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From the Desk of Editor-in-Chief

I am pleased to present the second issue of the year 2017 of this esteemed journal of Punjab Academy of Forensic Medicine & Toxicology. I am thankful to the authors and contributors for the scientific articles and research papers which are being published in this issue. I am also thankful to the editorial team for supporting me in its publication and the members of the Academy for giving me the opportunity to continuously serve as Editor-in-Chief of the journal.

My special thanks to Joint Editor Dr Amandeep Singh and Assistant Editor Dr Satinderpal Singh for their support and sincere efforts for timely publication and release of this issue.

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Any suggestions and advice for further improving the standards and quality of the journal will be highly appreciated.

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DEFICIENCIES IN THE PUNJAB ANATOMY ACT

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ABSTRACT:

Punjab Anatomy Act was enacted in 1963 to supply unclaimed dead bodies to medical colleges for teaching anatomical/surgical dissection. However most of such bodies are rendered useless because of Autopsy. Skeleton can be extracted from such autopsied bodies. Voluntary body donation is not illegal but not mentioned in the Act. Principals of Three Government Medical colleges are the only authorised officer. Act is silent over transfer of bodies from one medical institute to another. Same Hospital Ambulance is used to transport cadavers as well as living patients. So to clarify these issues Punjab Anatomy Act needs urgent amendment.

INTRODUCTION:

Punjab Anatomy Act was enacted in the year 1963 to supply unclaimed dead bodies to medical colleges for the purpose of anatomical examinations, dissections, surgical operation and research work. The Act has bounded the Police, Public Health officers and Village officers to assist authorized officers to take possession of such unclaimed bodies. The Act also mentioned the penalty of Rs 200/- for persons obstructing the Authorised officers to take possession of such unclaimed bodies. There are certain deficiencies in the Act requiring discussions and explanations. In this article, we have highlighted these deficiencies and compared the Punjab Anatomy Act with other states anatomy acts. Various media coverage regarding body donations, scarcity of bodies, excess of cadavers and sale of cadavers etc has been reviewed.

1. Absence of Voluntary Donation Clause: The Act only mention about shifting of unclaimed dead bodies to medical colleges and there is no mention about voluntary body donation, which is the most common method of receiving dead bodies in most of the medical colleges of Punjab. Many States in our Country have amended their Anatomy Acts to include voluntary body donations like Karnataka, Maharashtra, Odisha and Gujarat etc. The amended Acts of these states have specifically included the voluntary donation clause for whole body as well as parts of body. Karnataka Anatomy Act mentioned that If any person at any time before his death had expressed an intention in writing in the presence of two or more witnesses then his body may be donated by near relatives except under following circumstances:
   - That deceased has revoked/objected his intention any time
   - That any near relative of the deceased objected for body donation.

However Amended Acts of these states are also silent over the situation when near relatives of the deceased wish to donate the body in the absence of written will by the deceased. But there has been no such amendment in the Punjab Anatomy Act since 1963. Although Medical colleges of Punjab have not faced any problem till date because of absence of this clause and are continuing receiving bodies by voluntary donation, but still it is a legal deficiency in the Act and should be amended.

Madras High Court in its judgement, K.Uma Mahesh Vs State of Tamil Nadu, has instructed Madras Medical College to receive the body of the deceased in the absence of written will by the deceased. There has been no such amendment in the Punjab Anatomy Act since 1963. Although Medical colleges of Punjab have not faced any problem till date because of absence of this clause and are continuing receiving bodies by voluntary donation, but still it is a legal deficiency in the Act and should be amended.

2. Principals of Government Medical Colleges only as Authorised Officers: According to section 5(1), 5 (2) and 5(3) of Punjab Anatomy Act, the authorised officer is empowered to hand over the unclaimed body of a person to the authorities of
teaching medical institutions, if the person has died in any hospital or prison or any public place. Department of Medical Education and Research (DRME Punjab), Govt of Punjab vide letter No: 11/197/03-4399 dated 21st October 2003 has appointed the Principals of Government Medical Colleges of Punjab only as Authorised officers for the purpose of this act. In another letter addressed to Deputy Commissioner Bathinda, it has been mentioned that Principals of Private Medical Colleges cannot be appointed as Authorised officers for this Act. However, in the same letter it is mentioned that Private Medical Colleges can contact with Principals of Government Medical Colleges for supply of unclaimed bodies. Government Medical colleges in Punjab are situated at Amritsar, Patiala and Faridkot only. It is very cumbersome for cities other than Amritsar, Patiala and Faridkot. This makes it very difficult to get unclaimed bodies. Even unclaimed bodies of these cities are not reaching to medical institutions. Many such bodies are handed over to NGO for cremation after post-mortem or without post-mortem. Authors have the personal experience where a skeletonised body was recovered by a police from a well near Bathinda and sent for post-mortem examination to civil hospital Bathinda. After post-mortem examination, author requested the police to hand over the skeleton to a private medical college located at Bathinda for teaching purpose. Although police agreed and co-operated but formalities took more than 48 hours and finally police had to hand over the skeleton to NGO for cremation as police could not spare so much time for an unclaimed autopsied body.

**Now points for concern are:**

a. Why Principals of Medical Colleges are the Authorised officers and not the heads of Anatomy/Forensic Departments or similar officers of other government medical institutions like dental college, homoeopathic college, ayurvedic college, physiotherapy college or similar officers of private medical institutions as cadavers are required not for medical colleges but also for dental colleges, homoeopathic colleges, ayurvedic colleges and physiotherapy colleges.

b. For waiving off post-mortem in medico-legal cases, NOC from executive magistrate required, but in this Act Executive Magistrate role is not mentioned anywhere.

3. **Disposal of Dead Body After Postmortem**: Section 10 of the Punjab Anatomy Rules 1966, unclaimed dead bodies may be claimed by a near relative of the deceased includes spouse, children, siblings, including consanguineous relatives in collateral relationship within 60 and lineal relationship within 30 or anyone associated through marriage with any of the mentioned relations. Nephew, Niece, friends, live in relation partners, step children and Officers In charge of Old Homes; Orphanage etc are not under the definition of Near Relative as per the Act. The act mentions that dispute as to near relative be resolved by Executive Magistrate or authorised officer, whose decision will be final.

4. **Dispute as to Near Relative**: Near relatives of the deceased includes spouse, children, siblings, including consanguineous relatives in collateral relationship within 60 and lineal relationship within 30 or anyone associated through marriage with any of the mentioned relations. Nephew, Niece, friends, live in relation partners, step children and Officers In charge of Old Homes; Orphanage etc are not under the definition of Near Relative as per the Act. The act mentions that dispute as to near relative be resolved by Executive Magistrate or authorised officer, whose decision will be final.

5. **Claiming of Unknown Body**: As per Punjab Anatomy Rules 1966, unclaimed dead bodies may be claimed by a near relative of the deceased within a period of 96 hrs of the death. It is also mentioned that if claimed within 24 hours, then no preservation charges to be taken. Cases have been reported where family members have claimed a dead body after one month. Cases have been reported where police has handed over a body as unclaimed body to a medical college, which later on got identified and a case of murder was registered and cases were registered against the police as well as doctors. So it is suggested that a preliminary examination be done by a team of forensic and anatomy doctors before receiving an unclaimed body without autopsy. No such examination will be required for autopsied bodies or hospital naturally dead cases. The Act should differentiate between unclaimed persons dying in a
hospital versus persons dying out of hospital. (Certified death versus uncertified death). Karnataka Anatomy Act mentioned that certificate from Registered Medical Practitioner not concerned with utilisation of body be obtained before shifting the body to a medical college.

6. Transfer of Body From One Medical College to Another or Out of State: Some medical college has excess of cadavers and some are starving for cadavers. However Anatomy Act /Rules are silent over transfer of bodies from government to private medical institutions or from government to government institutions. News Report from “The Hindu” dated 10th May 2005 reads that there is no illegality in transferring cadavers from Government Medical College to private sector teaching institutions coming under the purview of the Kerala Anatomy Act, 1957. Same news reports also reads that the Government (Kerala) has issued an order allowing the sale of cadavers through the Head of the Department of Anatomy of medical colleges on payment of Rs.15000[15-18]. Same report also reads that case was registered against head of anatomy department as proper procedure was not followed in transferring a cadaver as Head of Department of Anatomy was not the competent authority to transfer bodies in and out of the institution. So there is a need to frame uniform procedure for transferring cadavers including the announcement of competent authority and procedure for maintenance of record. It should be clarified about receipt of money as preservation charges/chemicals expenses incurred etc[19].

7. Use of Hospital Ambulance for Transfer of Bodies: “Hearse” van is the official vehicle to be used for transfer of dead bodies. But in the absence of “Hearse” Van, most of medical colleges use hospital ambulance for shifting of dead body from deceased residence to anatomy department. Although in the motor Vehicle Act, there is no mention of any illegality for use of hospital ambulance yet it seems unprofessional to use ambulance for carrying dead bodies.

CONCLUSION:
Punjab Anatomy Act is 53 years old and requires amendment so that more and more bodies can be utilised for teaching purpose.

Conflict of Interest: None declared.

REFERENCE:
5. Goyal P K, Gupta M.Study of profile of cadavers donated to the Anatomy department of a private medical college of Punjab for Medical research via vis Body Donation Programme: A First hand experience of five years, Journal of Research in Medical Education and Ethics 2011; 1 (3): 176-79

17. Medical college accused of selling body parts.


Figure 1: Dainik Tribune Dated 16.12.2014
Alleged Medical Negligence Cases: An Autopsy Study

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ABSTRACT:
Medical negligence has always been a topic of debate in medical profession. In Medical Negligence cases, while the doctors and the hospitals plead their innocence, the relatives see the negligence as the cause of the patient's damage or death. Sometimes the things take an ugly turn and the relatives resort to violence with the doctors and medical staff. This study was undertaken to analyze the reasons of allegation of Medical Negligence against treating Doctor/Hospital by the relatives after death of the patient and the preventive steps to curb the menace. A total of twenty Medico-legal Autopsy Cases with alleged Medical Negligence were studied. The allegations were found more in age groups comprising of children and adolescent (50%) with a declining trend with increase in age. There was no sex predominance (M:F=1:1).

The super-specialty centers are accused of Medical negligence in 65% cases. The allegation of negligence was against the hospitals with both private and government ownership in a ratio of 1.8:1. The wrong treatment/procedure was the main reason of allegation (45%). The allegations were 75% against Medical disciplines and 25% against surgical disciplines. The authors surmised that lack of good communication and not explaining the prognosis/treatment of the disease of the patient to the relatives properly would have been the main reason of these allegations. The recommendations have been given in the article so as to stop the incidents of violence towards doctors and instill belief with confidence in the patient's relatives towards the treating doctors.

INTRODUCTION:
Medical negligence is the inadequate/absence of reasonable care and skill, or wilful negligence of a medical practitioner in the treatment of a patient which causes bodily injury or death of the patient [1-2]. Medical negligence has always been a topic of debate in medical profession. There are various judgements and guidelines of supreme courts issued in separate cases [3-5]. In a recent judgement the Supreme Court of India awarded a compensation of about Rs 6 Crores with 6% interest per annum to a petitioner [6]. In Medical Negligence cases, the relatives see the negligence as the cause of the patient's damage or death while the doctors plead their innocence. Sometimes the things take an ugly turn and the relatives resort to violence with the doctors and medical staff. The government have formed various legislations to stop such incidents [7] but still the incidents of violence towards the doctors are on the rise. Such incidents lead to protest and strikes by the doctors further harming the interest of the patient [8-9]. In one such case one doctor was even murdered by the patient relatives [10]. The court and the central government have also taken a serious note of the situation [11-12].

This study was undertaken, considering such unfortunate incidents, to analyze the reasons of allegation of Medical Negligence against treating Doctor/Hospital by the relatives after death of the patient and the preventive steps which could be taken to curb the menace. We tried to analyze the point of view of the relatives along with the treatment records so as to understand the reason behind such allegations, type of hospital involved, Medicine/Surgical Discipline,
MATERIAL AND METHODS:
The study was conducted in Department of Forensic Medicine and Toxicology, AIIMS, New Delhi, who is providing the medico-legal services to south and south-east Delhi. The study was duly approved by the Institute ethics committee of AIIMS, New Delhi. The Medicolegal Autopsy Cases, in which there was an allegation of medical negligence, were taken up for study. A total of twenty cases were included in the study, for which data was gathered retrospectively and prospectively for 10 cases each. For prospective cases, the data was gathered by perusing the complaints of the relatives of the deceased along with personal interview. The data was gathered for retrospective cases from office records of inquest papers, telephonic conversation with the Investigating officers and relatives. The information regarding the names of the hospitals, doctors and patients and fate of the allegations in course of law was not recorded while collecting the data for confidentiality. The autopsy was conducted in all of these cases and the authors had detailed reports but the postmortem findings were not included in the study as the cases were sub judice and under investigation.

RESULTS AND OBSERVATIONS:
A total of twenty cases were included in the study. The male to female ratio was found to be 1:1 (Table-1). The age distribution showed a declining trend with the increase in ages (Table-1, Figure-1). The allegation of negligence was against the hospitals with both private and government ownership in a ratio of 1.8:1 (Figure-2) out of which 65% were super-specialty centers (Figure-3). The allegations were made against various departments of which 75% were against Medical disciplines and 25% were against surgical disciplines (Table-2). Pediatrics had the maximum allegations when the departments were considered individually (Table-2). Wrong treatment or procedure accounted as a major reason of allegations (45%) followed by lack of proper care during treatment (25%) (Table-3). In 55% of admitted cases the patient died within 24hrs of being admitted in the hospital (Table-4).

DISCUSSION:
Medical negligence can be alleged both in living patients and death cases. The present study involves the autopsy cases where kin of the deceased alleged Medical Negligence after death of the patient and police took the cognizance of the matter.

The age distribution showed a declining trend with increase in age. 7 cases were of the age group 0-10 years and 3 cases were in the age group 11-20 years i.e. 50% of the cases belonged to first two decade of life (Table-1, Figure-1). In more than half of the cases, the duration of death was less than 24 hrs after being attended in the hospital or clinics (Table-4). So, we can decipher that in cases of sudden and unexpected deaths, particularly in children and adolescents, the relatives are unable to accept the situation and more prone to consider the same as a failure on the part of treating doctor. When the allegations are considered as per different departments individually, Pediatrics had the maximum allegations leveled against them (Table-2). This also supports our above observation.

<table>
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<th>Female</th>
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<td>7</td>
</tr>
<tr>
<td>11-20</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>21-30</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
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<td>31-40</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
<td><strong>10</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

Table 1: Age & Sex Distribution

Figure 1: Trend in Age Distribution
There is a misconception amongst doctors that in India many of the allegations of Medical negligence are made so as to avoid or reduce the hefty bill of a hospital. Though the authors do not deny that in some cases it may be true but in our study 4 cases involved small clinics and 7 cases involved government hospitals where there would have been no such monetary issues (Figure-2).

The wrong treatment/wrong procedure was the main reason for allegation in our study (45%) followed by lack of proper care (25%) (Table-3). Whang JS et al reported that the most frequent causes of malpractice suits in radiology was error in diagnosis, followed by procedural complications, and inadequate communication. Though a non medical person is not completely able to understand the condition of the patient and the necessary treatment/procedure which would have been administered for the same, but still they allege wrong treatment, procedure or diagnosis. We can easily surmise that lack of good communication and not explaining the prognosis/treatment of the disease of the patient to the relatives properly could be the reason of these allegations. Kovalerchik et al reported that in cases of malpractice litigation related to iatrogenic CSF leak, 55.6% cases were resolved in the patient's favor, 11.1% resulted in damages awarded by a jury, and 33.3% were settled out of court before resolution of trial. They concluded that strategies to allow patients to make more informed decisions should include clear communication with patients that explicitly states potential risks.

Morris et al in their study found that types of alleged malpractice included negligent surgical technique (98%), lack of informed consent (21%), and failure to diagnose the injury (20%). There was not even a single case in our study where the allegations were due to issue of consent. This shows that people in our country still considers doctors the best judge for their patient and the allegations are made only when the patient dies in the process of treatment or unable to survive because of the secondary complications.

Three fourth of the cases in our study had the allegation towards the super-specialty centers (Figure-3). The super-specialty centers in Delhi, the capital city of India, have the best facilities to treat or manage most of the life threatening conditions or diseases, but still their incidence was highest in the study. This implies that negligence complaints are not only limited to the hospitals which are deficient in the patient care facilities. People have more hope and expectations from the higher centers of patient care. This further supports our initial hypothesis about the lack of communication between the doctors and the patients.

Medical Negligence suites have always been instrumental in formulation of laws and guidelines in Indian Medicolegal
scenario, both for the benefits of the patient and the protection of the doctor[3,4]. Many studies have been conducted in India and foreign countries regarding malpractice suits in various disciplines but only after their legal outcome by perusing the judgments[16-19]. But we were unable to find any study specifically analyzing the cause of allegation of medical negligence in point of view of the relatives just after the death of the patient. The study is an effort to find out the firsthand predisposing factors which might lead to these allegations.

CONCLUSION:

The super-specialty centers are more prone of being accused of Medical negligence due to high expectations and wrong treatment/procedure being the main allegation of the relatives towards the doctors. Sudden deaths in young age group are not accepted by the relatives easily. The pediatric departments are more susceptible for allegations. There should be good, sympathetic, humane approach for explaining the condition, treatment and prognosis to the relatives of the patient thus allaying their suspicion of wrong diagnosis, treatment or procedure.

