c. Proper ventilation and adequate lighting to keep floor dry and room well-lit.
Sharp Injury	Safe handling of needles and sharp instruments: 1. Should not be left lying around the work area. 2. Habit of putting scalpels on a firm, stable surface (table) by one prosector and then picked up by the second. 3. Do not hold tissues with the fingers of the non-cutting hand. 4. Surgical towels should be placed over the cut edges of the ribs to protect against a scrape injury. 5. Non-pointed (blunt-tipped) scissors should be used wherever possible. 6. Disposal of entire syringe and breaking the needle with needle shredder. 7. Wear cut-resistant gloves (finely woven stainless steel fabric) on the non-dominant hand. 8. Use a thick (3-inch) sponge to stabilize the organ with the non-cutting hand for organ slices. 9. Pre autopsy whole body radiography to locate bullet fragments and irregular bone fragments.
Electrical Injury	1. Properly installed ground fault interrupters (GFI electrical receptors). 2. Implanted cardioverter-defibrillator should be deactivated before manipulation. 3. High-quality latex surgical gloves can protect from inadvertent shock.
Chemical Exposure	Adequate ventilation: 1. Air-exhausted and air-conditioned mortuary 2. Negative-pressure isolation room 3. Wear chemical protective gloves, visors and glasses for protection of face and eye. 4. Mandatory training for employees exposed to formaldehyde above 0.1 ppm.
Radiation Exposure	1. Detailed information of the radioisotope (the amount given and the time of administration) should be attached to the medical record and death certificate. 2. Pathologist and the radiation safety officer to be alerted by the attending physician if the body contains more than 5mCi. 3. Wearing radiation-monitoring badges and Standard procedures for X-ray safety techniques should be followed. 4. Wearing protective rubber gloves can reduce [beta]-radiation very much, but not the [delta]-radiation from the isotopes. 5. A team of pathologists may be required to limit individual exposures to prosector by performing limited portion of the autopsy. 6. Female pathologists and assistants of childbearing age should consult radiotherapist and/or oncologist before commencing the autopsy on a body having implanted radiation materials. 7. Autopsy room should be monitored for radioactive contamination and de-contaminated if necessary.

Table 3: Preventive Measures from Contaminants of Infectious Diseases in Mortuary

Blood borne Pathogens	1. Vaccination against hepatitis B. 2. Prevention of access of immunosuppressed or immune deficient individuals and individuals who have uncovered wounds, weeping skin lesions. 3. 10% formalin should be introduced into the lungs after appropriate microbiological specimens have been taken and before the lungs are examined. 4. Standard universal precautions do not apply to faeces, nasal secretions, sputum, sweat, tears, urine and vomitus unless they contain visible blood.
Agents spread by aerosols e.g. Mycobacterium tuberculosis	1) Adequate ventilation in the post-mortem room. 2) Unauthorized entry & free movement within mortuary should be restricted. 3) Bone surfaces should be moistened before sawing in order to cut down the dispersion of bone dust. 4) Plastic cover or a vacuum bone dust collector attached to the vibrating saw. 5) Immunization with BCG. 6) In case of tuberculosis infection, surgical masks have proven insufficient, in such cases, wearing of N-95 respirators should be made mandatory (High-Efficiency Particulate Air (HEPA) masks.
Exotic agents (both Aerosol transmitted & Blood borne) for which there is no prophylactic or post-exposure treatments	1. Avoids cuts and punctures. 2. Protection against tetanus. 3. All persons in the autopsy room should wear a surgical gown with full sleeves, surgical cap, goggles and shoe covers as recommended safety devices to protect the eyes, skin, and mucous membranes. 4. All the exposed personnel should have access to appropriate health care facilities at the earliest. Information should be given to the authorities and an appropriate medical advice should be sought. 5. Autopsy personnel should have baseline blood tests / serological status of HBV and HIV and tuberculin skin test at the time of employment and a periodic retesting should be undertaken at regular intervals. 6. Training and education of staff in safe working environment and appropriate work practices 7. Use of labels such as "Danger of infection" on the dead body is considered appropriate. Cat. 1 : BLUE label - Standard precautions are recommended. Cat. 2 : YELLOW label - Additional precautions are recommended. Cat. 3 : RED label - Stringent infection precautions are recommended.

Recommendation:**1) Identifying Hazards:**

- Carrying out physical inspection.
- Analyzing accident records.

- c) Interacting with the employees.
- d) Observing and analyzing tasks and processes.
- e) Using consultants.
- 2) **Risk Assessment:** It is essential to evaluate the risk of every case entering into the mortuary complex. It is advisable to have an autopsy risk assessment tool in all mortuary setups where autopsies are performed.
- 3) **Hazard Control:**
- a) **Preparation and planning priorities for control:** Preparation of a written plan of the control measures, in consultation with employees. If control of each hazard is not possible immediately, a priority list should be constructed and the most worrying hazards dealt with first.
 - 1. Elimination of the risk posed by autopsies, both standard and high-risk, is not possible.
 - 2. Isolation of identified high-risk cases to facilities with appropriate work practice controls or isolation of certain procedures within autopsies to areas of effective environment control.
 - 3. Minimization of the risk can be achieved by the institutions, by forming their own policies of work procedures and personal protection along with appropriate training of staff, visitors and contractors.
- b) **Engineering Controls:**
 - 1. Facility design - The mortuary shall be so designed as to allow proper separation of clean and dirty areas by transitional zones.
 - 2. Facility Construction – As per the design, three areas with minimum standards should be constructed.
 - a) The 'Clean area' includes offices, changing areas, viewing room and reception.
 - b) The 'Transitional area' constitutes risk assessment area, vehicle bay and body storage. It is important that all workers and visitors to dirty areas move through the transition areas, and are provided with adequate information about personal protection, safety issues and emergency evacuation procedures prior to their entry. These transition areas need to provide adequate cleaning, showering, hand washing and toilet facilities.
 - c) 'Dirty areas' – Post mortem room, dirty storage for sorting and discarding

disposable material (medical waste, disposable instruments and equipment) and the cleaning and preparation of reusable equipment (non-disposable dissection tools, gum boots, face shields). International standards suggest a minimum 2 dissecting tables to allow for efficient work practice. Post-mortem rooms need to have adequate flooring, lighting, electrical fittings, surface finishes, water supply, drainage control, ventilation, emergency showers & eyewashes, work surfaces, and communication equipment.

- 4) **Personal Protective Equipment (PPE)** – The concept of universal protection is well known in health facilities. PPE is the final barrier to preventing hazards, known or unknown, from causing personal injury.
- 5) All employees of mortuary facilities should be educated to identify the hazards likely to be encountered, steps to minimize them and supervised training in the safe use of equipment. Mortuary facilities must have in place a programme which ensures that staffs are suitably vaccinated [22]
- 6) Mortuary facilities are maintained as per the laboratory guidelines, which are inadequate considering the multitude of autopsies performed and the bio-hazardous material preserved & discarded every day.
- 7) All mortuary employees should be covered by appropriate comprehensive health schemes, compensation benefits and expenses incurred due to occupationally acquired diseases.
- 8) Most mortuaries across the country are in a state of neglect and constant shortage of funds to procure minimum prescribed materials, leading to unhygienic work conditions thereby predisposing both the management and staff to a host of contagious and infectious diseases. The government should take genuine note of this and allocate more funds towards improving the work environment of all mortuaries.

Conclusion:

Mortuaries in India now need to have standards that are stringent enough to cope with the advent of the new or re-emerging infections which pathologists are increasingly confronted with. Of particular concern is the development of the multi-drug resistant strains of tuberculosis and the recognition of the major transmissible viral illnesses. In India, both the mortuaries and their safety norms are lagging behind the expected international standards.