RECOMMENDATIONS:

1. The doctors particularly those working in emergency and ICU's should undergo training in declaring the death of the patient to the relatives sympathetically or a counselor may be appointed for such purpose.
2. Special precaution should be taken in cases of children and young adolescents admitted in critical stage. A good communication should be ensured with the relatives explaining properly the condition and prognosis of the patient.
3. The doctors should refrain from making vague promises of complete recovery and should always explain the complication or unforeseen danger associated with a specific treatment procedure.
4. Posters depicting various laws related to violence against Medical Professionals and the punishments provisions should be displayed at the high risk zones like emergencies, Operation theaters and ICUs.
5. Ministry of Health and Family welfare and medical associations like Indian and State Medical Association should periodically advertise in print and electronic media so as to educate the people about protection of Medical personnel and the penal provisions associated with them.
6. In every strike done by the doctors there is demand for increased security but the authors feel that sudden spurt of violence and that too by a mob of agitated people cannot be stopped by hospital security. The doctors and hospital authorities should take preventive steps rather than remedial measures.

CONFLICT OF INTEREST: Nil

SOURCE OF FUNDING: None

REFERENCES:

8. Over 75% of doctors have faced violence at work, study finds. Times of India. [Internet]. 2015 May 04[cited 2016 Aug01]. Available from: http://timesofindia.indiatimes.com/india/Over-75-of-
doctors-have-faced-violence-at-work-study-finds/articleshow/47143806.cms.

9. Saxena A. Delhi doctors went on strike 18 TIMES in the past year after worrying rise in assaults by patients' families. Mail Online India. [Internet]. 2016 July 24 [cited 2016 Aug 01]. Available from:


11. Assault on doctors: Ask cops to use special Act, HC tells govt. The Indian Express. [Internet]. 2014 Feb 06 [cited 2016 Aug 01]. Available from:

12. Panel formed to look into assault on doctors. The Indian Express. [Internet]. 2016 Jul 25 [cited 2016 Aug 01]. Available from:


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<td>Conservative</td>
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Diversified Aspects Affecting Forensic Examination of Samples in Sexual Abuse Cases

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ABSTRACT:
In this modish ambience we have gadgets all around but the condition of women are still getting worse. They are still struggling for their legitimate rights. According to the Indian national crime record bureau a total number of 3,37,922 cases of sexual abuse have been recorded throughout the country, India. The Union Territory has reported the highest crime rate compared to at all India level. Sexual Abuse cases in India have increased during the last 5 years. The present study focuses on the procedure used from reporting the case to the analysis of the samples. Samples have been taken from Delhi, India. There is a great need to look forward from the channel of investigation to the examination of the samples so that no offender gets benefit of doubt and go unpunished.

INTRODUCTION:
Role of police in a country like India is invaluable. Despite India being the biggest democracy having the largest police organization, heinous crimes like sexual abuse are increasing day by day. Strict measures for preventing such crimes have been planned and implemented too but the outcome is not up to expectations because of the system and the procedure adapted from investigation to the examination is inappropriate. Sufficient measures should be taken to guarantee that all clauses are fixed and examination happens immediately, to abstain from altering of proof quite far.

These cases can be effectively prosecuted regardless of the fact that the examination uncovers that proof is not accessible from every one of the three sources i.e. victim, accused and the scene of crime. The primary objective of the interrogation of sexual abuse is to obtain precise information about the crime. During interrogation efforts should be made to guarantee that victims are dealt with respect and professionalism. Postponed reporting is basic and requires the special investigative strategies. In delayed reports, important proof may at present be recuperated from the scene of crime. In such restrained circumstances the police investigate but lack of cooperation and insufficiency of evidences and evidential source make victim loose the case.

Medical examination is a crucial part of information which is gathering for medicolegal evidences, their documentation and interpretation in court. It becomes more valuable where there is no other witness to the incident. The issue or problem is that in these cases police investigators suppose that large numbers of sexual abuse reports are false. Deferred reporting of sexual abuse is very common because of disgrace privacy worries fear of striking back by the culprit or his/her family.

Delaying in forensic examination of the samples: Biological evidences of forensic importance particularly found in cases of sexual abuse. These cases are characterized by low rates of disclosure, reporting, prosecution, and conviction. It is the only way to prove the occurrence of abuse and to identify the offender. Strict measures should be taken to avoid contamination, degradation, and loss of biological evidence, (i.e., selection, collection, packing, sealing, labeling, storage, preservation, transport, and guarantee of the chain custody). Sexual abuse is a serious social and public health problem that needs immediate forensic medical examination (FME), that is, when the elapsed time between the abuse and the FME is less than 72 hours.

Few countries have adopted guidelines for evidence management, which are essential during judicial proceedings. These guidelines will support in optimizing forensic intervention and reduce unnecessary variations in the procedures, as well as improving cooperation among several entities and professionals. Forensic expert and examiner should also be aware of the scope and limitations of laboratory analysis as well as the consequences of contamination or degradation of any evidence because there are multiple variables that may influence the quality of evidence. Biological evidence for DNA studies is considered the most important evidence for legal proof in courts of law. The proper
handling procedures during selection, collection, packaging, labeling, storing, and transportation of evidence to the laboratory are key steps aiming to achieve final valid and reliable results\(^4\).

To collect and preserve DNA evidence “rape kit,” is used and receive important medical care. DNA evidence needs to be collected within 72 hours in order to be analyzed by a crime laboratory. The purpose of the physical examination is to assess the injuries and to collect evidence for legal proceedings. It is important that evidence collected more than 48 to 72 hours after the abuse often may be difficult to recover or may be invalid\(^5\).

The ability to develop a profile from touch DNA is affected by three factors: i) the length of time the victim was in contact. ii) The amount of force applied. iii) The number of other individuals who were involved\(^6\). The probability of finding sperm from vaginal swabs declined substantially after 24 hours and DNA evidence dropped dramatically two days after the abuse\(^7\).\(^8\).

The reliability of DNA evidence depends upon the quantity and quality of the sample analyzed, laboratory equipments, method of collection and preservation of the samples. A DNA sample is capable of analysis if there is sufficient quantity and reasonable quality of DNA present in the sample. The analysis of poor quality DNA samples may lead to tentative results. A DNA sample may be contaminated with other human DNA in a number of ways, including: contain a mixture of fluids or tissues from different persons due to the nature of the crime; contaminated during sample handling, collection and transportation; contamination may occur in PCR-based testing if the amplification products of one test are carried over into the mix for a subsequent PCR test\(^9\).

Spermatozoa can be identified only for 72 hours after abuse. If a victim has suffered more than three days, avoid taking swabs for spermatozoa. Evidence on the outside of the body and on materials such as clothing can be collected even after 96 hours\(^10\). Low quantity and poor quality of DNA samples contain PCR inhibitors that reduce the probability of obtaining desired results. Increased degradation of samples affects overall success rates and efficiency of generating STR-based DNA profiles\(^11\). Semen is rarely present in oral, rectal, vaginal cavities after 72 hours of sexual contact. In vaginal cavity the half-life time depends on the age of the victim (pre- or post pubertal) and if the semen is localized in the cervix, the half-life may be much higher than 72 hours. In post pubertal girls spermatozoa may remain motile in the vaginal secretions for 6 to 12 hours and in the cervix for as long as 5 days; nonmotile spermatozoa may be found in stains of vaginal secretions from 12 to 48 hours after ejaculation. Dried secretions on clothing remain quite stable, so that semen may be detected for longer than 1 year. These half-lives represent several variables must be considered when documenting the presence of semen in sexual abuse cases like the type of practice and circumstances (e.g., where evidence is deposited; ejaculation occurred in the skin, oral, anal, or vaginal mucosa or in the cervix; condom use; the perpetrator is azospermic or vasectomized); the time between abuse and evidence collection; victim's gender, age, and activities (e.g., urinating, defecating, vomiting, brushing teeth, bathing, eating, drinking, smoking, spitting, running, and walking) after sexual contact\(^12\). Accurate result of spermatozoa presence may found when it collected from vagina- motile 6 hours; non-motile 72 hours and the longest interval sperm could be found after abuse was 48 hours. The 72 hours rule originated due to increased degradation rate of DNA and the evidence collected after 72 hours the quality and the quantity of the DNA obtained will not sufficient to get appropriate profile\(^13\).

**MATERIAL AND METHODS:**

The research was designed in a manner that stressed on collection of information of sexual abuse cases through review of F.I.R, and charge sheet and essence of the cases was worked out for the serological analysis of samples collected from crime scene and forwarded to forensic science laboratory. Out of which 50 cases reported were chosen for the analysis. After all the preliminary examination required, the samples were then analyzed for DNA sample match.

- The present study examined the investigation procedure of 50 cases of sexual abuse.
- All the 50 cases were thoroughly examined and analyzed through semen, blood and DNA analysis.

**RESULT AND OBSERVATION:**

The result of this study suggests that success in investigation of sexual abuse cases mainly depend upon timely reporting, examination of samples, poor quality and quantity of the samples and the analysis of degraded samples for fair and timely prosecution and justice to the victim of this heinous crime.

The observations gathered are given vide Table No. 1 to 4 which reveals that:

1. **The investigation of cases is seriously affected due to postpone reporting i.e. only 13% cases reported just after the case, 15% within 24 hours, 22% reported after 48 hours and maximum number of cases reported i.e. 50% after 72 hours. [Table 1]**

2. **Delay in reporting the case directly affects the forensic examination. Out of 50 cases only 10% samples examined after 1-2 days, 15% examined after 3-10 days, 31% examined after 1-2 months and 40% samples examined**
more than 4 months or it took years to get examined [Table 2].

3. Another important factor is poor quality and the quantity of the samples. Out of total number of cases samples which have good quality and enough quantity to examine are only 15% from which appropriate results came out. 35% samples were of average quantity from which results came out were of poor quality but in 50% cases the quality was very poor and the quantity was too small because of the higher degradation rate so that results got affected [Table 3].

4. Analysis of the samples depends upon the poor quality and quantity along with the degradation rate. In 70% of cases blood samples get degraded because of improper preservation, collection and transportation methods while 30% of semen stains get degraded [Table 4].

DISCUSSION AND CONCLUSION:
In the cases of sexual abuse, samples of blood, semen, and other body fluids or tissues can be analyzed for identification purposes and then individualized by deoxyribonucleic acid (DNA) typing. The DNA types of persons involved can be determined and compared with the types obtained from the case specimens. Generally reports of sexual abuse get postpone because of fear of re-exploitation, not being supported by family, friends, relatives, and community and not believing by police personnel’s.

The lack of knowledge of investigation of the police personals, samples took long time to reach to the laboratory for the examination and there is lack of man power in the laboratories examination will take more time. 42% of the cases examined after more than 4-monthsand only 13% examined just after the case because of the upper authorities pressure. Some of the highlighted cases examined just after the crime.

In DNA analysis, results depend on the quality and the quantity of the samples obtained from the scene of crime and the victims. Only in 15% of the cases samples have good quality and the quantity to obtain appropriate results. The evidence should be collected before 72 hours after that the proof of evidentiary material decreases.

Depending upon the time, that has passed since the crime, male reproductive cells may be alive and motile (free moving) or dead. The motile cells indicate relatively recent sexual abuse contact. A major distinction made between the microscopic examinations for the motile cells, typically conducted immediately following the medical examination of a victim,
and the normal analysis for the spermatozoa in the forensic laboratory.

After reporting of any abuse to the police the investigation of case took long time in MLC of the victim, collection, preservation and the transportation of evidences to the laboratory but in present condition after collection, biological evidences send to the 'MALKHANA' (a place in the police station) where samples get degraded because of no preservation facilities that needs for the biological samples. Inappropriate procedures for investigation and the formality of paper work took long time to send the evidence to the forensic laboratory for examination. Improper collection, preservation and packaging of the exhibits often lead to degradation. All the four factors as shown in flow chart are independent to each other that affect the investigation procedure in sexual abuse cases.

The major focus of this paper on the practical approaches of investigation techniques, collection, packaging, preservation and transportation of biological evidence for DNA analysis.

It may be useful to (1) to give proper training to police personals of handling the biological samples; (2) identification of the perpetrator (3) support to victim (4) and to develop a proper protocol for investigation of such abuse.

REFERENCES:

7. Leeuw WD, Olson S, Green R, Holt A, Schade LL.


ABSTRACT:
The connotation for undertaking the research falls on an attempt to perceive the range of natural variations in handwriting as a reliable and substantial solution for authenticating any document as genuine. Three handwriting samples - two in present handwriting (with a gap of 5-10 minutes) and one old or past handwriting (gap ranged from 2-33 years from present handwritings) samples were collected from 540 (from both genders) individuals each, from 9 different age groups. The samples were analyzed and measurements were taken through transparencies made from Auto CAD software. A range of natural variations for size and proportion of letters ('of', 'it', 'ly', 'ed' and 'he') has been deduced in terms of numeral values separately for both the genders as well as for different age groups. The proposed findings are expected to relieve experts from the requirement and dependability on contemporary writings.

Keywords: Range, Natural Variations, Size and Proportion, Contemporary Writings

INTRODUCTION:
An inclination to look for identification of handwriting is firmly resisted on the fact that within a language it might tends to be evolved and permanently refined to a degree, there are certain more or less distinctive peculiarities in the formation of letters of which he is generally unaware. Just as no two individuals are precisely indistinguishable, the fancied resemblance of their handwritings too becomes less apparent in their combination of characteristics\[1-3\]. Of all, Size and proportion of letters alongwith natural variations can be used as an indicator for identification of handwriting. Since whenever an individual writes, size may change yet size alongwith proportion remains almost constant\[4\]. Consequently, both natural variations and consistency are two chief determinants and inevitable parts of a genuine handwriting. Numerous studies tosses light on different areas of questioned documents yet aspect of natural variations stays untouched. The object of present investigation has been embraced to explore this confined yet critical area of specialization of natural variation in size and proportion of letters.

The conscious act of writing and its rehashed use enables the actual formation of each letter and word almost automatic\[5\]. In some cases, variation is slight and happens just in minor subtle elements of the writing; in other instances, the formation of letters and words will shift broadly about a master pattern\[6\]. Size and proportion of letters is a habit in which combination and the comparative size of block and small letters are taken into consideration and are almost fixed and remains fairly constant\[7\] for a specific time frame and again changes in this manner, may help in proving the genuineness in writing (my)\.. Thus, inculcating the range of natural variations for size and proportion of letters could be easily used for revealing the penmanship. Time is one of the reasons which may show natural variation in handwriting. Contrast can be found in handwriting, written by a person now and years prior. Dawson (1987) in his research established an internal consistency in handwriting\[8\]. Shrihari (2002), on the basis of his study had concluded the significant role of individuality in handwriting along with variations\[9\]. Kapoor et al. (1985) Conducted research on the study of the form and extent of natural variations in the genuine handwriting with the maturity in age, concluded that though natural variations are encountered; some of the characteristics remain unaltered\[10\]. Bafra (1998) had worked on 'the effect of time on handwriting' the results concluded very less difference and writing was more or less fixed even in terms of the range of natural variations\[11\]. With so many letters available for analysis, relative sizes were taken as an indicator by other contemporaries to deal with examining of questioned sample...
for size and proportion and natural variations\textsuperscript{[4,11]}. Proportion of letters within a word and their relative heights were taken into the investigation\textsuperscript{[6,12,13]}. Gupta et al. (2011) has also worked on natural variations in handwriting characteristics in which the extracted consistency and variations in the characteristics, so that it would help in forming opinion from documents lacking in contemporary writings\textsuperscript{[10]}.

**AIM OF THE STUDY:**

The aim of this study is to compare age related changes in various handwriting characteristics between males and females as well as to estimate the range of natural variations in handwriting character – “Size and proportion of letters” in different age groups with the passage of time. It is hoped that this research work will provide valuable information and aid to document experts so that they could reach to an opinion in documents ailing in contemporary handwriting samples.

**MATERIALS AND METHODS:**

**Materials**

- A-4 sized plain paper sheet
- Ball point pen (045 Reynolds fine carbure)
- AutoCAD Software transparencies Scale
- Past sample: One writing sample with previous written script was marked with the year of their writing and preserved separately.
- Present sample: Two handwriting samples in present with content (a small paragraph consisting 4-8 lines) in English were taken which was same as the previous written script for comparative study.

**PARTICIPANTS:**

Three samples were collected from each individual (Past, Present I and Present II). A total of 540 samples (60 samples from each age group- 30 samples each from males & females), has been collected from 9 different age groups i.e.: - 20 to 25 years, 25 to 30 years, 30 to 35 years, 35 to 40 years, 40 to 45 years, 45 to 50 years, 50 to 55 years, 55 to 60 years, 60 above. The exclusion method for continuous data classification has been adopted to classify above said age groups\textsuperscript{[10,11]}. Some combinations of letters were selected which are fairly common in any handwritten script such as - 'of', 'it', 'ly', 'he' and 'ed'. For the sake of statistical calculations and for substantial results the values measured for size and proportion of letters were in 'mm' scale.

**PROCEDURE:**

The samples were collected on A-4 sized plain paper sheet with '045 Reynolds fine carbure' ball point pen along with their personal details and signatures indicating their consent for handwriting sample. The collected samples were analyzed for size and proportions of letters and has been measured through transparencies with horizontal lines starting from 1 mm to 18 mm with increment of 0.2 mm each time with the help of AutoCAD software (previous and both present handwritings).

**STATISTICAL ANALYSIS:**

Formulation of the null hypothesis and alternate hypothesis has been done so as to apply t- test for the observed values of size and proportion of letters in each age group.

**RESULTS:**

The values obtained for the size and proportion of letters for 5 different age groups, individually for Females, Males and combinely for both the genders for all the age groups. These values were utilized for further calculations for p-value and determination of a range of natural variations in size and proportion of letters.

**Table 1:** Contains the p-value evaluated for Females for different age groups. No significant differences in natural variations were found between the two handwritings except for 'of' with significant difference at 50 -60 years of age group as well as in 'of' at age group 60 above. Minor difference was found for the combination 'it', 'ly' and he at 30-40, 40-50 and 50-60 age groups respectively. Least difference for 'ed' was observed at 50-60 age group.

**Table 2:** Depicts the p-values in Males for different age groups. Comparative to females, the significant difference seen for males was specifically in 'of' at the age group of 40-50 years and least difference was in 'ed' as 0.009 for 50-60 age group. For 'it' and 'ly' a slight difference was seen at 30-40 years. The letter combination 'he' got difference at 20-30 and 40-50 years.

**Table 3:** Demonstrates the p-values for different age groups irrespective of gender in comparison between Past to Present – I and Present – I and Present – II handwritings. For P-I and P-II, a slight difference was seen only in combination 'ly' indicating non-significant difference between the two handwritings and consistency or similarity between them. For Past to P-I, the handwritings are significantly different. The difference was seen at 30-40 age groups for 'it' and 'he', at 40-50 age groups for all combinations, at 50-60 age group for all combinations except 'he', at 60 above age group for three combinations respectively.
Table 4: Mean values have been calculated for Past, Present – I and Present – II handwritings for all the 5 age groups. From the resultant differences, the range of natural variations in size and proportion of letters (of, it, ly, he and ed) for both the genders has been estimated for all the 5 age groups. The difference in the mean values depicts the lowest and maximum range for natural variation for size and proportion. From all combinations, the range for 'ed' was least followed by 'of' as compared to 'he', 'ly' and 'it'.

Table 5: The final range of natural variations depicted by size & proportion of letters in Females (in mm) obtained from different age groups has been demonstrated. The final range for 'ed' and 'of' was comparatively lowest of all followed by 'it', 'ly' and 'he' respectively.

Table 6: Depicts the final range of natural variations by size & proportion of letters in Males (in mm) obtained from different age groups. The final range for 'ly' was observed least in females as compared to that of males. The letter combination 'ed' and 'of' demonstrates significant difference range of natural variation followed by 'it' and 'he' respectively.

Table 7: The final range of variations depicted by size & proportion of letters incorporating both the genders has been shown. The overall range was calculated in millimetres depicting the least and the highest range for all the combination of letters respectively. The combination 'ed' was comparatively more consistent as compared to all other combinations followed by 'of', 'ly' and 'it'. The combination 'he' shows less consistency of all.

Table 1: Demonstrates the P-values Obtained for Different Age Groups in Females (N=150)

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</tr>
<tr>
<td></td>
<td>S2-S3</td>
</tr>
<tr>
<td>30 - 40 Years</td>
<td>S1-S2</td>
</tr>
<tr>
<td></td>
<td>S2-S3</td>
</tr>
<tr>
<td>40 - 50 Years</td>
<td>S1-S2</td>
</tr>
<tr>
<td></td>
<td>S2-S3</td>
</tr>
<tr>
<td>50 - 60 Years</td>
<td>S1-S2</td>
</tr>
<tr>
<td></td>
<td>S2-S3</td>
</tr>
<tr>
<td>60 Above</td>
<td>S1-S2</td>
</tr>
<tr>
<td></td>
<td>S2-S3</td>
</tr>
</tbody>
</table>

S1– Past, S2 – Present 1, S3 – Present 2, *significant P-value if < 0.05
Table 4: Exemplar Showing Observations of the Range of Natural Variations in Size and Proportion of Letters in Both the Genders for 20-30 Years of Age Group (M + F)

<table>
<thead>
<tr>
<th>Size and Proportion of Letters</th>
<th>Mean Value Past (mm)</th>
<th>Mean Value P-I (mm)</th>
<th>Difference (mm)</th>
<th>Mean Value P-I (mm)</th>
<th>Mean Value P-II (mm)</th>
<th>Difference (mm)</th>
<th>Range of Natural Variations (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“of”</td>
<td>0.296</td>
<td>0.282</td>
<td>0.014</td>
<td>0.282</td>
<td>0.287</td>
<td>0.005</td>
<td>0.005-0.014</td>
</tr>
<tr>
<td>“it”</td>
<td>0.529</td>
<td>0.494</td>
<td>0.035</td>
<td>0.494</td>
<td>0.488</td>
<td>0.006</td>
<td>0.006-0.035</td>
</tr>
<tr>
<td>“ly”</td>
<td>0.861</td>
<td>0.828</td>
<td>0.033</td>
<td>0.828</td>
<td>0.816</td>
<td>0.012</td>
<td>0.012-0.033</td>
</tr>
<tr>
<td>“he”</td>
<td>1.802</td>
<td>1.770</td>
<td>0.032</td>
<td>1.770</td>
<td>1.785</td>
<td>0.015</td>
<td>0.015-0.032</td>
</tr>
<tr>
<td>“ed”</td>
<td>0.548</td>
<td>0.537</td>
<td>0.011</td>
<td>0.537</td>
<td>0.533</td>
<td>0.004</td>
<td>0.004-0.011</td>
</tr>
</tbody>
</table>

Table 5: Depicts the Final Range of Natural Variations for Size & Proportion of Letters in Females (N=150)

<table>
<thead>
<tr>
<th>Size and Proportion of Letters</th>
<th>Range of Natural Variations (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“of”</td>
<td>0.001 – 0.135</td>
</tr>
<tr>
<td>“it”</td>
<td>0.002 – 0.149</td>
</tr>
<tr>
<td>“ly”</td>
<td>0.001 – 0.158</td>
</tr>
<tr>
<td>“he”</td>
<td>0.011 – 0.31</td>
</tr>
<tr>
<td>“ed”</td>
<td>0.003 – 0.14</td>
</tr>
</tbody>
</table>

Table 6: Depicts the Final Range of Natural Variations for Size & Proportion of Letters in Males (N=150)

<table>
<thead>
<tr>
<th>Size and Proportion of Letters</th>
<th>Range of Natural Variations (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“of”</td>
<td>0.002 – 0.117</td>
</tr>
<tr>
<td>“it”</td>
<td>0.001 – 0.184</td>
</tr>
<tr>
<td>“ly”</td>
<td>0.001 – 0.061</td>
</tr>
<tr>
<td>“he”</td>
<td>0.016 – 0.334</td>
</tr>
<tr>
<td>“ed”</td>
<td>0.001 – 0.27</td>
</tr>
</tbody>
</table>

Table 7: Depicts the Final Range of Natural Variations for Size & Proportion of Letters Incorporating 20 - 60 above (N=300)

<table>
<thead>
<tr>
<th>Size and Proportion of Letters</th>
<th>Range of Natural Variations (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“of”</td>
<td>0.002 – 0.118</td>
</tr>
<tr>
<td>“it”</td>
<td>0.003 – 0.159</td>
</tr>
<tr>
<td>“ly”</td>
<td>0.004 – 0.104</td>
</tr>
<tr>
<td>“he”</td>
<td>0.008 – 0.281</td>
</tr>
<tr>
<td>“ed”</td>
<td>0.001 – 0.124</td>
</tr>
</tbody>
</table>

DISCUSSION:

According to Harrison (1999) the size of a handwriting taken as a whole cannot be regarded as an identifying feature of any great value, for whilst the majority of people have a preferred size which they normally employ when space is not limited but altering the absolute size of his handwriting when circumstances call for some modification.[4,12] Relative size of letters can be of great significance, as such characteristics has been adopted by Kaur and Garg in 2008 for evaluation of trends in handwriting characteristics in Punjabi (Gurmukhi Script) and English (Roman Script). Teulings (1983) observed that letter ratios remain consistent despite changes in the angle of the writing upward or downward, whereas features such as...
letter form and slant begin to decompose\(^{[5,6]}\). Supporting Teulings' study, Mehta (1970) in his book has stated that size of the letter is a character which can be conveniently disguised by the writer. In concurrence with above, Kelly and Lindblom (2006) has said that unless confined to a restricted space or written at different times, the size of writing by most individuals is rather consistent. Although changes in the size of natural writing by the same individual occur from time to time, the relative size of capital and lowercase letters is usually constant\(^{[5,6]}\).

With profoundness of the statements and facts mentioned by the authors, this vision of estimating the ratio of size and proportion of letters has been utilized in present research. Results have shown that amongst size and proportion of letters (‘of’, ‘it’, ‘ly’, ‘ed’ and ‘he’) ‘ed’ is the most consistent combination in terms of size and proportion from others with least variations. The range of natural variations in size and proportion of letters have been extracted from mean values and in females it is found to be 0.001 mm – 0.135 mm for “of”, for “it” it is 0.002 mm – 0.149 mm, for “ly” it is 0.001 mm – 0.158 mm, for “he” it is 0.011 mm – 0.31 mm and for “ed” it is 0.003 mm – 0.14 mm. In case of males for “of” it is 0.002 mm – 0.117 mm, for “it” it is 0.001 mm – 0.184 mm, for “ly” it is 0.001 mm – 0.061 mm, for “he” it is 0.016 mm – 0.334 mm and for “ed” it is 0.001 mm – 0.27 mm. And in case if the gender is not known then for “of” the range obtained is 0.002 mm – 0.118 mm, for “it” it is 0.003 mm – 0.159 mm, for “ly” it is 0.004 mm – 0.104 mm, for “he” it is 0.008 mm – 0.281 mm and for “ed” it is 0.001 mm – 0.124 mm. These values are found to be very specific and descriptive for utilizing manually as well as through inventing software which can help in determining the the extent of natural variations in one's handwriting. Simultaneously, it helps in limiting the range of natural variations and beyond this range, the variations in handwriting will falls in fallacious category that will help in distinguishing between the two handwritings whether they belong to same source or not in order to establish authenticity in handwriting in terms of size and proportion of letters – of, it, ly, he and ed since these are the commonly used combinations of letters.

**CONCLUSION:**

A range of natural variations for size and proportion of letters has been deduced which has contributed for singularity in research particularly in this area of specialization and for ‘of’ it is 0.002 mm – 0.118 mm, for “it” it is 0.003 mm – 0.159 mm, for “ly” it is 0.004 mm – 0.104 mm, for “he” it is 0.008 mm – 0.281 mm and for “ed” it is 0.001 mm – 0.124 mm. The results gathered in terms of p-value for each letter combination revealed that amongst all, the letter ‘ed’ is the most consistent combination with least variations. From the present investigation the cases ailing in contemporary handwriting can be attempted with ease as well as releasing the experts from the requirement and dependability on contemporary writings.

**REFERENCES:**

ABSTRACT:
Pre donation blood donor screening is done for the safety of the donor and recipient. Individuals disqualified from donating blood are known as "deferred" donors. Donor deferral might appear as discrimination and violation of a human right. Deferring prospective donors often leaves them with negative feelings about themselves as well as the blood donation process. Additionally these donors are less likely to return for blood donation in future. So causes of the pre-blood donation deferral need to be studied systematically to improve the donation rate. Retrospective observational study was done for whole blood donations over a period from April 2016 to December 2016. Out of 16298 blood donors who came to donate blood, 15783 (96.84%) were males and 515 (03.16%) were females. Total 1766 (10.83%) blood donors were deferred, out of which 1706 (96.6%) were temporary deferrals and 60 (3.4%) were permanently deferred. Overall more males (1413) were deferred than females (353) but females had higher deferral rate (68.5%) than males (8.9%). Effective measures need to be initiated to address the issue of lost donors due to temporary deferrals which can be reduced by providing detailed information and educating the donors & camp organizer by blood bank staff. Donors with permanent deferrals should be counseled, notified and referred to specialists for further treatment.

INTRODUCTION:
In India, human blood is covered under the definition of “Drug” under section 3(b) of drugs and cosmetic act. Hence blood banks are regulated by Drug and Cosmetic Act 1940 and Rules 1945. Center government (Ministry of Health and Family Welfare, New Delhi) in 1967, enacted a separate provision in schedule F Part XII B of Drug and Cosmetic Rules, which is further supplemented for donor deferrals[1].

Pre donation blood donor screening is done for the safety of the donor and recipient. Individuals disqualified from donating blood are known as "deferred" donors. Donor deferral might appear as discrimination and violation of a human right. Deferring prospective donors often leaves them with negative feelings about themselves as well as the blood donation process[2]. Additionally these donors are less likely to return for blood donation in future[3]. So causes of the pre-blood donation deferral need to be studied systematically to improve the donation rate. This study was undertaken to record reasons for donor deferral at our centre, analyze them and give further recommendations.

METHODS: Retrospective observational study was done for whole blood donations over a period from April 2016 to December 2016. Donors presenting at in house as well as outdoor locations were included in the study. Standard Operating Procedures based on National guidelines were used for donor selection and deferral. Deferred donors data was analyzed with respect to sex of donor and causes for deferral which were also categorized into permanent and temporary causes based on the curability of the condition.

RESULTS:
Out of 16298 blood donors who came to donate blood, 15783 (96.84%) were males and 515 (03.16%) were females (Table 1). Total 1766 (10.83%) blood donors were deferred, out of which 1706 (96.6%) were temporary deferrals and 60 (3.4%) were permanently deferred (Table 2). Overall more males (1413) were deferred than females (353) but females had higher deferral rate (68.5%) than males (8.9%) (Table 3). Reasons for permanent deferral in our study were hepatitis, cardiac disease, asthma, epilepsy and thyroid disorder (Table 4). Reasons for temporary deferral in our study were anemia, medication, alcohol intake, underweight, fever, last donation<3 months, etc.( Table 5).
Table 1: Demographic Profile of the Donors

<table>
<thead>
<tr>
<th></th>
<th>Registrations</th>
<th>Deferrals</th>
<th>Deferrals of Total Registrations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>15783</td>
<td>1413</td>
<td>08.67%</td>
</tr>
<tr>
<td>Female</td>
<td>515</td>
<td>353</td>
<td>02.16%</td>
</tr>
<tr>
<td>Total</td>
<td>16298</td>
<td>1766</td>
<td>10.83%</td>
</tr>
</tbody>
</table>

Table 2: Frequency of Permanent and Temporary Deferrals

<table>
<thead>
<tr>
<th></th>
<th>Deferrals</th>
<th>Total Deferrals (%)</th>
<th>Deferrals of Total Registrations (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary</td>
<td>1706</td>
<td>96.6%</td>
<td>10.46%</td>
</tr>
<tr>
<td>Permanent</td>
<td>60</td>
<td>3.4%</td>
<td>00.37%</td>
</tr>
<tr>
<td>Total</td>
<td>1766</td>
<td>100%</td>
<td>10.83%</td>
</tr>
</tbody>
</table>

Table 3: Frequency of deferrals among male and female donors

<table>
<thead>
<tr>
<th></th>
<th>Donations</th>
<th>Deferrals</th>
<th>Deferrals Among Male/Female Donors (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>15783</td>
<td>1413</td>
<td>08.90%</td>
</tr>
<tr>
<td>Female</td>
<td>515</td>
<td>353</td>
<td>68.54%</td>
</tr>
</tbody>
</table>

Table 4: Causes of permanent deferrals with their relative proportions

<table>
<thead>
<tr>
<th>Causes</th>
<th>No.</th>
<th>Permanent Deferrals (%)</th>
<th>Total Deferrals (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hbsag/HCV/HIV</td>
<td>10</td>
<td>0.62%</td>
<td>18.33%</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>11</td>
<td>0.56%</td>
<td>16.67%</td>
</tr>
<tr>
<td>Asthma</td>
<td>14</td>
<td>0.79%</td>
<td>23.34%</td>
</tr>
<tr>
<td>Epilepsy</td>
<td>22</td>
<td>1.25%</td>
<td>36.66%</td>
</tr>
<tr>
<td>Thyroid disorder</td>
<td>03</td>
<td>0.18%</td>
<td>05.00%</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>3.40%</td>
<td>100%</td>
</tr>
</tbody>
</table>

DISCUSSION:

Safe donor is the first step towards safe blood transfusion which can be achieved by right donor selection & deferral. The rate & reasons of deferral differ from region to region and from one center to other leading to huge losses in terms of blood units for transfusion. Variation in deferral rates probably reflects the regional diversity and marked variation in whole blood donor eligibility criteria internationally.

The overall deferral rate in our study was 10.83% which is very near to donor deferral rate of 9.54% to 15.83% in previous studies but it is much higher than 2.80% to 5.6% in other studies and is much lesser than study done by Di Lorenzo Oliveira where it was 21.6%.

Females constituted less (3.16%) of total registered donors as compared to males (96.84%) in this study which is similar to other studies.

Deferral rate among females was higher than males like in most studies.

Temporary deferral in this study was much higher (96.6%) than permanent (3.4%) deferral like most studies done in past but does not coincide with study done by Girish CH.

Reasons for permanent deferral in this study were hepatitis, cardiac disease, epilepsy, depression & asthma similar to study done by Rehman et al.