Mortuaries and autopsy rooms across India lie neglected not only by the concerned administration but also by the government (both central & state) with little or no attempt to uplift them; the workers are exposed to the hazardous environment of mortuary. The directive principles of the Constitution of India provide for securing health and strength of employees, men & women, that the citizens are not forced by economic necessity to enter a vocation unsuited (Article 39), which therefore necessitates the introduction of an Act/ Rules by the Government of India and enact the statutes related to occupational safety and health for mortuary employees.

Ministry of labour and employment, Govt. of India and labour department of states who are responsible for the safety and health should notify mortuary environment as hazardous and prepare safe working guidelines as per international standards on OSH (occupational safety and health).

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Case Report

Bee Sting Envenomation: Rare Fatality

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Abstract

Among the invertebrates, insects, particularly hymenoptera, most commonly cause anaphylaxis. In stinging bees, wasps and ants, the ovipositor of female has been modified into a stinger. Honey bees leave behind their barbed stinger in the victim's body and eventually die by evisceration. Bee sting in most of the situations is potentially serious, the severity and duration of reaction varies from one person to another depending on location and no of bee stings received. The spectrum of bee sting disease ranges from local reaction to death. Stings from bees usually cause a transient local reaction which may last for several days and generally resolves without treatment. Occasionally death may occur mostly due to anaphylactic shock. Non anaphylactic causes of death are mainly due to multi organ failure. Honey bee sting is responsible for large number of casualty in tropical and subtropical countries.

Key Word: Bee stings, Envenomation, Anaphylaxis, Post-mortem Examination

Introduction:

The majority of insects causing stinging reactions belong to the order hymenoptera and the species under this order which are medically important are Apidae- honey bees; Vespidae- yellow jacket and hornet, wasp; Formicidae- ant. [5] Reaction to sting depends on

- The amount of venom injected,
- Absence and presence of sensitivity,
- Site of sting. [6]

Risk factors are associated with higher chance of insect sting and their reactions. Occupation like gardening, beekeeping, farming, greenhouse worker and other outdoor activities are more susceptible to bee bite. Cold climates and insect behavior also contributes risk.

Patients using NSAID, ACEI, and Beta blocker are also at increased risk. Most deaths related to hymenoptera stings are the result of immediate hypersensitive reaction causing anaphylaxis and less commonly death occurs from toxic effects of massive envenomation involving hundreds to thousands of stings.

Case Report:

Although honey bees sting is rare, yet it is not uncommon in rural and forest area. But unfortunately he was received dead.

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The history revealed that he got multiple bee stings while he was working in the field early in the morning. A swarm of bees attacked him and bee sting occurred over whole body.

The presenting complaint was pain at the site of sting. He was referred to our centre and found dead at the emergency ward. The body was sent to central morgue for post-mortem examination.

Autopsy Findings:

The dead body was average body built, conjunctiva clear, nail beds are livid, faint post-mortem lividity on back, rigor mortis was present over whole body, natural orifices were normal. No sign of decomposition was present.

On external examination, multiple stings bites marks were found over whole of the body. Whale and flare were found around the site of the bites. (Fig. 1 & 2)

Brain was intact, congested and edematous. Larynx and trachea were edematous. All other internal organs were congested. Cause of death was "Death due to anaphylactic shock".

Discussion:

The honey bee's barbed sting cannot be withdrawn by the insect, once it has penetrated the skin. The bee's only means of escape is to tear away part of its abdomen leaving behind the sting with its venom sac attached. The muscles of the sting apparatus continue to pulsate after the bee has flown away, driving the sting deeper into the skin and injecting more venom. [4]

The venom of winged hymenoptera contains over 30 individual compounds. These include biogenic amines e.g. acetylcholine,

dopamine, histamine, nor epinephrine, serotonin; polypeptide or protein toxins e.g. Apamin, melittin, kinins, MCD peptides;

Enzymes e.g. hyaluronidase, Phospholipase A, acid phosphatase and protease. [7]

Table 1: Major Constituent of Honey Bee Venom and Their Activities [1]

Peptides	Melittin	Hemolytic and Cytolytic activity
	Apamin	Neurotoxic activity, block potassium channel
	MCD peptides (mast cell degranulation)	Include release of histamine and allergic reaction
Enzymes	Phospholipase A	Block biological function of membrane, inhibit blood coagulation, decrease blood pressure
	Hyaluronidase	Cause spread of inflammation
	Acid phosphatase	Allergic reaction
	Protease	Tissue necrosis
Amines	Histamine	Allergic hypersensitivity and inflammation
	Dopamine	Increase pulse rate
	Norepinephrine	Increase pulse rate

Most of the death from hymenoptera stings are caused by dysfunction of body immune system where as the venom allergen principally reacts with cell bound specific Immunoglobulin E. [8]

The dermal, respiratory, circulatory and gastrointestinal system reacts to sting after one or a few initial sensitizing stings (type 1 hypersensitivity). The striking feature is the rapidity of death e.g. 58% dies in less than one hour and over 75% die within 6 hours. [8]

Autopsy report of 150 sting induced death showed that 70% were caused by airway obstruction followed by Anaphylactic shock as most important cause of death.

Mass envenomation occurs with greater than 500 honey bee stings. This is not an allergic response but is related to large amount of venom received by the victim.

The dose of sting bee that was calculated to kill half of the victim (LD50) is 19 stings per kilogram of body weight. [9] The spectrum of bee sting disease ranges from local reaction to death. [4]

The symptoms of most stings are:

1. Normal reaction: e.g. redness, flare, wheal;
2. Local reaction: e.g. swelling; superimposed infection e.g. cellulites;
3. Toxin reaction: e.g. Venom injection (no sensitivity);
4. Generalized allergic reaction: e.g. sensitivity;
5. Delayed reactions: 1-2 weeks after sting;
6. Psychological reaction: e.g. anxiety present; fatal reaction. [6]

Management:

The first local treatment is removal of stings from skin by scraping them out. Bee venom is acidic so it should be neutralized. Adrenaline is the only known effective control of immediate hypersensitivity reaction.

Cold pack should be applied locally to reduce pain. IV fluid, chlorpheniramine with close monitoring of respiratory, cardiac and renal functions are effective in treatment.

Conclusion and Suggestions:

Prevention is better than cure. Always try to avoid or prevent a situation where these insect get infuriated by human intrusion into their hives. The best possible cure or remedy is to run away from the place as fast as possible because this insect swarm usually does not attack beyond their own area. [3]

The local method adopted toward off sting bite by means of ignition and also the body is smeared with kerosene substance.

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Fig. 1: Multiple Stings over Face



Fig. 2: Multiple Stings over Upper Limb



Case Report

First Reported Death in India during MRgFUS: A Case Report

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Abstract

Uterine adenomyosis is an important problem for women of reproductive age. Although hysterectomy has been the traditional treatment for symptomatic fibroids, many child bearing women are interested in a less invasive therapy. Magnetic resonance-guided focused ultrasound (MRgFUS) is a new technique for treating a variety of solid tumors. The procedure is completely noninvasive. It is performed as an outpatient procedure and the patient can resume her normal activities the day following the procedure. A 39 years female came with c/o dysmenorrhea, menorrhagia and polymenorrhagia since 5 years. Patient's vitals were normal before procedure but patient suddenly collapsed and died after procedure. Dead body was forwarded for postmortem examination. During postmortem it was found that there was 3 liter of blood in peritoneum. As this is the safest outpatient procedure then what was the reason for this 3 liter of blood in abdominal cavity...?

Key Words: MRgFUS, Fibroids, Uterine Leiomyoma, MR-Guided, Magnetic Resonance Imaging, Ablation

Introduction:

Noninvasive treatment of tumors is highly desirable and provides an alternative to surgery. One such treatment undergoing active research is Magnetic resonance-guided focused ultrasound (MRgFUS).

The ultrasound beam carries a high level of energy and is brought to a tight focus. Energy carried by the beam is rapidly converted into heat and a rise in temperature is observed.