The most common reason for temporary deferral was low hemoglobin which is consistent with studies.

Most of females deferred were anemic where as 20.8% males were deferred due to low hemoglobin.

Second main cause of temporary deferred in our study was medication which is higher than 8.5%, 11.45%, 9.5%, 8.85% and 11.65% in other studies.

Alcohol intake one day prior to blood donation was the third most common cause for deferral in this study because it is common practice to consume alcohol by males in the state of Punjab. It is almost similar to 8.84% in a study by Fred John but is higher than 3.3% in a study done by Prinja et al but lesser than 21.24% in study by Kulkarini N.

About 7% donors were deferred due to underweight in our study in which 24% were females of total deferred & rest were males. It is almost similar to 6.22% by a study done by Fred John et al. In a study by Prinja et al it was 12.7% which almost double than this study. It was four times in a study done by Kulkarni N where it is 27.45%.

Minor reasons for deferral in our study were underage, sore throat, major & minor surgery vaccination, history of fever, hypertension, tattooing, ear piercing, anxiety, dental extraction, skin disease, uncontrolled diabetes etc. like in other studies.

CONCLUSION:

Effective measures needed to be initiated to address the issue of lost donors due to temporary deferrals which can be reduced by providing detailed information and educating the donors & camp organizer by blood bank staff. Donors should not feel discriminated and should not have negative feeling about blood center and return for donation after temporary deferral period is over. Donors with permanent deferrals should be counseled, notified and referred to specialists for further treatment.
## Table 5: Causes of Temporary Deferrals with their Relative Proportions

<table>
<thead>
<tr>
<th>Causes</th>
<th>No.</th>
<th>Temporary Deferrals (%)</th>
<th>Total Deferrals (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemia</td>
<td>635</td>
<td>35.95%</td>
<td>37.22%</td>
</tr>
<tr>
<td>On Medication</td>
<td>405</td>
<td>22.93%</td>
<td>23.74%</td>
</tr>
<tr>
<td>Alcohol</td>
<td>132</td>
<td>7.45%</td>
<td>7.73%</td>
</tr>
<tr>
<td>Under Weight</td>
<td>125</td>
<td>7.07%</td>
<td>7.32%</td>
</tr>
<tr>
<td>History of Fever</td>
<td>60</td>
<td>3.39%</td>
<td>3.51%</td>
</tr>
<tr>
<td>Donated &lt; 3 months</td>
<td>44</td>
<td>2.49%</td>
<td>2.57%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>42</td>
<td>2.46%</td>
<td>2.63%</td>
</tr>
<tr>
<td>Upper Respiratory T I</td>
<td>40</td>
<td>2.26%</td>
<td>2.34%</td>
</tr>
<tr>
<td>Typhoid</td>
<td>28</td>
<td>1.58%</td>
<td>1.64%</td>
</tr>
<tr>
<td>Anxiety / Restlessness</td>
<td>27</td>
<td>1.52%</td>
<td>1.58%</td>
</tr>
<tr>
<td>Dental Extraction</td>
<td>22</td>
<td>1.24%</td>
<td>1.28%</td>
</tr>
<tr>
<td>Dog Bite</td>
<td>22</td>
<td>1.24%</td>
<td>1.28%</td>
</tr>
<tr>
<td>Skin Diseases</td>
<td>21</td>
<td>1.18%</td>
<td>1.23%</td>
</tr>
<tr>
<td>Tattooing / Ear piercing</td>
<td>17</td>
<td>0.96%</td>
<td>0.99%</td>
</tr>
<tr>
<td>Chickenpox</td>
<td>17</td>
<td>0.96%</td>
<td>0.99%</td>
</tr>
<tr>
<td>Minor/Major Surgery</td>
<td>16</td>
<td>0.90%</td>
<td>0.94%</td>
</tr>
<tr>
<td>Uncontrolled Diabetes</td>
<td>16</td>
<td>0.90%</td>
<td>0.94%</td>
</tr>
<tr>
<td>Under Age</td>
<td>10</td>
<td>0.56%</td>
<td>0.58%</td>
</tr>
<tr>
<td>Menstruation/Pregnancy/ Lactating Mother</td>
<td>10</td>
<td>0.56%</td>
<td>0.58%</td>
</tr>
<tr>
<td>History of Dengue</td>
<td>10</td>
<td>0.56%</td>
<td>0.58%</td>
</tr>
<tr>
<td>Poor Veins</td>
<td>7</td>
<td>0.39%</td>
<td>0.41%</td>
</tr>
<tr>
<td>Total</td>
<td>1706</td>
<td>96.6%</td>
<td>100%</td>
</tr>
</tbody>
</table>

### REFERENCES:

12. Mahapatra S, Mishra D, Ray GK, Sahoo BB, Panigrahi R, Patjoshi S. Analysis of The Causes And Study Of Frequency of Donor Deferral For Blood Donation: J o u r n a l  o f  D e n t a l  a n d  M e d i c a l  S c i e n c e s 2016:15(9):122-4.


ABSTRACT:

Introduction: Attack on doctors by patient's relative has increased of late. This is due to lack of understanding of doctor-patient relationship or medical ethics and law by the doctors than anything else. Medical ethics and law is taught to undergraduate students.

Objective: To evaluate if the undergraduate students have adequate knowledge on medical ethics and law.

Material and Method: A cross-sectional, questionnaire-based, anonymised, evaluation of students, who completed the course of medical ethics and law, was carried out.

Result: 44.6% of the students had poor knowledge on medical ethics and law.

Conclusion: Undergraduate students do not have adequate knowledge on medical ethics and law. Knowledge can be modified by teachers of forensic medicine, who can create interest and motivating students to follow the path of medical ethics and law. If required curriculum may be modified and ancient Indian medical ethics may be introduced. The process of selection of medical students may be made more stringent.

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INTRODUCTION:

Medical ethics deals with moral principles which should guide the members of medical profession, in dealing with each other, with patients and with the state. Ethics can be explained as moral conduct of right and wrong in a civil society, which comes from within. It is a branch of Philosophy. Medical ethics help doctors in dealing with patients, for the best possible outcome. It is different from law which is enforced on an individual only after crime is committed. Ethics prevents individual from committing wrong. Ethics is a preventive aspect where as law is therapeutic. Medical ethics and Law go hand in hand or they are the two sides of same coin, hence both are dealt together.

India can boast of its own code of ethics proposed by Charaka roughly 4700 years ago the ethics prevented physicians to eat meat, drink alcoholic beverages and commit adultery. Physicians should not harm their patients and be solely devoted to patient care, even if this puts their lives in danger.

Western World had its foundation on ethics as Hippocratic Oath. The examination of moral issues in medicine largely began in 4th century BC by the great Greek physician Hippocrates (sometime between 460-377 BC the accepted life period). Muslim ethics has always been guided by the teachings in the Koran. Mughals established themselves in India in 1526. Muslim physicians (hakims) were drawn from that in vogue in Persia which, in turn, was of Greek and Roman origin.

During World War, barbaric torture was done on human being. Dr Brandit, Hitler’s number one medical authority, under his supervision the worst calamity was created by Nazi regime. In October 1939 amid the turmoil of the outbreak of war Hitler ordered widespread "mercy killing" of the sick and disabled. Code named "Aktion T 4," the Nazi euthanasia program to eliminate "life unworthy of life". It was first focused on newborns and very young children… the Nazi euthanasia program quickly expanded to include older disabled children and adults. This so called mercy killing destroyed more than 70,000 innocent lives. Dr. Kazu Tabei of Japan, gave typhoid germs to prisoners by mixing with milk, Dr Hisato Yoshimura, froze captivities to death during World War. In history, there are innumerable examples of unethical act and torture, by use of medical knowledge. Dr. Guillotine of France invented decapitating machine of execution and this infamous machine was named after him. Dr. Alfred a dentist designed electric chair. Dr. Stanly an anaesthiologist conceived lethal injection
and used against 40 yrs old African American in 1782 in Texas. The convict died in minutes as doctors watched. The cruel torture on human led to formation of International Code of Medical Ethics which is modernized version of the Hippocratic Oath. It was approved at the Declaration of Geneva in the II General Assembly of the World Medical Association and adopted in 1949 by the III General Assembly of the World Medical Association at London in 1949. It was further amended in 1968, 1983 and 2006. Main goal was to establish the ethical principles of the physicians worldwide, based on his duties in general, to his patients and to his colleagues.

All member countries of World Health Organization adopted the international Code of Medical Ethics. India has also updated the Declaration of Geneva in the form of ‘Code of Medical Ethics’. In contemporary India, some of disturbing recent news include: June 10, 2017-Doctor injured in nursing home attack after patient’s death, Aug 13, 2015-2 junior doctors beaten up at SSKM Hospital, Jan 11, 2016-A PG trainee at RG Kar admitted in ICU after he was assaulted by a mob, Jun 22, 2016-Junior doctor assaulted at SSKM Hospital, Mar 24, 2017- Doctors attacked at RG Kar Medical College, Feb 15, 2017-Mob vandalism at CMRI Hospital.

The attacks on doctors are more due to lack of doctor-patient relationship or understanding of medical ethics than anything else. This disturbing trend in doctor patient relationship, led us to carry out the evaluation: Does under graduate student learn Medical Ethics and Law in Medical College

MATERIAL AND METHOD:

After getting clearance from Institutional Ethics Committee, present cross sectional study was conducted between February 2017 and July 2017 in the Department of Forensic Medicine and Toxicology of a Medical College on students who completed the course of Ethics and Medical Law, in 4th semester and passed the exam. Ten pre-designed and pre tested questions on medical ethics and medical law were given two students. '1' mark awarded for correct answer and '0' mark for wrong answer. Data analyzed using suitable statistical and mathematical technique.

RESULTS:

109 (63%) of the 173 students who completed the course of Ethics and Medical Law, in 4th semester, returned the completed questionnaire. Of them there were 61 girls and 48 boys. Significant difference in the performance of boys and girls was not noticed. One of the students answered all questions correctly.

- Student scoring 7-10 were categorized as good. 35.2% had good knowledge on medical law and ethics.
- Score between 7-10 were categorized as adequate knowledge, 20.2% of the students were in this category.
- Scoring equal to or below 4 were categorized as poor, 44.6% of the students were in poor category (Table 1).

Table 1: Distribution of Students According to Individual Score:

<table>
<thead>
<tr>
<th>Score</th>
<th>7-10:Good</th>
<th>6-5:Adequate</th>
<th>&lt;4:Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>61</td>
<td>35</td>
<td>77</td>
</tr>
<tr>
<td>%</td>
<td>35.2%</td>
<td>20.2%</td>
<td>44.6%</td>
</tr>
</tbody>
</table>

Knowledge on medical ethics and medical law, question wise correct response: Knowledge on Hippocratic Oath and knowledge on Medical Negligence was correct in 52% of students. Knowledge on Professional misconduct was correct in 49.7 of students. Knowledge in Implied consent was correct in 39% of students. Knowledge in Vicarious Liability was correct in 43.3% of students. Knowledge on CPA-86 was correct in 37.5% of students. Knowledge on confidentiality was correct in 31.7% of students. Knowledge on euthanasia was correct in 42.7% of students. Knowledge on organ donation was correct in 46% of students (Table 2).

DISCUSSION:

44.6% students had poor knowledge on medical ethics and law, where as 55.4% (35.2%+20.2%) had more than adequate knowledge. Almost 50% of student population did not have adequate knowledge in medical ethics and law. This is a cause of concern not only among the patients, but also among the teachers, who teaches medical ethics and law. A study was done in Sri Lakshmi Narayana Institute of Medical Sciences, Osudu, Agaram, Puducherry, on “Are tomorrow’s doctors aware of the code of medical ethics?” This study covered 172 medical students who were administered a questionnaire, based on the ‘medical code of ethics’ as set out in the chapters on ‘unethical acts' and 'misconduct' of the Indian Medical Council (Professional conduct, Etiquette and Ethics) Regulations, 2002. Result shows only 128 (74.4%) of the 172 medical undergraduates enrolled in the study returned the completed questionnaire. None of them answered all the questions correctly. The overall mean score was 6.13 out of 10.
with an SD of 1.36. There were no significant differences between second-, third- or final-year students. There was no significant difference in the performance of boys and girls. Most of the students erred in scenarios related to decision-making and communication. It was concluded “There are major deficiencies in the understanding of medical ethics among medical undergraduates. Including medical ethics as a mandatory and separate subject in the first few years of under graduation can help students understand and follow ethical principles[10] Our study agrees with the above study and found there are major deficiencies in the understanding of medical ethics and law among medical undergraduates

A study was done in Christian Medical College, Vellore 632 002, Tamil Nadu titled “Survey of ethical issues reported by Indian medical students: basis for design of a new curriculum” Education in ethics is now a formal part of the undergraduate medical curriculum. However, most courses are structured around principles and case studies more appropriate to western countries. The cultures and practices of countries like India differ from those of western countries. It is, therefore, essential that our teaching should address the issues which are the most relevant to our setting. An anonymised, questionnaire-based, cross-sectional survey of medical students was carried out to get a picture of the ethical problems faced by students in India. The data were categorized into issues related to professional behavior and ethical dilemmas. Unprofessional behavior was among the issues reported as a matter of concern by a majority of the medical students. The survey highlights the need to design the curriculum in a way that reflects the structure of medical education in India, where patients are not always considered socio-culturally equal by students or the medical staff. This perspective must underpin any further efforts to address education in ethics in India[11], our study shows, students are not comfortable understanding of medical ethics and law as found in the study. India’s own code of ethics in Sushruta Samhita describes in detail the internal character and external built of a pupil who is to be admitted as a medical student. This admission process was very stringent. A medical student was expected to be honest, humble, temperate, generous, and hard-working[12]. He was not supposed to be enamored with women or engage in gambling or hunting. His memory and academic performance were also given importance[13]. The students had to renounce lust, anger, greed, ignorance, vanity, selfishness, envy, rudeness, miserliness falsehood, sloth and all other act that bring a man to disgrace. Students should respect and obey teachers. Students had to cut nails and hair at proper time. He laid more emphasis on practical training. Sushruta Samhita prescribes the dress code of white or brownish yellow clothes for the vaidya[14]. May be if we go back to ancient Indian ethics and choose students as per qualities described by them, we can have brilliant doctors.

CONCLUSION:

Under graduate students on whom the study was done did not have adequate knowledge on medical ethics and law. The result shows 44.6% students had poor knowledge on medical ethics and law, where as 55.4% (35.2%+20.2%) had more than adequate knowledge. According to the study almost 50% of student population, who would turn to doctor in less than 5 years, provided with registration number may not have adequate knowledge in medical ethics and law. This is a great dilemma among medical profession. This may result in problem of doctor-patient relationship; attacks on doctors may be on the rise. It would ultimately result in increase suffering of innocent patients.

A teacher of forensic medicine has to ensure, students understand medical ethics and law. They should also be able to motivate the students to follow the path of medical ethics and law on becoming doctor.

Selection of medical students requires modification as directed in Sushruta Samhita: doctors were selected as per character; admission process was very stringent where a medical student was expected to be honest, humble, temperate, generous, and hard-working. The process of selection of doctors is stringent in many parts of world, where academics are not the only criteria.

Curriculum of medical ethics and law, as per MCI, may require modification. Ancient Indian medical ethics may be introduced. It will create more interest among the students and

Table 2; Question Wise Correct Response:

<table>
<thead>
<tr>
<th>No.</th>
<th>Knowledge</th>
<th>Number of Students: Correct Response</th>
<th>(%age)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hippocratic Oath</td>
<td>90</td>
<td>52%</td>
</tr>
<tr>
<td>2</td>
<td>Professional Misconduct</td>
<td>86</td>
<td>49.7%</td>
</tr>
<tr>
<td>3</td>
<td>Implied Consent</td>
<td>66</td>
<td>38.1%</td>
</tr>
<tr>
<td>4</td>
<td>Right of Registered Medical Practitioner to Choose Patient</td>
<td>68</td>
<td>39.3%</td>
</tr>
<tr>
<td>5</td>
<td>Medical Negligence</td>
<td>90</td>
<td>52%</td>
</tr>
<tr>
<td>6</td>
<td>Vicarious Liability</td>
<td>75</td>
<td>43.3%</td>
</tr>
<tr>
<td>7</td>
<td>CPA-86</td>
<td>65</td>
<td>37.5%</td>
</tr>
<tr>
<td>8</td>
<td>Confidentiality</td>
<td>55</td>
<td>31.7%</td>
</tr>
<tr>
<td>9</td>
<td>Euthanasia</td>
<td>74</td>
<td>42.7%</td>
</tr>
<tr>
<td>10</td>
<td>Organ Donation</td>
<td>80</td>
<td>46%</td>
</tr>
</tbody>
</table>
students will be more knowledgable..

Source of Support: Nil
Conflict of Interest: Nil

REFERENCES:


9. The Times of India, Kolkata, Saturday, June 10, 2017, page 39, column 1


An Epidemiological Study of Deaths Due to Injuries in Head and Neck Region in Eastern India

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3. Tapas Sinha, Medico Legal Expert, Department of Forensic Medicine, DM Sadar Hospital, Purulia, WB, India.
4. Ashok Kumar Samanta, Professor and Head, Department of Forensic Medicine, ESI-PGIMSR, ESIC Medical College, Joka, Kolkata, WB, India.