If the temperature at the target spot can be raised to more than 55°C, protein denaturation occurs, resulting in cell death and the creation of a cigar-shaped lesion of coagulative necrosis in the direction of the ultrasound beam. The tissue in the path of the ultrasound beam but away from the focus is warmed, but not to lethal temperatures, avoiding tissue damage except at the focus.

Principles of Focused Ultrasound Treatment (FUS): (Fig.1-3)

- High intensity focused ultrasound transducer in the table top of the MRI

- Targeting done using MR image
- Treatment performed under conscious sedation
- Treatment monitoring using MR thermometry
- Tissue is destroyed following multiple ultrasound sonications
- Patient goes home the same day
- Indication is for patients with *symptomatic* fibroids

Case History:

A female patient was admitted in a private hospital for infertility treatment in Mumbai with complaints of dysmenorrhea, menorrhagia & polymenorrhea since 5 yrs.

On MRI there was diffuse adenomyosis involving anterior & posterior walls. Patient was admitted in the morning & treatment was started at 12.30 pm, treatment was completed at 4 pm with 209 sonications.

At 4.19 pm Patient tried to stand post procedure & felt giddy & suddenly collapsed. In spite of all resuscitative measures Patient was declared dead on same day at 8.25 pm. Body was sent for P.M. examination at our center.

Autopsy Findings:

Post-mortem was conducted on the body of female.

External Examination:

Abdomen was distended, Conjunctiva was pale, Oozing of straw colored fluid from tongue & mouth, Injection marks were present

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over right thigh & both forearms with blood infiltration in surrounding tissue.

Internal Examination:

Abdominal wall was tense & distended, peritoneum was intact. On taking incision blood oozes out forcibly from peritoneal cavity.

Approximately 3 Liter of fluid blood was present in peritoneal cavity. (Fig. 4)

On further dissection of posterior abdominal fascia & soft tissue in right Iliac fossa showed blood infiltration.

On vessel dissection right uterine artery near uterus shows rupture near the uterus & Right ovarian artery also shows rupture with infiltration of blood in surrounding tissue Kidneys showed perinephric hemorrhage. (Fig. 5)

Cause of death was given as **"Hemorrhage & shock following rupture of lower abdominal vessels with perinephric hemorrhage Following MRgFUS therapy of uterus however final opinion reserved pending for Histopathological and Chemical analysis report"**

Discussion:

Techniques of treatment of uterine fibroids are still being refined, but significant progress has been made in understanding some of the challenges for this new technology.

Some fibroids are more responsive to the focused ultrasound; some fibroids are more resistant. Not all women are candidates for this procedure.

Absolute contraindications include location of bowel that is in the path of the ultrasound beam, or surgical scars in the beam pathway. The procedure of MRgFUS is feasible, safe and becoming increasingly popular.

Ultrasound frequencies in diagnostic radiology range from 2 to approximately 15 MHz. Medical ultrasound transducers contain more than one operating frequency viz. 2.5 – 3.5 MHz for general abdominal imaging and for ex. 5.0 – 7.5 MHz for superficial imaging.

MRgFUS sonication uses lower frequencies but higher intensities (up to 240W) Sonications

Expected Side Effects of MRgFUS Therapy:

1. Transitory:

About 30% patients may experience nausea, vomiting, leg and buttock pain, abdominal tenderness

2. Less Frequent, Transitory:

Less than 10% patients may experience swelling, abdominal cramping, vaginal bleeding, urinary difficulty and less than 3% patients may

experience first degree skin burns (skin redness) and general pelvic pain.

3. Very Rare Complications: (< 1% patients)

- Second and third degree skin burns, Neuropathy <0.1% and Injury to abdominal/pelvic organs in less than 0.1%. [9]

As per NICE interventional procedure guidelines 413, Scotland, Nov 2011 Side effects are, Sciatic nerve palsy, Skin burns, Spontaneous vaginal expulsion of t/t fibroid and Bowel perforation. [5]

If blood vessel comes in the pathway of MRgFUS it acts as heat sink with increase in temp at that site. The energy from MRgFUS may cause formation of small gas bubbles concentrating acoustic energy with increase in temp at that site. [6]

As per the studies done uptill now if a bowel or vessel comes in the pathway of MRgFUS the temperature at that site increases which can result in damage of that site of bowel or vessel resulting in to perforation at that site.

It is the one of the very rare complication of this procedure that we have found during autopsy.

Conclusion:

Uterine & ovarian artery have come in the pathway of MRgFUS therapy which caused damage to its intima with its rupture and bleeding due to which patient may have gone into hypovolemic shock and died.

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Fig. 1: Procedure of MRgFUS

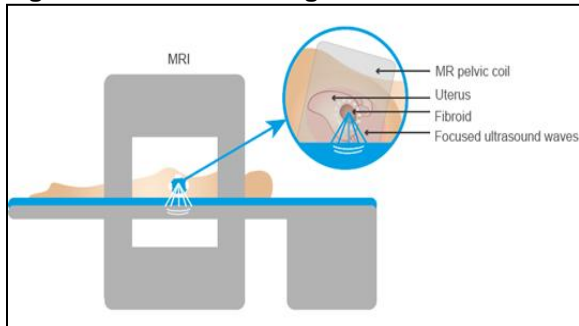


Fig. 2: Targeting of fibroid by Ultrasound beam

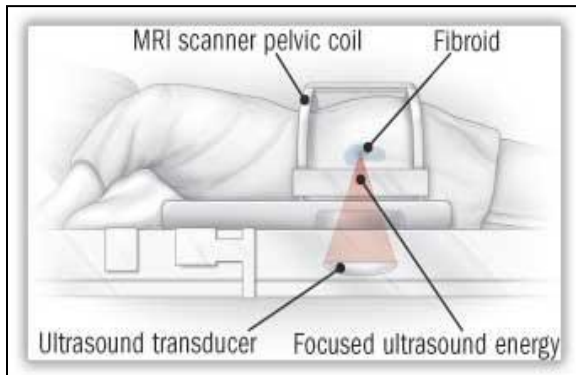


Fig. 3: Types of Uterine Fibroids

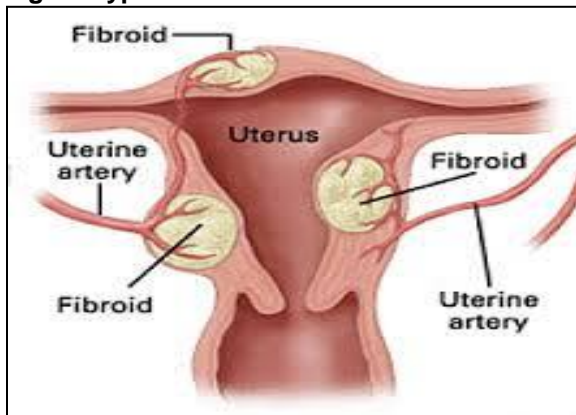


Fig. 4: Oozing of Blood Forcefully from Peritoneal Cavity after Incision

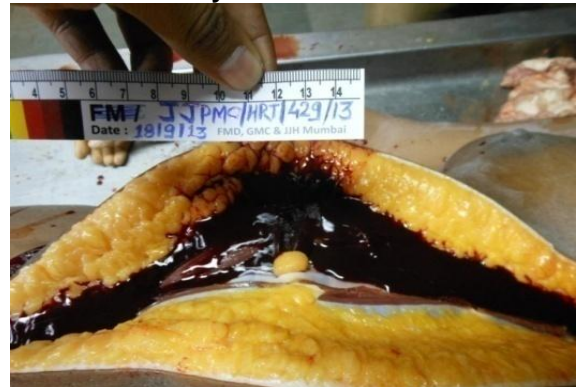


Fig. 5: Pelvic Hemorrhage due Rupture of Uterine and Ovarian Artery



Case Report

A Case of Lightning Stroke through the Cell-Phone

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Abstract

This is a case report of a man who was killed by a lightning stroke while using a cell-phone during a thunderstorm. The electric current in lightning is direct with a potential of 1000 million volts or more. A lightning bolt may injure or kill a person by a direct strike, a side-flash, or conduction through another object. In a direct strike or a side flash strike, the current can spread over the surface of a body, enter it or follow both routes. In a side flash strike, the flash of lightning hits an object e.g. a tree, and jumping from it, strikes the person. In conduction through another object, the lightning hits a metallic object, flows through it and strikes a grounded person touching it.

In the present case, a flash of lightning hit the cell-phone in his hand and conducted the electric current through his body. On autopsy, a charred area was seen on his hand corresponding with the size of the cell-phone besides internal signs of asphyxia. This case report is done with the aim of spreading awareness and to take up precautionary measures while using cell-phone during a thunderstorm.

Key Words: Lightning, Cell-Phone, Thunderstorm, Asphyxia

Introduction:

A flash or bolt of lightning is due to an electrical discharge from a cloud to the earth. The electric current is direct with a potential of 1000 million volts or more. Dry skin and dry clothes are bad conductors. Lightning or atmospheric electricity differs from ordinary electric current only in degree.

A lightning bolt may injure or kill a person by a direct strike, a side-flash, or conduction through another object. [1] This is a case report of a man getting a lightning stroke while talking on the cell-phone during a thunder storm. The phone was on charging mode.

Case Report:

On 2-7-13 at around 7p.m., a thunderstorm occurred in one of the hilly districts of Manipur and a man was killed in it while using a cell- phone which was on charging mode.

The case was brought to the Regional Institute of Medical Sciences (RIMS) Morgue under UD Case No. 3/G-SPM-PS/2013 u/s 174 CrPC. On autopsy, the victim was a 27 yrs old man with a stature of 5'1", weighing 55kg of average physique and good nutrition.

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A charred area was seen on his left hand corresponding to the size of the cell-phone and other signs of lightning injury like electrical burns on various parts of the body. Besides, internal signs of asphyxia like congestion of the organs and pulmonary oedema on histopathological examination were also seen.

Discussion:

Lightning injuries are the third commonest cause of storm-related deaths in the United States next to flash floods and tornadoes. [2] A flash or bolt of lightning is due to an electrical discharge from a cloud to the earth and the electric current is direct with a potential of 1000 million volts or more. [1]

Most of the deaths occur outdoors. [3, 4] Few occur indoors from contact injuries with plumbing or landline telephone mediated strikes and use of cell-phone does not increase the risk of injury. [5]

The present case is different because of the fact that it has occurred indoors and the current was conducted through the cell- phone held in the hand which was on charging mode.

Injuries range from tiny static electricity like exposures to cardiac arrest. [6] In this case, the injuries corresponded with the history of contact with the cell-phone.

Since persons struck by lightning have a better chance of survival than persons who experience cardiopulmonary arrest from other causes, resuscitation must be instituted early. [7] Death is instantaneous in 44-60% of the cases. [2]

Conclusion:

As Manipur is in the north east hilly region, lightning is a potential hazard. As resuscitation can reverse the cardiac arrest in many lightning cases, prompt emergency care should be instituted. Though the use of cell-phone as such during thunderstorm is not dangerous, its use while being connected to an electrical source should be avoided as the consequences could be fatal as has been seen in this case.

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Fig. 1: Congested Face



Fig. 2: Charred Area on the Hand



Fig. 3: Burnt Area on the Chest



Fig. 4: Burnt Area on Left Forearm



Fig. 5: Burnt Area on Right Forearm



Case Report

Fingering in Vaginal Introitus: A Case of Sexual Assault In the Perspective of POCSO Act, 2012

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Abstract

Childhood sexual assault is a very important topic to be discussed seriously, as the statistics regarding the cases are increasing day by day. The research literature and advocacy should focus upon improving the community responses to sexual assault cases and preventing it. The offenders must be prosecuted and treated vigorously. The newly introduced POCSO Act, 2012 (Prevention of Children against Sexual Offence Act) has made a provision for stringent and rapid dispensation of justice in such cases. In the present case, the alleged accused had inserted his right middle finger in the vaginal introitus of the victim aged Five years. Two crescentic abrasions were present on the medial aspect of thigh and one contusion on left vulva with intact hymen of the victim. There was no evidence of any injury or stains on the body of accused. The present case of 'fingering' in vaginal introitus is discussed in the perspective of new POCSO Act.

Key Words: Sexual abuse; POCSO Act 2012; Sexual assault in Children, Fingering

Introduction:

Sexual abuse or sexual assault is a widespread problem in our Indian society as well as worldwide. It causes long term effects on psychological and physical health and the effects extend far beyond of it, because family, friends, nearer and relatives are negatively affected by it.

Sexual abuse are of many types, initiating just from a seduction by beloved and nearer or strangers up to violent sexual acts. In variety of circumstances it can occur within and different relationship associated with the victim. [1] As popularly stated "Today's children are the futures of tomorrow," this powerful statement assumes special significance because today one third population is of the children in our country.

The child sexual abuse has gained much attention and significance in recent years. Ministry of statistics and program implementation had clearly mentioned the statistics of childhood abuse including sexual assaults and sexual abuse of children in India.

They states that the most of sexual abusers are not strangers or pedophiles but are nearer, neighbors or known persons to family or child. [2] An Asian center for human rights (ACHR) also mentioned the statistical values of childhood abuse cases in India. [3]

There are 48338 cases of rapes on children in 10 years from 2001 to 2011. Among these, 733 cases are reported in justice homes. With 33.6% increase in these 10 years (National Record Bureau of Statistics), Madhya Pradesh has highest incidence rate with 9465 cases in 2001-2011 followed by Maharashtra with incidence rate of 6868 cases in 10 years and minimum 38 cases had reported in Nagaland. [4]

But this is just a tip of iceberg as large numbers of cases were either not reported due to fear of stigma on the family or suppressed by the assailant. The present case of sexual assault is discussed in the light of new legislation, the "Prevention of Children against Sexual Offence Act", 2012.

Case Report:

A five year girl child was brought by police for medico-legal examination in an alleged case of sexual offence. The complaint in this regard was lodged by the mother of the victim against the alleged accused who was a neighbour and was well known to the family and child. The child used to call him uncle and play often with him.

On the day of incidence, the girl while playing around her home in afternoon, the alleged accused called her to give

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candy/chocolate. He took the child to his home. While searching the daughter, mother heard her child was crying in neighbors' house. She knocked the door, initially the accused resisted to open the door, but later on he opened the door and showed that nothing has happened and explained that the child was crying for demanding more candies. By the time many people gathered there and asked the child about the incidence.

The victim child told that the uncle has removed her jeans and shirt. Then he hurt me here (by pointing the finger towards private parts), with hand and fingers. He told me not to reveal the fact to mother so that I will get more candies. The victimized child has been taken to Government Medical College and hospital within six hours of the incidence. The alleged accused was arrested by the police u/s 376 and was also sent for medical examination on next day.

Examination of Victim:

Examination of victim was carried out by a team comprising of one female Gynecologist and one Forensic doctor. Clothes of the victim were intact without having any stains. There was oval shaped reddish-blue contusion over abdomen at right anterior superior iliac spine of size 1.5x1cm.

Two reddish crescentic abrasions placed one below other on medial aspect of right thigh in upper one third area of size 0.8x0.1cm each. There was also a reddish-blue oval contusion over left vulva of size 2x1cm placed vertically at middle one third area.

Hymen was intact with reddish colored serous secretion present in vaginal orifices. The samples of vaginal swab, vulval swab, blood, and nail scrapping were sent for chemical analysis.