INTRODUCTION:
Head, the relatively small portion at the cranial part of human body has been always considered as a prime part in several aspects. The injury to head, naturally, has been again considered with serious thoughts. Numerous research works and studies have been done till date to realize the pathology related to or the cause and circumstances resulting it and to find a way to get rid of either head injury or its consequences. All these trials are nothing but the newer additions for the concepts to ensure more secured life to mankind. Deaths from head injury comprise 1-2% of all deaths from all causes and one third to one half of all deaths due to trauma are due to head injury. Of the survivors, those with a head injury were substantially more impaired than those without the former, therefore also being an important cause of morbidity. Head injury can be approached both through a clinician's vision and a medico legist's vision. Because of the often regular litigations associated to this injury, a forensic pathologist or a medico legist remain concerned not only to the findings of autopsy, but also for the pre and post fatality related incidences of any specific head injury case. The challenge naturally lies in elaborating the meticulous pattern of the autopsy findings as well as relating those findings in causing the actual mishap and representing this in a rational manner to the investigating authority for the complete inquiry or for disbursement of justice.

MATERIALS AND METHODS:
Retrospective autopsy based study was conducted in association with the available clinical records at department of Forensic and State Medicine in Eastern India from 1st April,
2013 to 31st March, 2014. During this period, post mortems of total 1518 cases were conducted out of which 104 post mortem cases of fatal head injuries with positive findings of head and neck traumas (on gross autopsy) were considered for this study that includes head injury cases (where injury to other parts of body are not significant). Asphyxial death, decomposed body and subjects having preexisting disease were excluded. Detailed history of circumstances of injury over head and neck region and treatment were noted. Tabulation, data and statistical analysis was done in the department of Forensic Medicine at Microsoft Excel (version 2016).

RESULTS:

Victims from age group 31-40 years were maximum-23 (22.11%) cases, followed by 21-30 and 51-60 years age group (15.38%) cases. The victims of age group 81-90 years and 01-10 years are least affected by head and neck injuries as seen to be 04 (3.84%) cases (Table1). There is preponderance of fatal head and neck injuries in males as compared to females. Out of 104 cases, 88 (84.61%) males are affected by fatal head injuries while females affected are 16 (15.38%) cases. Male, female sex ratio is 5.5:1 (Table 2). Fatal head injury cases seen to have occurred most commonly during the Monsoon (July to October) as seen in 42 (40.38%) cases, followed by Winter season (November to February)- 32 (30.76%) cases (Table 3).

25.96% cases of head and neck injury died within 6 hours of casualty either at the spot or on the way to hospital. 47.11% cases survived for more than 72 hours and then died. 11.53% and 9.61% of cases died in 24-48 hrs and 48-72 hrs respectively and 1.92% cases died in 6-12 hrs of the incidents (Table 4). Maximum number of death was accidental in nature 88.46% cases followed by unknown cases (5.76%) (Table 5). Trachea was involved in only 2 (2%) cases (Table 6).

### TABLE-1 : Distribution of the Study Population According to the Age (N=104)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-10</td>
<td>4</td>
<td>3.84%</td>
</tr>
<tr>
<td>11-20</td>
<td>12</td>
<td>11.53%</td>
</tr>
<tr>
<td>21-30</td>
<td>16</td>
<td>15.38%</td>
</tr>
<tr>
<td>31-40</td>
<td>23</td>
<td>22.11%</td>
</tr>
<tr>
<td>41-50</td>
<td>11</td>
<td>10.57%</td>
</tr>
<tr>
<td>51-60</td>
<td>16</td>
<td>15.38%</td>
</tr>
<tr>
<td>61-70</td>
<td>12</td>
<td>11.53%</td>
</tr>
<tr>
<td>71-80</td>
<td>6</td>
<td>5.76%</td>
</tr>
<tr>
<td>81-90</td>
<td>4</td>
<td>3.84%</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE-2 : Distribution of Study Population According to Sex (N=104).

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>88</td>
<td>84.61%</td>
</tr>
<tr>
<td>Female</td>
<td>16</td>
<td>15.38%</td>
</tr>
</tbody>
</table>

### TABLE-3 : Distribution of Study Cases According to Seasonal Variation (N=104).

<table>
<thead>
<tr>
<th>Seasonal Variation</th>
<th>NO.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter (Nov-Feb)</td>
<td>32</td>
<td>30.76%</td>
</tr>
<tr>
<td>Monsoon (July-Oct)</td>
<td>42</td>
<td>40.38%</td>
</tr>
<tr>
<td>Summer (March-June)</td>
<td>30</td>
<td>28.84%</td>
</tr>
</tbody>
</table>

### TABLE-4 : Distribution of study Population According to the Period of Survivability (N=104).

<table>
<thead>
<tr>
<th>Survival Time (Hours)</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>27</td>
<td>25.96%</td>
</tr>
<tr>
<td>6.12</td>
<td>2</td>
<td>1.92%</td>
</tr>
<tr>
<td>12-24</td>
<td>4</td>
<td>3.84%</td>
</tr>
<tr>
<td>24-48</td>
<td>12</td>
<td>11.53%</td>
</tr>
<tr>
<td>48-72</td>
<td>10</td>
<td>9.61%</td>
</tr>
</tbody>
</table>

### TABLE-5 : Distribution of Study Population According to the Alleged Manner of Death (N=104).

<table>
<thead>
<tr>
<th>Manner</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidental</td>
<td>92</td>
<td>88.46%</td>
</tr>
<tr>
<td>Suicidal</td>
<td>2</td>
<td>1.92%</td>
</tr>
<tr>
<td>Homicidal</td>
<td>4</td>
<td>3.84%</td>
</tr>
<tr>
<td>Unknown</td>
<td>6</td>
<td>5.76%</td>
</tr>
</tbody>
</table>
Table-6 : Distribution of Cases According to Injury to Trachea (N=104)

<table>
<thead>
<tr>
<th>Trachea</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injured</td>
<td>2</td>
<td>1.92%</td>
</tr>
<tr>
<td>Not Injured</td>
<td>102</td>
<td>98.08%</td>
</tr>
</tbody>
</table>

DISCUSSION:

Regarding age, it is observed that no age is immune for head & neck injury to occur. It is also clear from the given Table-1 of present study that From that the victims from age group 31-40 years are maximum (22.11%) cases, followed by 21-30 and 51-60 years age group (15.38%) cases. The victims of age group 81-90 years and 01-10 years are least affected by head and neck injuries as seen to be (3.84%) cases.

Tirpude et al (1998)\(^1\) observed that the maximum incidence of fatal road traffic incidents was found to be in the age group 21-30 years -38.88% followed by 31-40 years -18.51%, lowest incidence being at the age group 61 and above as 05.55% cases. Sanjeeva et al (1999)\(^2\) at the study on fatal falls, found that 21-30 year age group forms the majority of cases-27.58%, followed by 31-40 years- 19.54%. Eqabal et al (2005)\(^3\) in their study observed that the maximum number of casualty occurred in age group of 0-10 years, both in male and female. Gupta et al (2007)\(^4\) observed that the incidence of fatality was seen to be maximum in 21-30 years -23% cases followed by 31-40 years- 19% cases, lowest incidence being at above 70 year age as was seen in 02% cases. In a study of variability of intracranial haemorrhages Dash & Roy (2009)\(^5\) reported that maximum number of cases was observed in the age group 21-30 years followed by 31-40 years. In profile of RTA and head injury study, Pathak et al (2008)\(^6\) reported that 20-29 year age group was maximally affected followed by 30-39 year age group in close succession.

Thus the age and gender related findings at present study are nearly similar to the above mentioned studies except the observation of Eqabal et al regarding the age group affected mostly as they found it to be 0-10 years in both sexes while present study shows highest affected age group as 31-40 years. In the study of Eqabal et al, fall from height accounted for most of the casualties and Road traffic incidents are next common and it has been stated that below 10 years of age, fall from an unspecified height was a predominant aetiological factor.

Regarding sex, in our present study male:female was 5.5:1. Tirpude et al (1998)\(^1\) in the study on cranio cerebrals injuries observed that male to female ratio was 4.4:1. In a retrospective review on fatal falls, Sanjeeva et al (1999)\(^2\) reported that in their study, male: female ratio was 4.6:1. Patil & Vaz (2010), [10] in their study on pattern of blunt head injury, reported that Male: female sex ratio of 7.6: 1. In a study on pattern of head injury, Eqabal et al (2005)\(^3\) studied on 100 cases in Aligarh, U.P. and observed that male: female sex ratio 4.9:1. Gupta et al (2007)\(^4\) in a study on fatal craniocerebral cases, conducted at North Bengal Region, West Bengal, in 2003, observed that male: female ratio was 7.3:1. Pathak et al (2008)\(^6\) in the year 2003-2004, observed the ratio of male and female as 4:1 for Road traffic accident cases.

Govekar et al (2009)\(^7\) in another study of road traffic incidents at Surat city, in 2006 showed that male: female approx.10:1. Dash & Ray (2009)\(^8\) studied 207 medicolegal autopsies of fatal head injuries and found that male: female ratio was 3.6:1. So, it is seen that male and female ratio as noted in the above studies are as close as my observation in this present study.

High preponderance of males belonging to the age group 21-40 years may be because males are bread earners, for which they go outside more than females and adults are the valuable source of family income. Such bulk of activities and assignments make them more prone to high risk factors leading to head injuries. The fewer incidences at above 81 year age group because of avoiding outside activities and to enjoy a sedentary retired lifestyle.

Regarding seasonal variation, fatal head and neck injury cases occurred most commonly during the Monsoon (July to October) 40.38% cases, followed by Winter season (Nov. to Feb.) 30.76% cases. Govekar et al (2009)\(^7\) in a study at Surat city, observed maximum fatal RTA cases occurred in winter season- 39.9% cases, while in Monsoon season incidences were 35% respectively. In a study Biswas et al (2003)\(^9\) observed that at North East Delhi, during 1999-2000, Road Traffic Accidents took place mostly during Summer (May- July ) a 32.7%, and least number of cases during Winter (November to January) 17.2%. Merchant et al (2009)\(^10\) at their study, carried out at Ahmadabad, in 1995-1999, observed that maximum number of Road Traffic Accidents took place during summer -40.3% while minimum at monsoon- 25%. The higher incidence of head and neck injury during Monsoon can be due to damaged road conditions and haziness of the wind-screen of the vehicles which makes difficulty in sight. Regarding the period of survivability a study was carried out in India showed that 24.35% of the victims died at the site of accident or during transportation to hospital\(^[11]\). Another study which was carried out in England revealed that 16% of road traffic deaths take place at site of accident, immediately or within few minutes.
44% of the victims who arrived at hospital died within 24 hours; among which 9% died within one hour, 28% died within six hours and 16% died between 6 to 24 hours. 56% of the victims, who arrived hospital survived more than 24 hours and 29% of them survived more than a week. Another interesting fact is that, fatality within first 24 hours is highest among motorcyclists and lowest among the pedestrians\(^{[16]}\).

In a study carried out by A K Rastogi et al\(^{[11]}\) in Agra region reveals that, more than two-third (71.6%) of the cases of head injury were died within 24 hours of the casualty of which 34% died either on the spot or within an hour of the accident. Only 3.6% cases survived for more than a week then died.

Regarding manner of death, Present study depicts that 88.46% deaths were accidental in nature. Road Study conducted by Patil & Vaz (2010)\(^{[10]}\) on fatal traumatic head injuries observes that most of the people were died in accidents (91.5%), followed by other circumstances (5.3%) and homicides (2.1%). Suicidal blunt head injuries were the least common (1.1%).

The thickness of the scalp in the adult is variable, ranging from a few mm to about one cm. Most wounds are caused by blunt force to the head, like falls or blows, and such wounds are contusions or lacerations.

Contusions may occur in the superficial fascia, in the Temporalis muscle, or in the loose areolar tissue between the galea aponeurotica and the pericranium. A hematoma of the scalp may be very extensive and spread beneath the galea aponeurotica over most of the skull (Subgaleal haemorrhage) (Reddy, 2012)\(^{[12]}\). Husain et al (2009)\(^{[11]}\) observed that in 86 cases of cranial-intracranial injuries studied, all had either scalp laceration or hematoma formation. In cases of head injuries due to fatal falls from height as studied by Sanjeeva et al (1999)\(^{[2]}\), it was seen that injuries in the scalp occur as laceration or contusion with or without Subscalpular extravasations of blood. In 03.45% cases, scalp was involved individually while scalp injury along with brain injury was found in 14.4% cases.

Thus it is seen that scalp injury that is often manifested as Subscalpular findings bear importance either to locate the impact site or to assess the manner of the injury sustained. Our study shows similarity with the study by Husain et al as per the prevalence of it in head injuries.

In the textbook of “Forensic Medicine and Toxicology” the author Prof. Krishan Vij\(^{[1]}\) mentioned that wounds of the neck are mostly incised and rarely punctured. They are more often homicidal than suicidal and rarely accidental. The chief danger in incised and stab wounds of neck is from haemorrhage due to an injury to blood vessels. Death is due to haemorrhage, air embolism consequent upon the entry of air into the venous system, or due to asphyxia from filling air passages with blood.

**CONCLUSION:**

Trauma, that carries medicolegal implications in general, is a burden often responsible for the fatal outcomes of human life; and it is head injury which has major contribution to trauma, has always been a matter of concern for the medics regarding diagnosis and treatment because of the fact that it cannot be completely evaluated until some time has elapsed after the alleged injury. From the above observation it can be summarized that the designated manner and cause of deaths in such scenarios and prevention of head and neck injury should be the aim and this can be achieved by improving the real socioeconomic condition of common people, education of mass, providing more safety measures in this rapidly progressing and changing lifestyle of society and the extension of support to the judiciaries by better submission of evidences as an expert to avoid miscarriage of justice.

**REFERENCES:**


9. Merchant SP, Zariwala RC, Mehta T, Bhise R. Epidemiology of road traffic accidents(RTA) victims in


ABSTRACT:
Background: Determination age and sex of skeleton remains/advanced decomposed body is an important task for the forensic expert to help in the investigation of concern cases.
Objectives: To study the relationship between age and phenomena of graying of hair of scalp, pubic region, axillary region, mustache and beard.
Materials and Methods: An autopsy based descriptive cross sectional study of 116 cases of age above 10 years was done at New Civil Hospital, Surat.
Results: The study group comprised 65.5% males & 34.5% females. More than two third of the male (69.7%) and 65 % female had blackish hair on their scalp. Pattern of gray colour hair observed from the age of 41 year in both sex.
Conclusion: Graying of hairs may not establish age in terms of definite figures, yet it would be an important corroborative index for age estimation.

INTRODUCTION:
Determination age and sex of skeleton remains/advanced decomposed body is an important task for the forensic expert to help in the investigation of concern cases. Age is determined from secondary sexual characteristics, dental status, appearance and fusion of ossification centre of bones and various skull sutures. The present study is an attempt to study the hair of scalp, moustache, beard, axillary hair and pubic hair in the purview of existing parameters for the determination of the age. Graying of hair is also called canities. It occurs due to gradual depigmentation of hair with advancement of age of an individual.[1-4]

MATERIAL AND METHODS:
An autopsy based descriptive cross sectional study conducted with prior approval of institutional committee for research & ethical concerns at Government Medical College & New Civil Hospital, Surat. We studied 116 cases of age above 10 years including both sexes from rural and urban area of Surat city brought for medico-legal post mortem examination in the Department of Forensic Medicine and Toxicology during January 2008 to December 2008. Information regarding the age of the deceased were obtained from nearest relatives and investigating officer of concern cases. From these cases, hair of scalp, moustache, beard, axillary hair and pubic hair were examined for graying. All cases selected for the study were apparently healthy without any congenital or constitutional disease.

RESULTS:
More than two third of the male (69.7%) and 65 % female had black hair on their scalp. Age group of 21-30 years was found the highest percent of black hair in male (49.1%) and 38.5% in female. Gray hair was found from the age of 41 year in both sex and mixed from the age of 31 year. No gray scalp hairs were observed below 30 yrs of the age in both sex (Table 1).
Three fourth (75%) of the male had black hair in relation to their mustache and near about three fourth had black hair on their beard. There was highest percent of black colour of hair in relation of mustache in the age group of 21-30 years and also in relation of beard (47.3%). The pattern of gray colour hair in relation to mustache and also for beard had started from the age of 41 year. No gray beard or mustachio hairs were observed below 30 yrs of age (Table 2).

More than three fourth (78.9%) of the male and near about it (72.5%) of the female had found the black colour of axillary hair on their body. The pattern of gray colour of axillary hair started from the age of 41 for both sex. No gray axillary hairs were observed below 30 yrs of age in both sex (Table 3).

Four fifth (80.3%) of the male and three fourth (75%) of the female had black pubic hair. According to the age group, 21 to 30 years had highest number of black pubic hair among male (42.6%) whereas in female two groups 21 to 30 & 31 to 40 years had similar findings which were 33.3%. Gray colour of pubic hair started from the age of 41 for both sex where as mixed colour started from 31 years of age. No gray pubic hairs observed below 30 yrs of age in both sex (Table 4).