Examination of Alleged Accused:

The accused person is 35 years male and was well known to the girl victim. When asked about the incidence, he told that he had inserted a tip of right middle finger into the vaginal introits of the victim and moved to and fro once, but the child started crying. He had washed his hands after the incidence.

He was well oriented in time, place and person. There was no evidence of any physical or mental abnormality. He was of thin built, 5.2 feet height and 52 kg weight. He was married and has normal development of body. There was no evidence of any systemic abnormality.

There was no evidence of any injury, mark of struggle, and stains over body.

Smegma was present and pubic hairs were not matted. The external genitalia and

secondary sexual characters were well developed. The samples of penile swab, blood and nail scrapping were sent for chemical analysis.

Discussion:

Constitution of India clause (3) of article 15 empowers the state to make special provisions for children. India is also acceded to the convention on the rights of the child of United Nations. In view of this "The protection of children from sexual offences Act", 2012 has been implemented in India on 19th June 2012. [6] Preamble of this act stated that sexual exploitation and sexual abuse of children are heinous crimes and need to be effectively addressed.

According to the **section 3 A clause (b)**, a person is said to commit "penetrative sexual assault" if he inserts, to any extent any object or part of the body, not being the penis, into the vagina, the urethra or anus of the child or makes the child to do so with him or any other person. The punishment for such an act as per section 4 is imprisonment of either description for a term which shall not be less than seven years but which may extend to imprisonment for life, and also be liable to fine. [6]

As per **section 5 B clause (m)**, a person is said to commit "aggravated penetrative sexual assault" if commits penetrative sexual assault on a child below twelve years of age and as per section 6, punishment for aggravated penetrative sexual assault is rigorous imprisonment for a term which shall be not less than ten years but which may extend to imprisonment for life and shall also be liable to fine. [6]

Section 7 C defines sexual assault as whoever with sexual intent touches the vagina, penis, anus or breast of the child or makes the child touch the vagina, penis, anus or breast of such person or any other person, or does any other act with sexual intent which involves physical contact without penetration is said to commit sexual assault. [6]

Section 8 provides punishment for sexual assault as imprisonment of either description for a term which shall not be less than three years but which may extend to five years and also be liable to fine.

And as per section 9 D clause (m), if the age of child is below twelve years then as per section 10 punishment is imprisonment for a term shall not less than five years but which may extend to seven years and shall also be liable to fine. [6]

In the present case, the accused penetrates his finger in the vaginal introits of the child. The circumstantial evidence that child found crying inside the house of accused, delay in opening the door, history narrated by the child of removal of clothes and penetration of finger by pointing towards her genitals and the injuries over medial aspect of thighs and genitals are corroborated the facts narrated by the child. As there is no history of forceful full penetration of finger, due the resistance offered by child in the form of crying, hymen was found to be intact.

Taken into consideration of all the circumstances and corroborative evidence, the present case of fingering in vaginal introitus comes under the purview of Section 3A clause (b), of POCSO Act, 2012.

There are many cases of childhood sexual abuse and most of them based on mere suspicion of guardians. But in the present case, history of unclothing and penetration injuries to the innocent girl was noteworthy.

Prior to the new Act, 2012, mere fondling of the genitals was considered as 'indecent assault' under section 354 IPC and shall be punished with imprisonment of either description for a term which may extend to 2 years, or with fine or with both.

But after the enactment of new Act related with protection of children against sexual offence, there was provision of stringent punishment for such an act, which would deter the upcoming offenders.

Conclusion:

In child sexual abuse cases, the victim may face higher level of depression, guilt, shame, eating disorder, denial, sexual problems, relationship problems and behavior problems.

If these problems continue, they may leads to suicidal ideation, disturbed sleep pattern, and self-destructive behavior. [1] The study also revealed that the victims of sexual abuse experience more sexual problems than general population like erectile dysfunction in males, low sexual desire in both sexes and arousal disorders mostly in women. [1]

Hence, not only medical examination and treatment but also the counseling of the victim by social worker and psychologist is most important and it should be made mandatory in such cases. The child should be provided with such counseling up till she has been brought into the main social stream of her life with normal developmental contours.

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Case Report

Homicide Disguised By Suicide: A Rare Case Report

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Abstract

Violent asphyxial deaths are of common occurrence and constitute large group in medico-legal autopsies. Death due to constriction of neck may broadly result due to hanging, strangulation with ligature material or manual strangulation i.e. throttling. Sometimes due to external post-mortem appearance of the ligature marks on neck, it becomes difficult for the autopsy surgeon to clearly state whether the constriction of neck is homicidal or suicidal in nature. So in these cases, the expertise & high index of suspicion by "an expert forensic surgeon" is warranted to unmask the murder in disguise. Here we are presenting a case of man who supposed to hanged himself with the help of a nylon rope as per statement given by his wife and fabricating a scene of incidence as hanging and also the preliminary investigation by police as narrated before autopsy both were same. But a meticulous autopsy revealed that, cause of death is throttling and ultimately police registered a criminal case of murder against the alleged accused i.e. on his wife.

Key Words: Homicide, Asphyxia, Throttling, Autopsy, Ligature mark

Introduction:

Asphyxia is one of the common modes of death encountered in medico-legal practice. Asphyxial deaths by hanging and drowning are most common with varying percentage of other causes such as ligature strangulation, throttling, smothering, suffocation and traumatic asphyxia etc. Neck being a favored site of injury and a complex anatomical site, it requires enormous skills and expertise on the part of Forensic surgeon to arrive at correct diagnosis.

The hanging and drowning are commonly seen in suicidal cases while strangulation is usually homicidal.

It is highly essential to diagnose and differentiate between different asphyxial deaths, especially between hanging and strangulation by ligature and throttling.

The careful post-mortem can also help the investigator to arrive at the conclusion of manner of death.

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Case History:

On 05/10/2013 a dead body was referred by police to mortuary of the Forensic Medicine Department of Govt. Medical College and Hospital, Aurangabad for autopsy.

As per statement given by his own wife to police and creating a scene of incidence like that the deceased hanged himself (suicidal hanging) with the help of a nylon rope in his own house and also the preliminary investigation by police as narrated before autopsy both were same. The alleged nylon rope used by deceased was taken from the cradle of his kid.

Autopsy Findings:

External Examination:

Male of 25 years, moderately built. Rigor Mortis well marked over whole body. Post-mortem lividity fixed. No any signs of decomposition. The face was puffy and cyanosed. Both eyes were prominent and open with sub-conjunctival hemorrhages present.

Tongue within oral cavity without visible injury with no oozing from mouth, nostrils and ears. **Cyanosis was present in finger nail beds of upper hands, ear lobules and lips.**

Surface injuries on body were present as follows.

- 1) Multiple crescentic shaped abrasions (6 in number) of size varies from 0.3x0.2 cm over anterior part of neck and dark reddish in color at the level of thyroid cartilage. (Fig. 1)
- 2) A circular contusion of size 3x3 cm was present sub-mandibular region of left side of neck, dark reddish in color and 1.5 cm from

midline

- 3) A contusion of size 4.5cm x 2.5cm was present over medial aspect of right leg, 5.5cm above ankle joint, blue in color.

Internal Examination:

An oval shaped infiltration of blood in sub-cutaneous tissue of size 3x2 cm seen underneath the external contusion on neck, dark reddish in color. (Fig. 2) There was infiltration of blood within neck muscles & in the thyro-hyoid membrane of right side. (Fig. 3) Inward compression fracture of left superior cornu of hyoid bone with evidence of blood infiltration in edges was seen.

Petechial hemorrhages were present in the white matter of brain with congestion. No injuries seen over tongue, buccal mucosa and teeth. No imprint abrasion or any other injury suggestive of use of nylon rope.

Esophagus Mucosa congested. Larynx congested. Petechial hemorrhages found over laryngeal mucosa. Rest all organs congested. Dark fluid blood was present.

Stomach contains 60gms of semi-digested dal and rice with abnormal smell perceived and mucosa congested.