Table: 1 : Age & Sex wise Distribution of the Cases According to Colour of Scalp Hairs

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Sex Wise Colour of Scalp Hairs</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black (%)</td>
<td>Gray (%)</td>
<td>Mix (%)</td>
</tr>
<tr>
<td>11-20</td>
<td>10 (18.9)</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>21-30</td>
<td>26 (49.1)</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>31-40</td>
<td>13 (24.5)</td>
<td>Nil</td>
<td>5 (35.7)</td>
</tr>
<tr>
<td>41-50</td>
<td>4 (7.5)</td>
<td>3 (33.3)</td>
<td>6 (42.9)</td>
</tr>
<tr>
<td>51-60</td>
<td>Nil</td>
<td>4 (44.4)</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>61-70</td>
<td>Nil</td>
<td>2 (22.2)</td>
<td>Nil</td>
</tr>
<tr>
<td>TOTAL</td>
<td>53 (69.7)</td>
<td>9 (11.8)</td>
<td>14 (18.4)</td>
</tr>
</tbody>
</table>

Table: 2 : Age Wise Distribution of the Cases According to Colour of Mustache and Beard Hairs

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Colour of Hair Mustache</th>
<th>Colour of Hair on Beard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black (%)</td>
<td>Gray (%)</td>
</tr>
<tr>
<td>11-20</td>
<td>10 (17.5)</td>
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</tr>
<tr>
<td>21-30</td>
<td>26 (45.6)</td>
<td>Nil</td>
</tr>
<tr>
<td>31-40</td>
<td>14 (24.6)</td>
<td>Nil</td>
</tr>
<tr>
<td>41-50</td>
<td>7 (12.3)</td>
<td>3 (42.9)</td>
</tr>
<tr>
<td>51-60</td>
<td>Nil</td>
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</tr>
<tr>
<td>61-70</td>
<td>Nil</td>
<td>2 (28.6)</td>
</tr>
<tr>
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<td>57 (75.0)</td>
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### Table 3: Age & Sex Wise Distribution of Cases According to their Colour of Axillary Hairs

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Sex Wise Colour of Axillary Hairs</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black (%)</td>
<td>Gray (%)</td>
<td>Mix (%)</td>
<td>Black (%)</td>
<td>Gray (%)</td>
<td>Mix (%)</td>
<td></td>
</tr>
<tr>
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<td>10 (16.7)</td>
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<td>8 (27.6)</td>
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<tr>
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<tr>
<td>31-40</td>
<td>15 (25.0)</td>
<td>3 (33.3)</td>
<td>Nil</td>
<td>9 (31.0)</td>
<td>Nil</td>
<td>2 (40.0)</td>
<td></td>
</tr>
<tr>
<td>41-50</td>
<td>7 (11.7)</td>
<td>3 (42.9)</td>
<td>3 (33.3)</td>
<td>2 (6.9)</td>
<td>1 (16.7)</td>
<td>1 (20.0)</td>
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<tr>
<td>51-60</td>
<td>2 (3.3)</td>
<td>2 (28.6)</td>
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<td>2 (28.6)</td>
<td>Nil</td>
<td>Nil</td>
<td>3 (50.0)</td>
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<tr>
<td>TOTAL</td>
<td>60 (78.9)</td>
<td>7 (9.2)</td>
<td>9 (11.8)</td>
<td>29 (72.5)</td>
<td>6 (15.0)</td>
<td>5 (12.5)</td>
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### Table 4: Age & Sex Wise Distribution of Cases According to their Colour of Pubic Hairs

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<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
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<td></td>
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<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black (%)</td>
<td>Gray (%)</td>
<td>Mix (%)</td>
<td>Black (%)</td>
<td>Gray (%)</td>
<td>Mix (%)</td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>10 (16.4)</td>
<td>Nil</td>
<td>Nil</td>
<td>8 (26.7)</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>26 (42.6)</td>
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<td>Nil</td>
<td>10 (33.3)</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>16 (26.2)</td>
<td>Nil</td>
<td>2 (22.2)</td>
<td>10 (33.3)</td>
<td>Nil</td>
<td>1 (25.0)</td>
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<tr>
<td>41-50</td>
<td>7 (11.5)</td>
<td>3 (23.1)</td>
<td>3 (33.3)</td>
<td>2 (6.7)</td>
<td>1 (16.7)</td>
<td>1 (25.0)</td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td>2 (3.3)</td>
<td>1 (16.7)</td>
<td>4 (44.4)</td>
<td>Nil</td>
<td>2 (33.3)</td>
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<tr>
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<td>Nil</td>
<td>2 (33.3)</td>
<td>Nil</td>
<td>Nil</td>
<td>3 (50.0)</td>
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</tr>
<tr>
<td>TOTAL</td>
<td>61 (80.3)</td>
<td>6 (7.9)</td>
<td>9 (11.8)</td>
<td>30 (75.0)</td>
<td>6 (15.0)</td>
<td>4 (10.0)</td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION:**

Gray hair was found from the age of 41 year in both sex and mixed from the age of 31 year in this study. Graying of hair though countered as a sign of aging process, has not shown a definite pattern in the present study as regard to its appearance on the scalp. But as age advances graying of scalp hair increases. In both males and females graying appeared in all cases at the age of 41-50 years. Variations in graying of scalp hair have been also reported by Other Authors. Graying of scalp hair depends upon other factors especially anxiety, heredity, constitutional diseases, multifactorial diseases and some other unaccountable reasons as described by Franklin, C.A. (1996). As per study by Daulatabad D[1] heredity is most common factor for premature canities. They considered graying in less than 20 yrs of age as premature.

The graying of scalp hair in this study was comparatively delayed in comparison to study by Moondra, A. (2000) in Haroti region of Rajasthan, which would be probably due to...
better nutrition and lack of alcoholic habituation which is more found in the Haroti region because of more literacy and rapid industrialization. An old Study(1955) by Terada H in Japanese population graying of head hair appears at 30-34yrs of age in males and 35-39yrs of age in females[6]. He observed 100% graying at 50-54yrs of age in males and 55-59yrs of age in females. He describes pattern of appearance of gray hair in scalp regions as Temporal->Occipital->Parietal->Frontal->Nuchal in males and Parietal->Temporal->Occipital->Frontal->Nuchal in females.

The graying of axillary and pubic hair definitely shows relation with ageing process as they turn gray only at an advanced age. A autopsy based study in Shree Lanka by Senanayake & Wickramasinghe also revealed strong, positive correlations between age and appearance of gray hair in head, mustache, beard & pubic area among males and hairs of head and pubic area among females[3].

In the present study graying of axillary and pubic hair was noticed simultaneously by the age of 51-60 years and onwards. The observation is quite similar to the observation made by previous authors[6-11]. So if an individual shows graying of axillary or pubic hair, he or she is definitely above the age of 46 years. A study in Japanese population by Haga K et al also found strong association of graying of pubic hairs with age[8]. They described five stages (stage 0 to 4) of graying of pubic hairs density of gray hairs. They found appearance graying earliest at 30yrs of age in Male and 36yrs of age in Female.

Among the males, the graying of beard and moustaches appears simultaneously with the graying of scalp hair i.e. above the age of 46 years. Complete graying of beard and moustaches among males is seen in the elderly age group i.e. above the age of 61-70 years.

According to Krishnan, M.K.R. (1974)[11] graying of the hair starts at the scalp at 40 years of age, first at the temple area and spread later to involve the beard and moustaches and later still the cost. Axillary and pubic hair turns grey only at advanced age. As the age advances scalp hair become less dense in males. The same thing observed in our study where graying of hair was observed after 41 yrs of age in both sexes. It was also observed that mixed hair(grey and black) was seen in more than 30% cases of male and in more than 70% cases of female. Graying of axillary hair and pubic hair was observed in late age group of both sexes.

Reddy K.S.N. (1987) described that graying of hair is variable. Head hair tends to become gray after 40 years in the temple area, beard and chest hair are involved still later but pubic hair does not become gray before 50-55 years[9].

According to Parikh C.K. (1990), baldness of scalp in not of much value, nor the graying of hair, except in general way. Graying starts on the scalp at about 40 years, first at the temple followed by the beard and then moustache. As the age advances, scalp hair becomes less dense in the males and there is loss of axillary hair in females[7].

Nandy A. (1995) commented that with extreme variation, scalp hair starts graying by 40 years, pubic hair grays above 55years and body hair above 60 years usually. Baldness may appear in males by about 50 years. Females usually do not become bald[4].

Frankin, C.A. (1996) mentioned that the hair on the head turns gray to silvery white with advancing age but he also mentioned that gray hair are some times seen among the young people. In some cases it is a hereditary peculiarity. Cases have occurred in which the scalp hair suddenly changes to gray due to extreme terror, grief, shock or some unaccountable reason[6]. Some studies describes graying with age in other body hairs also like eyelashes, eyebrows and chest hairs at old age[9].

CONCLUSION:

Though this study has limitations of fewer number of cases, we can conclude that age do have definite effect on greying of hairs, whether scalp, facial or body hairs. After 40yrs of age, it seems natural process to get greying of all body hairs in human. It would be rare to find natural black scalp hairs after 50 yrs of the age and pubic hairs after 60 yrs of the age in both sex. The persons with grey hairs earlier than 30 yrs of age needs to be evaluated medically for causative factors or hidden pathology. Though greying of hairs may not establish age in terms of definite figures, it would be an important corroborative index for age estimation in middle and old age persons.

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Conflict of interest : None.

REFERENCES:


Morphometric Study of Ovary and Its Relation With Age and Height of The Individual In South Indian Population

1. Vikram Palimar, Professor, Department of Forensic Medicine, Kasturba Medical College, Manipal.
2. Chandni Gupta, Associate Professor, Department of Anatomy, Kasturba Medical College, Manipal.
3. Azim Adhir P, Casualty Medical Officer, Government Taluk Headquarters, Hospital Nileshwar, Kerala.

ABSTRACT:

Background: The ovaries are the organs responsible for the manufacture of the female germ cells, the ova in the sexually mature female. Ovarian morphometric measurements can be affected by patients age, height and existence of systemic disease.

Aim: The aim of this study is to measure various dimensions of the ovary and to correlate that with the height and age of the individual.

Materials and Method: The study was conducted on 46 females that came for the autopsy. Their ovaries length, breadth and thickness on both right and left side were measured using a vernier calliper. Their height was measured using graduated autopsy scale. The age of the patient was noted down from the autopsy file. The data obtained is subjected to statistical calculations using Spss computer programmer to derive linear regression equations.

Results: The mean length, width and thickness of ovary on the right and left side was 3, 1.6, 0.93cm and 3.07, 1.65, 0.92cm. There was a significant correlation of age with all the parameters of the ovary on both right and left side. Even there was a significant correlation of height with breadth and thickness of ovary on both right and left side.

Conclusion: The result of this study will help the forensic experts to find the age as well as the height of individual from this organ. Exact knowledge of the normal morphometry of the ovary may assist the gynaecologists to adopt suitable diagnosis and management of several clinical disorders related with the ovary.

INTRODUCTION:

Identification of a person or a dead body means the recognition of that person or dead body. In medico-legal practice, it refers to the determination of individuality of a person. The necessity of identification of an individual is utmost important from birth to death as mistaken identity can result in various medico-legal difficulties which need not be over emphasized. Age and stature of an individual are an important criteria in personal identification.

The ovaries are a pair of female reproductive and endocrine glands which are solid, nodular bodies, with the sizes approximately that of a huge unshelled almond. They are positioned on both side of the uterus, behind and beneath the uterine tubes.

They are the organs responsible for the manufacture of the female germ cells, the ova and the female sex hormones, estrogen and progesterone in the sexually mature female. Ovarian morphometric determinants i.e., the length, breadth and thickness, can be influenced by the age of the patient, height, laterality of the organ and existence of systemic disease. The present study is attempted to measure various dimensions of the ovary and to correlate that with the height and age of the individual.

The result of this study may help the Forensic pathologist to find the age as well as the stature of an individual from this organ. Precise knowledge of the normal morphometry of the ovary may assist the gynaecologists and endocrinologists to adopt correct diagnosis and management of several clinical disorders related with the ovary.
disorders related with the ovary[1].

MATERIALS AND METHODS:
The study was conducted on 46 females who were autopsied at Mortuary of Forensic Medicine & Toxicology department, KMC, Manipal. The cases under study were allocated into three age groups, Pre pubertal (Group A: 0-13yrs), Reproductive (Group B: 14-45 yrs) and Post-menopausal (Group C: >45 yrs) as shown in Table 1. Institutional Ethics committee clearance was obtained before the conduction of the study. The ovarian length, breadth and thickness on both right and left side were measured using a vernier caliper. (Figure 1)

The lengths of ovaries were measured from its upper pole to lower pole. The breadth and thickness were measured in the mid portion of the ovaries. The height of the female (Stature) was measured using the graduated autopsy scale measuring from the vertex to the heel. The age of the patient was noted down from the autopsy file.

The data collected were processed to get mean values, standard deviation (SD) and appropriate statistical analyses were done through T-test. Linear regression equations were derived using Spss16 software to find height using ovary dimensions.

RESULTS:
The mean and range of all parameters of both right and left ovaries are shown in Table 2.

The Mean length, width and thickness of ovary on right and left side was 3, 1.67, 0.93 cm and 3.07, 1.65, 0.92 cm. Comparison of dimensions of ovaries with age group and stature are depicted in Table 3.

There was a significant correlation of age with all the parameters of the ovary on both right and left side. Even there was a significant correlation of height with breadth and thickness of ovary on both right and left side.

Regression equations of finding stature from right and left ovary dimensions are-

Right ovary-

Y (Stature) = 143.83 + 3.29 X (Ovary length)

Y (Stature) = 144.2 + 5.62 X (Ovary breadth)

Y (Stature) = 144.86 + 9.42 X (Ovary thickness)

Left ovary-

Y (Stature) = 144.13 + 3.11 X (Ovary length)

Y (Stature) = 142.9 + 6.54 X (Ovary breadth)

Y (Stature) = 143.69 + 10.8 X (Ovary thickness)

DISCUSSION:

During Early Fetal Life the ovaries are located in the lumbar region close to kidneys, later they gradually descend into the lesser pelvis. In infancy the measurement of the ovary are 1.3 cm long, 0.6 cm wide, and 0.4 cm thick. Before the first menstrual period (menarche) the ovaries are nearly one third of the normal reproductive adult size. Later they gradually increase in size with body growth. After childbirth, the position of the ovaries changes. They get displaced in the first pregnancy and usually never return to their original location. In the menopausal period the size of the ovary reduces. Its average size during early menopause is 2.0 × 1.5 × 0.5 cm and this reduces to 1.5 × 7.5 × 0.5 cm in late menopause[3].

In the Pre Pubertal Age Group (Group A), the mean length, breadth and thickness of Right and left ovaries were same and were 1.75 cm, 1cm and 0.5 cm respectively. Ahmed SM et al in his study on Bangladeshi women found out that length of right and left ovaries were 2.81 ±0.52 cm and 2.50 ±0.42 cm respectively, breadth of right and left ovaries being 1.45 ± 0.42cm and 1.38 ± 0.35cm respectively and thickness being 0.682 ± 0.15 cm and 0.709 ±0.08 cm respectively[4]. Their results of breadth and thickness were almost similar to our study.

In the Reproductive Age Group (Group B) the mean length, breadth and thickness of Right and left ovaries were 3.38 cm, 1.98 cm and 1.18 cm on right side and 3.49 cm, 1.88cm and 1.08 cm on left side respectively. Ahmed SM et al that length of right and left ovaries were 3.64 ± 0.92 cm and 3.50 ± 0.78 cm respectively, breadth of right and left ovaries being 1.88 ± 0.46 cm and 1.88 ± 0.51cm respectively and thickness being 0.877 ± 0.29 cm and 0.951 ± 0.28 cm respectively[4]. Their results were almost similar to our study.

The ovary shows significant individual disparity in size and the right is considerable, slightly larger than the left. In our study the mean length, breadth and thickness were more on right side than left.

Comparison of the results of reproductive age group with other authors is shown in Table 4.

In Post-menopausal Group (Group C) the mean length, breadth and thickness of Right and left ovaries were 2.35 cm, 1.11 cm and 0.6 cm on right side and 2.36 cm, 1.24cm and 0.68 cm on left side respectively. Ahmed SM et al observed that length of right and left ovaries were 4.15 ± 0.53cm and 4.32 ± 0.83cm respectively, breadth of right and left ovaries being 2.01 ± 0.46 cm and 1.67 ± 0.47cm respectively and thickness being 0.971 ± 0.17 cm and 0.814 ± 0.23cm respectively[4]. In the Post-menopausal group our results are different because during this age the ovary regress and their size decrease. This is probably due to atrophy of the medulla due to decrease in endogenous hormone production in the menopausal age group which is very well seen from the results in our study[4].
The present study has highlighted the morphological changes of the ovary at different ages. And it is noticed that the dimensions of the ovary is not identical on both sides of the same person. We have also found the regression equation which will help the Forensic pathologist to find the age as well as the stature of the individual from this organ which no author has done till now. Precise knowledge of the normal morphometry of the ovary may assist the gynecologists and endocrinologists to adopt correct diagnosis and management of several clinical disorders related with the ovary.

REFERENCES


Figure 1: Showing Measurements Done on Ovary.
A- Length of the Ovary
B- Breadth of the Ovary
Table 1: Groups Division According to the Age.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Cases</th>
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<td>02</td>
</tr>
<tr>
<td>B (14-45 Years)</td>
<td>30</td>
</tr>
<tr>
<td>C (&gt;45 Years)</td>
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</table>

Table 2: The Mean of All Parameters of Right and Left Ovary.