Blood preserved for chemical analysis and which contains 117 milligram of ethyl alcohol per 100 milliliters.

Opinion about cause of death: "Asphyxia due to throttling with evidence of alcohol consumption".

Discussion:

Asphyxial deaths, particularly due to compression over neck have always been a challenging scenario in Forensic practice.

Strangulation is defined as asphyxia by closure of the blood vessels and / or air passages of the neck as a result of external pressure on the neck. [1] It is subdivide into three main categories: hanging, ligature strangulation and manual strangulation.

The distinction between these three entities is attributed to the cause of the external pressure on the neck- either a constricting band tightened by the gravitational weight of the body or part of the body (hanging); a constricting band tightened by a force other than the body weight (ligature strangulation); or an external pressure by hands, forearms or other limbs (manual strangulation) which all practical purposes is always homicidal.

Hanging in its face goes in favor of suicidal in nature. In throttling, the upper part of the neck is mostly affected and the pressure is exerted there against the mandible.

The neck may be compressed from the front, back or from any side and one or both hands may be used. [2]

The situation and extent of bruised area over neck will depend upon relative positions of victim and assailant, manner of grasping neck and degree of pressure applied upon throat.

This linear or crecentric marks produced by the fingernails are occasionally present, if the finger tips are pressed deeply in to the soft tissue of neck.[3] On internal examination of neck, hemorrhages in sub cutaneous tissues and muscles underlying the nail marks are less as compared to that below skin contusion produced by finger pad.

According to Sirohiwal BL in one study [4] differentiating in between hanging and strangulation is an age old problem. Much depends on observations made by the investigating officer. An exhaustive examination of the scene of crime, ligature material, placement of ligature mark over the neck and other associated findings go a long way in deciding the issue. With a careful study of the ligature material, ligature mark, and their comparative study made it possible to conclude positively that it was a case of strangulation fabricated as a hanging in this study.

In this case, mis-leading history given by the deceased's wife and inconclusive preliminary investigation by police along with minimal injuries visible over neck, a homicide can be easily disguised over post-mortem suicidal hanging before post-mortem examination.

But findings, in this autopsy included crescentic abrasions, contusion over neck and hemorrhages in sub cutaneous tissues and muscles which strongly suggesting manual strangulation with subsequent immediate hanging of the dead body to create a scene of hanging.

As in post-mortem hanging, often a victim is killed by some other means and then hanged to simulate a suicidal death but there will be evidence of dragging of the body on the ground and friction at the point of suspension of the ligature material, as the ligature is first tied around the neck of the dead body and then the body is hanged but the actual cause of death and other circumstantial evidence will make the fact (post-mortem hanging) clear. [5]

This method is employed when the victim is an infant, a child or woman. Healthy adults can be throttled only when they are under the influence of drugs or other intoxicants, are stunned or the attack is sudden. [6] Also in this case, the wife later on admitted to the police

that, she killed her husband due to domestic violence on her by alcoholic addict husband.

In the cases of death due to violent asphyxia, sometimes there are fabricated or supposed allegations by the relatives of the deceased or, the investigating agencies register criminal case under pressure or on mere statement without prior investigation or, due to atypical nature and appearance of the ligature marks on the dead body, the autopsy surgeon is not in a state to clearly give opinion on postmortem examination.

Under such situations, the autopsy surgeons need not act in haste and must give ample time to the investigating agencies for complete and thorough investigation of the case and then only a final opinion should be given about the nature, mode and cause of death.

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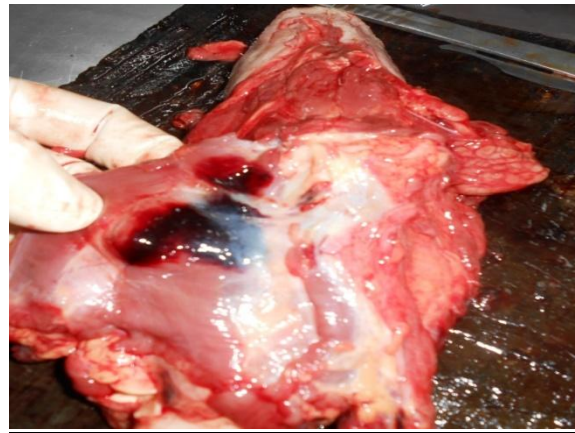
Fig. 1: Crescentic Abrasions and Contusion over Neck



Fig. 2: Infiltration of Blood under Contusion



Fig. 3: Infiltration of Blood in Soft Tissues of Neck



Case Report

A Case of Criminal Abortion by a Quack (unqualified person) Supreme Court Views

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Abstract

Unsafe abortion is one of the four main causes of maternal mortality and morbidity. One of the reasons for unsafe abortion is because safe abortion services are frequently not available, even when they are legal for a variety of indications in almost all countries including India.

A case of alleged illicit sexual relations of an unmarried woman of 27 years and consequently pregnancy and criminal abortion by an unqualified and inexperienced doctor came before the SC in appeal. Accused doctor had been convicted and sentenced by the trial court for seven years along with fine, concurred by the MP High Court. Case came before the SC in Appeal by the co-accused in this case. Various issues related to provisions of Indian Penal Code (IPC), Medical Termination of Pregnancy Act and Rules, qualification and experience of the doctor for MTP, Approval of the place for MTP, and issue of conviction and sentence of alleged accused, etc. has been discussed to create awareness among stakeholders to avoid further cases of criminal abortions in India. This may help in decreasing maternal morbidity and mortality in India due to criminal abortions.

Key Words: Expert Opinion, Post-mortem, Criminal Abortion, MTP, Conviction, Appeal, Supreme Court, High Court, Trial Court, Common Intention, Cross-Examination, Trial, Pregnancy, Illicit Relations

Introduction:

Unsafe abortion accounts for 13% of maternal deaths [1], and 20% of the total mortality and disability burden due to pregnancy and childbirth. [2]

Almost all deaths and morbidity from unsafe abortion occur in countries where abortion is severely restricted in law and in practice. Every year, about 47000 women die from complications of unsafe abortion [3]; an estimated 5 million women suffer temporary or permanent disability, including infertility. [4]

Where there are few restrictions on access to safe abortion, deaths and illness are dramatically reduced. [5]

Governments agreed in the United Nations International Conference on Population and Development, 1999 (ICPD+5). [6]

Review and appraisal process that “in circumstances where abortion is not against the law, health systems should train and equip health-service providers and should take other measures to ensure that such abortion is safe and accessible. Additional measures should be taken to safeguard women’s health”. [6]

The original document, *Safe abortion: technical and policy guidance for health systems*, published by the World Health Organization (WHO) in 2003 [7] and subsequently in 2012 [9] started from this mandate. They recommended that States reform laws that criminalize medical procedures that are needed only by women, and that punish women who undergo these procedures [8], both of which are applicable in the case of abortion.

They also recommended that States should ensure timely and affordable access to good-quality health services, which should be delivered in a way that ensures that a woman gives her fully informed consent, respects her dignity, guarantees her confidentiality, and is sensitive to her needs and perspectives. [8]

Issues emerged [1]:

- Issue of MTP Act and its Provisions
- Issue of Qualification and Experience for MTP
- Issue of Approved Place for MTP
- Expert Opinion

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- Issue of Applicability of Provisions of IPC:
- Issue of Conviction and Sentence

Background of the Case:

Appellant Surendra Chauhan (Chauhan) has been convicted for an offence under Section 314/34 Indian Penal Code (IPC) and sentenced to undergo rigorous imprisonment for seven years and a fine of Rs.10000/- and in default of payment of fine to undergo further rigorous imprisonment for a period of two years. Chauhan and Dr. Ravindra Kumar Sharma (Sharma) were tried together.