<table>
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<th>Mean ± SD</th>
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</tr>
<tr>
<td>Age (Years)</td>
<td>36.8±19.78</td>
<td>6-88</td>
</tr>
<tr>
<td>Length of ovary (cm)</td>
<td>Right 3±0.89, 3.07±0.95</td>
<td>1.5-5, 1-5.5</td>
</tr>
<tr>
<td></td>
<td>Left 1.67±0.56, 1.65±0.61</td>
<td>0.5-3, 0.5-3</td>
</tr>
<tr>
<td>Breadth of ovary (cm)</td>
<td>Right 0.93±0.41, 0.92±0.40</td>
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</tr>
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<td>Left 1.75, 1.75</td>
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Table 4: Showing Comparison of Results of Reproductive Age Group with Other Authors

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<tr>
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</tr>
<tr>
<td>Copenhaver WM et al[7]</td>
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</tr>
<tr>
<td>Damjanov I and Linder J[8]</td>
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</tr>
<tr>
<td>Young B and Heath JW[9]</td>
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</tr>
<tr>
<td>Romanes GJ[10]</td>
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<tr>
<td>Fawcet DW[11]</td>
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<tr>
<td>Moore KL and Agur AMR[12]</td>
<td>-</td>
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<tr>
<td>Kumar et al[13]</td>
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<td>Rosai J[14]</td>
<td>-</td>
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<td>Krantz KE[15]</td>
<td>-</td>
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<td>Dutta DC[16]</td>
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<td>Present Study</td>
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Table 3: Comparison of Dimensions of Ovaries with Age Group and Stature

<table>
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<td>Left</td>
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<td>&gt;45</td>
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<td>2.35</td>
</tr>
</tbody>
</table>
Detection and Determination of Pyrimethamine In Body Fluids Using Thin Layer Chromatography

1. Neha Tomar, Research Associate, Amity Institute of Forensic Sciences, Amity University, Uttar Pradesh
2. S.K. Shukla, Professor & Director, Amity Institute of Forensic Sciences, Amity University, Uttar Pradesh

ABSTRACT:
The cases of toxicity induced by drugs have risen tremendously in the past few decades. This pernicious effect is attributed to over dosage and drug reaction. Biological Samples in a case of poisoning was examined for presence of Pyrimethamine using thin layer chromatography. Drug residues were extracted from gastric lavage, vomit and urine employing solvent system extraction method at pH 9. Drug residues obtained were separated and identified by TLC on silica gel G layer with solvent system methanol: ammonia and visualized by potassium iodoplatinate reagent. The method was found applicable with limit of detection up to 0.05 mg/ml.

KEYWORDS: Pyrimethamine, Chromatography, GC-MS

1. INTRODUCTION:
Pyrimethamine (5-(4-chlorophenyl)-6-ethylpyrimidine -2, 4 -diamine) is an amino pyridine antiparasitic compound used to treat and prevent toxoplasmosis and acute malaria infections[1]. Pyrimethamine acts as folic acid antagonist that blocks protozoal enzyme dihydrofolate reductase. This will result in blockage of folic acid metabolism. Pyrimethamine inhibits the dihydrofolate reductase of plasmodia and thereby blocks the biosynthesis of purines and pyrimidines, which are essential for DNA synthesis and cell multiplication. This leads to failure of nuclear division at the time of schizont formation in erythrocytes and liver. Pyrimethamine (possesses blood schizonticidal activity) acts on blood forms of parasite and thereby terminate the clinical attacks of malaria. It is available in the market with various brand names such as Fansidar, Daraprim, Reziz and Pyralfin[2].

Some major drawbacks of Pyrimethamine therapy are relatively weak inhibitory activity and severe side effects[3].

Pyrimethamine is an odorless, tasteless weak base (pKa 7.3) of molecular weight 248.7. It is lipophilic and is poorly soluble in water but moderately soluble in alcohol and weak acids[4]. Various methods have been used to analyze the presence of Pyrimethamine content in biological samples such as blood, urine, gastric contents, vomit etc. Thin layer chromatography (TLC) is sensitive and specific technique for the separation of Pyrimethamine[5].

Used routinely in drug control laboratories, forensic laboratories, and as a research tool, TLC plays an important role in pharmaceutical drug analysis. It requires less complicated equipment than other techniques and has the ability to be performed under field conditions[6]. TLC is considered to be most convenient analytical technique because of its simplicity, low cost, and easy availability. For the TLC method, the drug is first extracted from alkalinized biological samples into an organic solvent such as ethylene di chloride, before final analysis[7].

2. MATERIALS AND METHODS:
2.1 Preparation of TLC plates: 25 gm of silica gel G was mixed in 50 ml water to make slurry. The slurry was spread over the glass plate with the help of applicator. The plates
were dried in air and then in an oven at 110°C for 20 minutes. The thickness of the adsorbent layer was maintained as 0.25mm.

The TLC plate was sprayed with 0.1 M potassium hydroxide in methanol and was then dried.

2.2 Preparation of Solvent System: Methanol and strong ammonia solution (100:1.5) were used as solvent system for development of the chromatogram. 50 ml of methanol was mixed with 0.75 ml ammonia to prepare the developing solvent.

2.3 Preparation of visualizing reagent: 0.25 gm of platinitic chloride was dissolved in 100 ml of 5% solution of potassium iodide in water and made up to 100 ml. For the acidified version 2 ml of conc. Hydrochloric acid was added.

2.4 Sample Application: Micro capillary was used for transferring the sample solution to chromatographic plate for analysis.

2.5 Development Tank: Ascending technique is used for TLC separation with a normal glass chamber for development. 50 ml of the solvent system (methanol: ammonia) was poured in the development tank. The plate was placed in development chamber at 45°C. The top of the development tank was covered with lid to allow saturation of solvent vapors.

2.6 Extraction of Drug from Body fluids: 50 ml of gastric lavage was added to 50 ml 0.1 N acetic acid and ammonium sulphate (to saturate the solution) and warmed on water bath for 30 mins. The contents were cooled and filtered. To the 50 ml aqueous acidic Filtrate 30 ml chloroform: ether (1:3) was added. Liquid ammonia was added dropwise to the solution till the pH becomes 9. Contents were shaken well and kept for 30 mins till the chloroform –ether layer becomes separate. Decanted the chloroform: ether layer. The step was repeated three times and organic layers which contain drug were collected. The collected organic solvent fraction was dried in porcelain dish. The drug residue thus obtained was used for analysis.

2.7 Thin Layer Chromatography (TLC)
Stationary phase – Silica gel G 0.25mm  Mobile phase – Methanol: Strong Ammonia (100:1.5) Visualizing reagent: Acidified potassium Iodoploutinate Reagent

The TLC plates prepared form Silica Gel G was marked with dots 10 mm from the edge. The spots were allowed to air dry. The TLC developing tank was placed by its base and 50 ml of the developing solvent system (Methanol: Strong Ammonia) was poured in the tank. Spotted TLC plates were developed in the solvent system for 10 cm from the spotting point. The spots were visualized under UV light of 254 nm/366 nm followed by spray of chromogenic reagent of potassium iodoploutinate. Rf value was calculated using the formula:

3. RESULTS AND DISCUSSION:
Extraction of drug from biological fluids and tissues was carried out. pH 9 was selected for extraction from aqueous layer to organic solvent (Chloroform : Ether, 1:3) keeping in view the basic nature of Pyrimethamine so that optimum recovery is obtained in the extraction process.

Further purification of the extracted contents (in case of presence of fats and extraneous matter) was carried out by re-extraction to obtain relatively pure extract. Recovery of above drug was found to be in the range of 90-95% [Table 1].

Selected solvent system Methanol- Ammonia was found to be good solvent as it gives clear oval shape dense spot at Rf 61 for Pyrimethamine.

Separated spots were well visualized under UV light at 254/336 nm and finally using chromogenic reagent acidified potassium iodoploutinate reagent giving pink colored spot. The spots from the extracted residues tallied with the spots of controlled drug sample of Pyrimethamine [Table 2].

In one of the sample, drug extract obtained was found to contain some fat and extraneous matter. The particular sample was re-extracted to obtain relatively purified extracted residue.

4. CONCLUSION:
TLC is simple, accurate, reproducible and fast method. It can determine Pyrimethamine. The present method can be routinely used for the analysis of Pyrimethamine and it will be valuable method in drug profiling.

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Conflict of Interest: None Declared

REFERENCES
Pyrimethamine Sulphadiazine as acute and long term therapy for toxoplasmic encephalitis in Patients with AIDS. Clinical Infectious Diseases, 268-275.


**Table 1: Recovery of Control Pyrimethamine Using Solvent-Solvent Extraction**

<table>
<thead>
<tr>
<th>Biological Matrix</th>
<th>Control Drug (mg)</th>
<th>Drug Recovery (mg)</th>
<th>% of Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomit (100 ml)</td>
<td>5</td>
<td>4.5</td>
<td>90</td>
</tr>
<tr>
<td>Urine (100 ml)</td>
<td>5</td>
<td>4.7</td>
<td>94</td>
</tr>
<tr>
<td>Gastric Lavage (100 ml)</td>
<td>5</td>
<td>4.5</td>
<td>90</td>
</tr>
</tbody>
</table>

**Table 2: Showing Rf Value and Color of Spot**

**a. Solvent System – Methanol : Strong Ammonia (100:1.5)**

**b. Chromogenic reagent – Potassium Iodoplatinate reagent**

<table>
<thead>
<tr>
<th>Biological Matrix</th>
<th>Distance Travelled by Mobile phase</th>
<th>Distance Travelled by Sample</th>
<th>Rf Value</th>
<th>Color of the spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomit</td>
<td>9.5</td>
<td>5.8</td>
<td>0.610</td>
<td>Blue</td>
</tr>
<tr>
<td>Urine</td>
<td>9.4</td>
<td>5.7</td>
<td>0.6063</td>
<td>Blue</td>
</tr>
<tr>
<td>Gastric Lavage</td>
<td>9.0</td>
<td>5.5</td>
<td>0.6111</td>
<td>Blue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control Pyrimethamine</th>
<th>Distance Travelled by Mobile phase</th>
<th>Distance Travelled by Sample</th>
<th>Rf Value</th>
<th>Color of the spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomit</td>
<td>9.5</td>
<td>5.8</td>
<td>0.61</td>
<td>Blue</td>
</tr>
<tr>
<td>Urine</td>
<td>9.4</td>
<td>5.7</td>
<td>0.60</td>
<td>Blue</td>
</tr>
<tr>
<td>Gastric Lavage</td>
<td>9.0</td>
<td>5.5</td>
<td>0.61</td>
<td>Blue</td>
</tr>
</tbody>
</table>
ABSTRACT:
Asphyxia is a condition caused by interference with respiration or due to lack of oxygen in inspired air due to which the organs and tissues are deprived of oxygen causing unconsciousness or death. Asphyxial deaths constitute a large group of medico-legal autopsy cases with hanging and drowning at top of the list. The present study was undertaken to determine the frequency of various asphyxial deaths and the demographic profile of the victims in Mangalore, a coastal district of India.

A two years retrospective study was conducted on a total of 162 cases of asphyxial deaths out of 1808 post mortems conducted from November 2014-October 2016 at Distt. Hospital Mangalore. The data was collected from the autopsy report and inquest forms.

Hanging was the most common form of asphyxial death constituting 67.9% of cases followed by drowning (27.8%) and strangulation (2.4%). Smothering and plastic bag suffocation were seen in 1.2% and 0.6% of cases respectively. Male predominance was observed and the most common age group involved was 31-40 years. Majority of the hanging cases occurred in closed places and suicide was found to be the most common manner of death. The most common location for drowning was river followed by Sea.

In any asphyxial death, a meticulous autopsy plays a major role to solve the case along with crime scene investigation. Education, involvement of young generations in non destructive activities, encouraging organizations which work on the reduction of addiction, appropriate management plan for those with psychiatric problem and improving the socioeconomic status of the people and providing employment are keys to prevent suicidal asphyxial deaths.

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KEYWORDS: Asphyxial deaths; hanging; drowning

INTRODUCTION:
The term asphyxia may also be defined as a state in which the body lacks oxygen because of some mechanical interference with the process of breathing. The asphyxial deaths form two to five percent of all unnatural deaths. These deaths may be suicidal, homicidal and accidental. Violent asphyxial deaths are common and may be broadly classified as (a) hanging, (b) ligature strangulation, (c) throttling, (d) suffocation and (e)
drowning. Violent asphyxial deaths are commonly encountered as an important cause for unnatural deaths by forensic expert during day to day practice. Drowning is a process resulting from submersion of body in water or any other liquid resulting in threat to life. When the victim initially recovers from drowning but then dies later due to complications it is called secondary drowning. If the victim of drowning survives for at least 24 hours after the incident, it is called near drowning. If the victim of drowning survives for at least 24 hours after the incident, it is called near drowning. Due to population explosion, poverty and increasing stress and strain in our daily lives, we frequently come across cases of suicides, homicides and accidents. In India hanging is among the top 5 methods for committing suicide. This study was undertaken to determine the frequency of various asphyxial deaths with their types and the demographic profile of the victim.

MATERIAL AND METHODS:
This two years retrospective study was conducted on a total of 162 cases of asphyxial deaths presented to Wenlock hospital mortuary of Kasturba Medical College, Mangalore from November 2014-October 2016. The Institutional Ethical Committee permission was obtained before the initiation of study. The data was collected from the autopsy reports and inquest forms that were available in the department. The data collected was assembled into categories based on sex, age, religion and month of incidence. For the purpose of our study we divided the ligature material into two broad groups. 1. Hard – e.g., electric wire, rope, nylon wire etc. 2. Soft – e.g., dupatta, bed-sheet, saree etc. The police inquest reports were used to collect details of place, time of occurrence and the manner of the act i.e. homicidal, suicidal or accidental. The data was recorded in the Microsoft windows excel working sheets. The final data was analysed using Statistical Package for Social Services (SPSS) version 17.0.

RESULTS:
The total numbers of autopsies conducted during the study period were 1808, of which 162 cases were of asphyxial deaths. The incidences of asphyxial death among males were 128 and in females were 34 deaths. The asphyxial deaths were more in age group of 31-40 years (25.9%) followed by 21-30 years (24.1%) and 41-50 years (14.8%) respectively (Figure 1). Out of total 110 cases of hanging, 86.3% of incidences occurred in closed secured places and the others occurred in open places (13.6%) (Table 1).

Table 1 : Showing Place of Hanging

<table>
<thead>
<tr>
<th>Place</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>95</td>
<td>86.3</td>
</tr>
<tr>
<td>Open</td>
<td>15</td>
<td>13.6</td>
</tr>
<tr>
<td>Total</td>
<td>110</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The most common form of asphyxial death was hanging (67.9%) followed by drowning (27.8%) and strangulation (2.4%). The other forms reported are smothering (1.2%) and Plastic bag suffocation (0.6%) (Table 2). According to religion, asphyxial deaths were more common in Hindu (75.5%) followed by Christian (13.7%) and Muslims (9.8%) and Buddhists (1.0%). In 60 cases religion was not known (Figure 2).

Table 2 : Showing Causes of Deaths

<table>
<thead>
<tr>
<th>Cause of deaths</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanging</td>
<td>110</td>
<td>67.9</td>
</tr>
<tr>
<td>Drowning</td>
<td>45</td>
<td>27.8</td>
</tr>
<tr>
<td>Ligature Strangulation</td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>Plastic Bag Suffocation</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Smothering</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Manual strangulation</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>162</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 1 : Showing Age Wise Distribution of Cases

Figure 2 : Showing Religion Wise Distribution of Cases
Suicidal deaths (86.4%) were more as compared to accidental (11.7%) and homicidal deaths (1.9%) (Figure 3). Out of 110 cases of hanging in 83 cases the ligature material was brought and 53.0% used soft materials whereas 47.0% case used hard ligature materials (Figure 4).

In our study out of 114 cases of hanging and strangulation, the incidence of hyoid bone fracture was 14.9%, all fractures were in hanging. Out of these 14 occurred in males and 3 in females. Majority (58.7%) cases of drowning in our study were from river and remaining were in other medium (Table 3).

Table 3 : Showing Place of Drowning

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>27</td>
<td>58.7</td>
</tr>
<tr>
<td>Sea</td>
<td>13</td>
<td>28.3</td>
</tr>
<tr>
<td>Well</td>
<td>5</td>
<td>10.9</td>
</tr>
<tr>
<td>Pond</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>100.0</td>
</tr>
</tbody>
</table>

DISCUSSION:
In our study, cases of fatal asphyxia constituted 9.34% of all the forensic autopsies. The male predominance of our study can be explained by the fact that in Indian society the male members are more expected to bear all the family responsibilities. So, they have the dual pressure of career and family responsibilities. Similar findings were observed in the study done by Ajay Kumar et al (Males: 67.96% & females: 32.04%), and Tirmizi SZ et al (Males: 75.68% & females: 24.32%). In the study done by Shankar et al the percentage of male incidences was less than our study (63%) and also in the study done by Srinivasa Reddy et al the percentage of male incidence was lesser than our study (59.14%). In our study the most commonly involved age group is 31-40 years (25.9%) which is in harmony with the study done by Azmak and Derya but in the study done by Shankar et al (31.11%), Ajay Kumar et al (38.89%) and Srinivasa Reddy et al (34.93%) the more number of cases was in the age group of 21-30 years.