While Sharma was tried under Section 314 IPC Chauhan was tried under Section 314/34 IPC. Sharma had also been convicted under Section 314 IPC and similarly sentenced as Chauhan by the trial court. [10]

Appeal before the MP High Court:

Both filed appeal in the Madhya Pradesh High Court. Their conviction and sentence were upheld and their appeal dismissed by judgment dated January 7, 1998. Both sought leave to appeal from the Supreme Court under Article 136 of the Constitution against the judgment of the High Court. [10]

Facts of the Case:

Alpana, a young girl of 24 years of age, was living with her mother Lalita Soni, a teacher, along with her younger sister 18 years of age. Alpana was not married. On March 23, 1993 Alpana told her mother that she was feeling unwell and would herself go to the hospital. Next day in the morning when her mother was sitting in 'pooja', Alpana told her that she was going to the hospital. She also told her mother that she along with Chauhan would be going to Sharma for her treatment. [10]

Same day at about 2 or 3 p.m. while Lalita was resting in her home both Sharma and Chauhan came to her and told her that Alpana was in a serious condition. Sharma told Alpana was under treatment in his hospital.

Chauhan said that condition of Alpana was serious. Lalita told them that her husband was not in the house and when he would come, they would both go to the hospital. Both the accused, i.e., Sharma and Chauhan said that the condition of Alpana was very serious and insisted Lalita to accompany them. [10]

On this Lalita immediately went along with them. In the hospital of Sharma she saw her daughter Alpana lying on the table inside the clinic. Lalita found that her daughter was dead. She asked what was the reason of the treatment and death of her daughter. On that Chauhan told her that he was having illicit relations with Alpana as a result of which she was carrying

pregnancy of two to three months. He also told Lalita that he got Alpana admitted in the hospital for her abortion and during the treatment the condition of Alpana became serious causing her death. Lalita then went to inform her husband Mohan Lal and again went to the hospital of Sharma by which time police had also arrived and there was crowd standing outside the hospital. [1]

Forensic Expert Opinion:

Dr. D.C. Jain is the Professor of Forensic Medicines in Medical College, Raipur. In his deposition he said that in his opinion "Deceased was pregnant foetus should be in uterus. Foetus age is 3 months. No injury to uterus or vagina detected. It is possible that the deceased died of vagal inhibition due to the effect of abortion without anaesthesia or due to fear." [10]

He did not find any injury in uterus or vagina. He said it was possible that the abortion was caused without applying the anaesthesia to the deceased causing her death or her death could be due to fear. He found that the uterus was enlarged containing blood clots.

PM Examination:

In his cross-examination he said that shock also takes place during the fear. Dr. H. K. Joshi performed post-mortem on the dead body of Alpana. According to him **cause of death was shock.**

There have been concurrent findings that Chauhan was having illicit relations with Alpana with the result that she became pregnant. He accompanied her to the clinic of Sharma for her abortion.

SC Observations on Issue of Qualification & Experience for MTP:

It has also come on record that Sharma was having degree of Bachelor of Medicines in Electro Homoeopathy from the Board of Electro Homoeopathic Systems of Medicines, Jabalpur (M.P.).

This entitled him to practice in Electro Homoeopathic systems of medicines. He also possessed a Diploma of Bachelor of Medicines and Surgery in Ayurveda.

SC opined that Alpana met her death in the clinic of Sharma either due to shock or without applying anaesthesia while she was being aborted.

SC observed that Sharma is not a medical practitioner, who possesses any recognised medical qualification as defined in clause (h) of section 2 of the Indian Medical Council Act, 1956, whose name has been entered in a State Medical Register and who has

any experience or training in gynaecology and obstetrics. [10]

Issue of Applicability of Provisions of

IPC: Section 314 IPC is as under:

"314. Death caused by act done with intent to cause Miscarriage:

Whoever, with intent to cause the miscarriage of a woman with child, does any act which causes the death of such woman, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine; if act done **without woman's consent** and if the act is done without the consent of the woman, shall be punished either with imprisonment for life, or with the punishment above mentioned.

Explanation: It is not essential to this offence that the offender should know that the act is likely to cause death."

SC observed that from the record it is apparent that Sharma and Chauhan had intent to cause miscarriage of Alpana, who was pregnant, and death was caused to Alpana by Sharma while conducting abortion. [1]

Questions for Consideration before the SC:

Two questions have been raised before the SC for consideration:

- (1) It was the extra judicial confession of Chauhan made to Lalita that he was having illicit relations with Alpana due to which she got pregnant and both of them wanted abortion and for that purpose Chauhan had got her admitted to the clinic of Sharma. Confession could not be solely made basis for conviction, and
- (2) Chauhan did not share any common intention with Sharma to cause the death of Alpana.

Case Law on Limitation of SC in Appeal under Article 136 of the Indian Constitution:

SC clarified that as far back in 1954 the SC in *Dinabandhu Sahu vs. Jadumoni Mangaraj and Others* [1955] [11] said that SC does not, when hearing appeals under Article 136 of the Constitution, sit as a court of further appeals on facts, and does not interfere with findings given on a consideration of evidence, unless they are perverse or based on no evidence.

Evidence Recovered during Investigations:

During the course of investigation police also recovered some instruments from the dickey of the scooter of Sharma allegedly used

for causing abortion. One Hindi book containing the literature on abortion, contraceptives and one Hindi book containing an illustrative abortion guide were seized from the clinic of Sharma.

When the Investigating Officer Y.K. Shukla (PW-9) stated that he recovered the instruments from the dickey of the scooter of Sharma on his disclosure statement, he had not been cross-examined. There is no reason for us not to take into consideration the extra judicial confession of Chauhan made to Lalita, mother of Alpana to base his conviction.

It was quite natural in the circumstances. It was Chauhan who took Alpana to the clinic of Sharma, who was not a qualified doctor to cause abortion. Chauhan was known to Alpana and had illicit relations with her. It is not possible to believe the defence version that Alpana just died lying on the table in the clinic of Sharma. She was a normal girl.

No explanation is forthcoming either from Sharma or Chauhan as to in what circumstances Alpana died. It was something within their knowledge. Court in normal circumstance does accept the explanation of the accused consistent with his innocence even though he has not been able to prove his defence by positive evidence.

But when the explanation offered by the accused or the defence set up by him which is not only inconsistent with his conduct but is palpably false, it cannot be worth consideration. When examined under Section 313 of the Code of Criminal Procedure Chauhan was asked if he wanted to say anything in his defence. He gave the answer as under:

"I am a driver. In connection with my work I use to visit Kusumkasa. So I know the parents of the deceased. On the day of incident I was going to motor stand. Then I saw Dr. Sharma standing outside his hospital. He called me there and took me inside the hospital where the deceased was lying and asked me whether I recognised her. I said that I knew her. Then we both went to Kusumkasa inform the mother of the deceased by one scooter and after informing brought her to the hospital. At that time there was lot of crowd and police was also present. Mother of the deceased found that her daughter was dead and she along with the police people went to the police station.

Prosecution version that I had illicit relations with the deceased is a wrong version. This is also not true that I took the deceased to the hospital of Dr. Sharma for abortion. This is also not true that she came to my house when she visited Rajhara (where clinic of Sharma is

situated). Witnesses speak lies to get the persons involved." [10]

Defence by Alleged Accused Sharma:

We may also note the defence set up by Sharma. In answer to the question if he wanted to say something he said:

"After opening my hospital I was examining the patients and prescribing them medicines. After some time deceased came there and sat with the patients. When I was examining the patients the deceased said that she was not feeling well. I told her that she could lie down on the dressing table and after examining the patients on her turn I went to her and asked about the problem she had. She did not reply and after examining I found that she was dead. Then I came out of my hospital. Incidentally, Surender @ Bunty met me there.

I took him to that girl and asked whether he knew the deceased. He said that he knew the deceased. Then I asked Surender @ Bunty to inform the parents of the deceased about the incident. Then I asked somebody to go to police station and lodge the report and I along with Surender @ Bunty went to inform the parents of the deceased. We asked her mother that the deceased was serious and brought her to the hospital where police was already present and lot of persons gathered.

Mother of deceased found that her daughter was dead. Thereafter she along with police personnel went to the police station.

I had not given any treatment to the deceased and I did not know why she had come to the hospital. Prosecution version that I was trying to do the abortion of the deceased due to which she died is false. I am innocent and I have been wrongly involved." [10]

Defence Rejected by the SC:

In the circumstances of the case the defence set up either by Sharma or Chauhan could not be true and had to be rejected. [10]

SC Observations on the Issue of Conviction and Common Intention:

It is contended that Chauhan could not be convicted with the aid of Section 34 IPC. Section 34 IPC is as under:

"34. Acts done by several persons in furtherance of common intention: When a criminal act is done by several persons in furtherance of the common intention of all, each of such persons is liable for that act in the same manner as if it were done by him alone."

Physical Presence of the Accused:

Under Section 34 a person must be physically present at the actual commission of the crime for the purpose of facilitating or

promoting the offence, the commission of which is the aim of the joint criminal venture.

Such presence of those who in one way or the other facilitate the execution of the common design is itself tantamount to actual participation in the criminal act.

The essence of Section 34 is simultaneous consensus of the minds of persons participating in the criminal action to bring about a particular result. Such consensus can be developed at the spot and thereby intended by all of them. [12]

Case Law on Common Intention: Attending Circumstance

The existence of common intention can be inferred from the attending circumstances of the case and the conduct of the parties. No direct evidence of common intention is necessary. For the purpose of common intention even the participation in the commission of the offence need not be proved in all cases. The common intention can develop even during the course of an occurrence. [13]

To apply Section 34 IPC apart from the fact that there should be two or more accused, two factors must be established:

- i. Common intention and
- ii. Participation of the accused in the commission of an offence.

If a common intention is proved but no overt act is attributed to the individual accused, Section 34 will be attracted as essentially it involves vicarious liability but if participation of the accused in the crime is proved and a common intention is absent, Section 34 cannot be invoked. In every case, it is not possible to have direct evidence of a common intention. It has to be inferred from the facts and circumstances of each case. [10]

SC Observations on the Issue of Intention:

SC observed that there is concurrent finding [of the trial court and High Court] that Sharma with intent to cause the miscarriage of Alpana with child by his act caused her death and the act was done in furtherance of the common intention of Chauhan. He has thus been rightly convicted under Section 314/34 IPC. [10]

Issue of MTP Act and its Provisions:

SC observed that after coming into force of the Medical Termination of Pregnancy Act, 1971 provisions of IPC relating to miscarriage became subservient to that Act because of non obstante clause in Section 3.

Under Section 4 of the Act termination of pregnancy shall be made in accordance with the

Act and at a hospital established or maintained by the Government or a place approved by the Government for the purposes.

Issue of Approval of Place for MTP:

Rule 4 of the Medical Termination of Pregnancy Rules, 1975, framed under the Act, provides as to how a place under Section 4 could be approved and how inspection etc. of such place is to be carried out. A place shall not be approved under Section 4:

- "(i) Unless the Government is satisfied that termination of pregnancies may be done therein under safe and hygienic conditions; and
- (ii) Unless the following facilities are provided therein, namely:
 - (a) An operation table and instruments for performing abdominal or gynaecological surgery;
 - (b) Anaesthetic equipment resuscitation equipment and sterilisation equipment;
 - (c) Drugs and parenteral fluids for emergency use."

SC Final Observations on the Issue of conviction: Competency to MTP, Approved Place

SC observed that in the present case Sharma was certainly not competent to terminate the pregnancy of Alpana nor his clinic had the approval of the Government.

Even basic facilities for abortion were not available in his clinic. Chauhan took Alpana to the clinic of Sharma with intent to cause her miscarriage and then her death was caused by Sharma while causing abortion, which act was done by Sharma in furtherance of the common intention of both Sharma and Chauhan. **There is no escape from the conclusion that Chauhan had been rightly convicted under Section 314/34 IPC. [10]**

Issue of Punishment:

The question then arises of the sentence awarded to Chauhan. Division Bench of SC on the issue of sentence observed that we are of the opinion that the sentence awarded is rather on the higher side. We would, therefore, reduce the sentence of imprisonment to one and half years (18 months) rigorous imprisonment but would enhance the fine to Rs. 25000 and in default of payment of fine Chauhan to undergo further rigorous imprisonment for a period of one year. In case fine is realised the same shall be payable to Lalita Soni, mother of Alpana.

With above terms SC partially allowed appeal and reduced the sentence awarded to Chauhan. [10]

Summary and Conclusions:

Lack of awareness about the legal provisions on MTP, illiteracy, lack of adequate infrastructure and qualified and experience doctors along with social stigma are responsible for such type of preventable immature deaths.

Such types of cases are substantially responsible for increased mortality and morbidity of woman in India.

Governments both at Central and State Level along with NGOs should act proactively to create awareness of the legal provisions of the MTP in different parts of the India.

Given the clear link between access to safe abortion and women's health, it is recommended that laws and policies should respect and protect women's health and their human rights. [9]

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Case Report

Sudden Slap: Sudden Death

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Abstract

A female unconscious patient aged about 72 years brought to the Govt. General Hospital of Rangaraya Medical College, Kakinada, Andhra Pradesh with a history of slap over the cheek. After examination by causality doctors, declared dead. Body was send to the mortuary same hospital. This was the result of a petty quarrel between two persons for theft of mangoes, into which this old lady entered. She got a slap on her cheek. Suddenly she fell down and found dead. Autopsy was conducted on 06/08/2014, in the same hospital's after receiving all necessary documents from the police people. On examination, there were no external and internal injuries found. With no positive post-mortem findings and presence of history of slap over cheek indicating that it is a case of sudden death due to vaso-vagal shock which occurred by stimulation of baroreceptors situated at the level of angle of mandible.

Key Words: Old lady, Sudden slap, Cheek, Vaso vagal shock

Introduction:

Establishing the cause of death in spot death cases is always a mammoth task for an autopsy doctor, especially when it is brought as a murder case. No external injuries over the body make the task much more difficult.

Case History:

A female aged about 72 years, native of Kakinada, was slapped on her cheek and fell down and died on the spot on 06/08/2014, at about 09:30am. This is the result of a petty quarrel between two persons for the theft of mangoes. To subside the quarrel between two persons, entered this old lady, got a slap over her cheek and fell down and died on the spot. The deceased was immediately shifted to GGH casualty by 108 ambulances, where she was declared brought dead. Police were intimated and the body was shifted to mortuary for post mortem examination.

Autopsy Findings:

Ante-mortem External and internal Injuries: Nil. On histo-pathological examination of the viscera, no abnormality was detected.

Chemical analysis by RFSL revealed no toxin or poison. The Death was due "vaso-vagal shock".

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Discussion:

A female aged 72 years got a slap on her cheek and fell down right on the spot. There were no external injuries and no internal injuries. Histo-pathological examination of viscera was also negative so in this case, we may think of vasovagal shock due to slap (pressure) over baroreceptors situated in the carotid sinuses, carotid sheaths, and carotid body of internal carotid artery (located about the level of angle of mandible). Stimulation of this vital center inhibits the heart function via parasympathetic nervous system. This condition also precipitated by old age due to low voluntary cerebral control of reflex responses in old age. [1-3]

Conclusion:

To conclude in this case, the cause of death could be associated with inhibition of vital system of the body i.e. cardio vascular due to stimulation of vagus nerve. In such cases where post-mortem findings are negative, it is very difficult for a Forensic expert to opine about the cause of death. We should be very careful to search any positive findings and to establish a document to present in the court or law. In such cases, we should have sufficient visual evidences also. [4, 5]

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