Hanging accounted for Maximum Percentage (67.9%) of all asphyxial deaths. Similar findings were observed by Ajay Kumar et al (80.60%), Srinivasa Reddy et al (61.19%) and Shankar et al (56.3%), Azmak and Derya (41.8%), Tirmizi et al (36.48%) and Patel A et al (82.48%). All the cases of hanging in our study are suicidal (100%) This is in agreement with the study done by Shankar et al and Tirmizi et al. But in the study conducted by Patel A et al, it was found that (97.5%) of hanging cases were suicidal and rest (2.5%) were accidental in nature. It has been observed in our study that majority people commit suicide by hanging within the closed secure places rather than at open place. In our study the most preferred place for hanging is closed place like house (86.3%). Shankara et al also reported the maximum number of cases in house (76.3%) for the act. This can be explained as suicide may not prefer his act to be interfered by others.

In our study following hanging, drowning is the most frequently encountered asphyxial death with 27.8% cases. Similar result were found by Shankar et al (34.81%), Srinivasa Reddy et al (31.96%) and Patel Ankur et al (14.43%) but in the study conducted by Chaurasia et al, in Varanasi region, it was observed that the incidence of drowning being the commonest (59.40%) asphyxial death. According to WHO report 2000, both China and India have particularly high drowning mortality rates and together contribute 43% of all drowning deaths worldwide. Most of the deaths caused due to drowning (nearly 97%) occur in developing countries like India, drowning is a common method of committing suicide especially amongst women, and more particularly in localities near the sea, river, dam or canal. 58.7% cases of drowning in our study were from river and
remaining in other type of medium. This is comparable with
the study done by Patel A et al\[10\] (42.84%).

In our study, incidence of strangulation was 2.4%. Similar
results were found in Srinivasa Reddy et al\[14\] (4.31%), Patel A
et al\[10\] (3.09%), but differed when compared to Shankar et al\[11\]
(8.8%) and Tirmizi et al\[12\] (24.31%).

Out of 110 cases of hanging in 83 cases the ligature material
was brought and 53.0% (n=44) used soft materials whereas
47.0% (n=39) cases used hard ligature material. This is
consistent with the findings of Kumar Naik\[15\] who found soft
ligature (57.7%) and hard ligature material in 45% cases. This
can be explained as victim may wish to avoid any pain which
may occur due to use of hard ligature.

Maximum number of victims found in our study were Hindus
(75.5%) followed by Christian (13.7%) and Muslim (9.8%)
population which is consistent with Prateek et al study (Hindu
-91.8%, Christian-6.8% and Muslim-2.0%) and the study
conducted by Ajay K et al\[11\] (Hindu-94.4% followed by
Muslim-5.6%). This is probably because of similar population
distribution of different religions in the area and may be
because of low per cent of Muslim population in Mangalore.

In our study out of 114 cases of hanging and strangulation, the
incidence of hyoid bone fracture was 14.9% cases (17/114), all
fractures were in hanging asphyxial deaths. The cases were of
males in 82.3% of cases and female in 17.6% of cases with
their Mean age being 36.8 years, contrasting to findings of
Abhishek Yadav et al\[10\] (1.6%), Meera\[19\] (3.6%) and Sai
Sudheer\[20\] (4%) cases. Other studies have reported the higher
incidence of hyoid bone fracture\[21\]. They mentioned about the
variation of incidence of fractures of hyoid bone from 0-60%,
with an average being 15-20% cases. Betz\[22\] found the
incidence of throat skeleton fractures to be as high as 67%. Di
Maio\[23\] reports it in11%. Fractures are common after 40 years
of age\[23\] because in the old (i.e. after 40 years) age group hyoid
bone gets calcified and ossified\[24\] But Simonsen observed
fractured of hyoid bone in 30% of cases aged less than 40
years\[25\]. The level of ligature mark was found above the level
of thyroid cartilage in 87.2%, on the level of thyroid cartilage
in 7.2% of cases as were also reported by Prateek et al\[14\] in
67.4% and 26.5%, Polson et al\[26\] in 80% and 15% Puller\[1\],
Krishan Viz\[27\] and Reddy\[28\] have also found similar result.

CONCLUSIONS:

Asphyxial deaths constitute a large group in medico-legal
autopsy cases and the number of suicidal hanging cases is
increasing day by day. Our study conclude that most of the
victims were of 31-40 years age group. This is considered to be
due to marriage, children and work responsibilities in this
particular age group. Most of asphyxial deaths were in males
and suicidal in manner in our study. Poverty, alcoholism,
psychological, family problems and lack of job are the known
main reasons for suicidal hanging. Education, involvement of
young generations in nondestructive activities, encouraging
organizations which work on the reduction of addiction,
appropriate management plan for those with psychiatric
problem and improving the socioeconomic status of the people
are keys to prevent suicidal asphyxial deaths. Safety measures
like use of warning signs, presence of life guards should be
employed to minimize the occurrence of accidental drowning.

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,Ayder Research Hospital , Mekelle Hospital for all the support
in facilitating the residents to do collaborative work .

Limitations of Study : As it is a retrospective work so we need
to work with existing data and no additional information can be
obtained.

Financial Support of Study : Nil

REFERENCES :

1. Mant AK. Taylor's Principle and Practice of Medical
Jurisprudence.13th ed. London: Churchill Livingstone,
1984; p 282.
2. Reddy KSN. The Essentials of Forensic Medicine and
Toxicology. 28th edition. Hyderabad: Sugunadevi K,
2009; p 311-313.
3. Igor L, Mladen M, Niclic V, Radic R and Selthofer R.
Morphological Classification and Sexual Dimorphism  of
4. Chaurasia N, Pandey SK and Mishra A. An
Epidemiological Study of Violent Asphyxial Death in
Varanasi Region (India) a Killing Tool. Journal of
Forensic Research, 2012; 3(10); 174.
5. Mant AK. Mechanical asphyxia. Taylor's principles and
practice of medical jurisprudence, 13th edition. New
legal medicine. 3rd edition. Bristol: John Wright and
7. Di Maio VJ, Di Maio DJ. Forensic Pathology, 2nd ed.
Suicide, suicide note, and psychological autopsy.
International Journal of Medical Toxicology and Legal
Medicine, 1999: 1(2); 38-39.
10. Abhishek Y, Manish K, Sumit T, Kumar LR. Study of Fracture of Hyoid Bone in Hanging Cases. Journal of Indian Academy of Forensic Medicine, 2013: 35(3); 239-241.
**Original Research Paper**

**Paternity Suspicion: Current Scenario in India**

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**ABSTRACT:**

DNA testing has now become a norm to adjudicate in the disputes in criminal and civil cases in various courts across India. It was observed that in majority of the medico-legal cases directed by Honourable Courts to the DNA Fingerprinting Laboratories are related to the establishment of paternity by DNA profiling. The present study was carried out with the aim to determine the non-paternity rate in India and its impact on the Indian population. It was interesting to note; that in 92% of such cases, paternity results by DNA fingerprinting technology went in favour of the mother. The study also concluded that a larger percentage of male petitioners sought to ascertain his non-parentage of the child born from wedlock was significantly higher, when compared to the number of women petitioners. Most significantly, these cases were registered either to get divorce, attest adultery of life partner or to avoid compensation for the child after divorce. Indian laws give the male partner right to DNA profiling to establish the identity of his child; but on the other side, such cases carry a major social stigma. The surreptitious, but with a mala-fide intenfiled paternity cases; are generally attributed to severe psychological trauma for the child and mother. Even though, it may be a basic requirement for one parent to establish the identity of her/his progeny; the results may lead to a sense of insecurity, lack of trust and psychological impairment in the child.

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**KEYWORDS:** DNA Fingerprinting, Deoxyribonucleic Acid, Paternity, India

**INTRODUCTION:**

An old Indian Hindi saying “Maa pe poot, pita pe ghoda kuch nahi to thoda thoda” implying that progeny whether it is of horse or of human, inherits at least some traits from their parents and tend to look or behave like them. It is a vowed that the child inherits characters from both the maternal and paternal lineage and the phenotype depends on the expression of alleles (genotype) in accordance with the Mendelian laws\(^1\). It is the basis of paternity testing.

Paternity is a legal and social acknowledgement of the parental relationship between a child and his / her father. In broader terms parentages can be defined in social/putative (within the wedlock) and biological parentage. Any dispute arising regarding the parentage of a child comes under paternity disputes. Questions on Paternity can arise in either of these two situation\(^2\):

i) Misattributed paternity\(^3\)/paternal discrepancy\(^3\)(PD) refers to non-judgmental identification of children who have a biological father other than the man who think he is the biological father.

ii) Paternity fraud refers to cases where in men are coerced to obtain money from them, for example via the child support system.

Alleged fathers who strongly suspect that they are not the biological father tend to apply for in-person testing with the suitability of the test report for use in a legal setting (i.e. paternity testing on orders of a court); whilst alleged fathers who are merely satisfying a nagging doubt over paternity, opt first for the anonymous test (i.e. testing in a private laboratory, which does not have legal sanction)\(^2\). Akin to the developed countries, people in India too believe in free and open sexual relationship; however, a child born out of such a relationship is now becoming a major legal issue. In such a scenario, paternity tests are an essential tool to ensure child support (i.e. to establish or enforce) child custody, new-born last names, confirm new-born identity
same has had an incredible impact in criminal justice systems with refinement in DNA based investigations; the decades, DNA testing has achieved gold standards in forensic paternity of a child were falsely implicated. In the last two approximately 30-40% of these men who contested the and HLA typing, some were performed by HLA typing only. In 1980s, only a minority of the accused men denied initially paternity testing was done by both blood grouping (marriage duration etc.) and biological evidences (blood and the revised provisions of Section 112, both substantial and advancement in science and technology compelled the Malimath Committee. Changes in the social environment but, on the basis of the recommendations made by the provisions of Section 112 of the Indian Evidence Act, 1872 has given greater importance to social parentage than a biological one. Section 112 of Indian Evidence Act, was based on the rule that the child born in wedlock should be treated as the child of the man who was then the husband of the child’s mother. The exceptions being when the husband proves that he has had no physical access to his wife when the child was conceived. The Indian Judiciary today is slowly but steadily accepting the changed social environment and accepting with greater conclusiveness the use of advanced modern technology like DNA test in matters related to disputed Paternity cases. Therefore in matters of disputed paternity, the legitimacy or illegitimacy of a child cannot be determined solely by provisions of Section 112 of the Indian Evidence Act, 1872; but, on the basis of the recommendations made by the Malimath Committee. Changes in the social environment and advancement in science and technology compelled the Law Makers to revisit Section 112 of Indian Evidence Act. In the revised provisions of Section 112, both substantial (marriage duration etc.) and biological evidences (blood and DNA profiling) are now admissible in a court. Initially paternity testing was done by both blood grouping and HLA typing, some were performed by HLA typing only. In 1980s, only a minority of the accused men denied paternity when deposing before a court. It was observed that approximately 30-40% of these men who contested the paternity of a child were falsely implicated. In the last two decades, DNA testing has achieved gold standards in forensic cases with refinement in DNA based investigations; the same has had an incredible impact in criminal justice systems around the world. Importance of technology boomed with automation in the technique. In India, the same has been used to solve forensic case related to identification, paternity determination and to trace the culprits in rape, murder and robbery cases. There are numerous reasons and perspectives which argue for a greater use of DNA technology in forensic and paternity cases. In 2007 1st Human DNA Profiling Bill 2007 came into existence on recommendations of DNA Profiling Advisory Committee. It was found that with advancement of social and technical support number of DNA testing, the paternity cases are increasing day by day. The number of paternity cases are increasing at the rate of 10-12% per year in India. Therefore, the study was designed to find out the correlation of cases reported and positive paternity testing. We also analyzed the cultural, ethical and legal dimensions of the testing. In this paper, we shall consider different perspectives and associated problems, and analyze their cultural, ethical and legal dimensions. We are trying to deal with here-after the aforesaid questions from the point of view of prospect and problems of application of DNA technology in administration of justice for paternity testing cases.

METHODS:

Material: We considered and compared data received for DNA testing in the Forensic Medicine Laboratory of All India Institute of Medical Sciences (AIIMS), New Delhi which was directed by the Honourable High Courts of India.

Procedure for Extraction and Analysis of DNA: Genomic DNA was extracted using the standard Phenol–Chloroform method followed by purification by ethanol precipitation. Multiplex PCR for 15 STR loci (D8S1179, D21S11, D7S820, CSF1PO, THO1, D3S1358, D16S539, D2S1338, vWA, TPOX, D19S433, D18S51, D5S818, FGA) was performed using AmpFlSTR Identifiler kit (Applied Biosystems, Foster City, USA). Also analysis was done on AmpFISTR filer kit (containing 17 YSTR markers: DYS391, DYS389 I/II, DYS514, a/b, DYS438, DYS439, DYS435, DYS392, DYS393, DYS390, DYS395, H4, DYS456, DYS458, DYS448 and DYS635)(Applied Biosystems, Foster City, USA) wherever required. The amplification reactions were performed in Gene Amp PCR system 9700, as per manufacturer’s guidelines. Genotyping of all PCR products was accomplished using ABI 3130 Genetic Analyzer (Applied Biosystems, Foster City, USA). All genotypes were analyzed using the GeneMapper ID 3.2 software. The comparative analysis of the non-paternity rate was done with the data available from previous studies. The analytical software Sigma plot 13 was used to plot graph.
Most of the cases that the forensic laboratory receives are those of murder, identification, rape and paternity cases. In past four years, DNA Fingerprinting laboratory of All India Institute of Medical Sciences, New Delhi received thousands of exhibits; it was observed that approximately 50% of these cases related to paternity identification (including alleged father cases, rape aborts foetus, baby swapping and where father refuses to take responsibility of the child). The most interesting part of the study is that of the total paternity cases, 85% were those where the alleged father refused to accept the child, 7.4% related to baby swapping and the balance 7.6% cases were those of the alleged rapist father (Figure 1).

Figure 1: The Ratio of different cases received in the Forensic laboratory for paternity testing

The results showed that in 92% of the cases the appellant was the biological father of the child.

In a majority of the paternity cases, the fathers of the child alleging infidelity of the partner (or wife) formed a large chunk of the cases filed before the courts of law. In a male predominant society, as it exists in India, the alleged fathers tend to exercise their legal option using this modern scientific tool. A moot question arises; whether the Indians are just aping the West or they actually lack self confidence in accepting the arrival of new birth with joy and hope. The outcome of such investigations is eye opener for both the alleged father and the mother. The results of such investigations (DNA test results) mostly were in favour of the woman / the mother. In addition, to being an essential tool in assistance in providing justice to the child and women, DNA fingerprinting is playing an important role in protection of women’s dignity and child’s rights. Comparative analysis of DNA Testing with other countries shows that India has the lowest non-paternity rate as compared to the developed countries (Figure 2).

Figure 2: Comparative Analysis of the Paternity Discrepancy in Different Countries of the World

DISCUSSION:

As an impact of modern scientific and technological revolution on different aspects of our social and cultural activities, we may often find a shift from our traditional age-old ideas based on subjectivism in our intellectual exercises[21]. In addition, cases of cohabitation without marriage are increasing since last decade[22]. This shift in the social environment has put to test our conventional (albeit controversial) value-based system of justice. Paternity testing has had many positive impacts on the society, some points are as under:-

1. Overcoming Guilt: It helps the person to overcome guilt that he/she is not paying for someone else’s child.

2. Peace of Mind: Testing brings peace of mind to an individual (people who are in dilemma whether they are biological father/mother of the child or not), as it assists in proving misconceived phobia of child. Paternity is proved scientifically, besides being an important piece of evidence, which stands judicial scrutiny.

3. Right of Child: It is of immense benefit to the child; who get the rights related to name, finance and property rights,
besides being socially relevant.

4. Cases of Paternity Fraud: One may seek DNA parentage testing in order to obtain evidence of non-paternity for the purpose of civil proceedings against the child’s mother to prove “paternity fraud” and claim damages for emotional stress and financial loss that was suffered due to such fraud.

However, in the same breath, we cannot overlook the fact that it cannot be implemented in any legal system without hampering some basic human rights of an accused e.g. right against self-incrimination, right of privacy etc. The rise in the number of cases of paternity testing is in itself an alarming issue. A 10-20% hike in the number of cases per year is not a healthy sign for the society.[17] The impact of paternity testing on child and the female are still to be analysed. Merely suggesting a paternity test could poison a relationship between the partners and child forever need further studies. If the results are negative, the emotional consequences could be life shattering for every one concerned. Paternity is a very serious matter and what you do today, can forever change your life and that of the child. Though data from Gujarat Forensic Laboratory suggested that negative paternity rate is 98%, but the in present study the rate was observed to be only 8%.

Encroachment on Individual’s Right and Privacy: In most of the cases it has been observed that DNA paternity testing is being used as tool to obtain a divorce, and to avoid paying maintenance to the mother and child. The test may also lead to emotional in security for the mother and the child, if the parents have been living together.

In addition, in the male dominated society, the male does not encourage friendship of his wife with other males; and eyes such relationship with suspicion. In such cases, even DNA testing will not be able to bring faith and trust between partners. They possibly would need psychological counselling. The courts need to dwell into the aspect (infidelity), before ordering paternity test, the result of which could have no bearing on the future of partners.

CONCLUSION:

There is little doubt that this new technology is being effectively used as a tool in crime detection to accelerate crime control for betterment of the society. Men (who do not know the alleged mother or the child, nor are they the biological father) who are not aware of these developments in science and technology will suffer serious injustice. The percentage of probability varies from state to state, but the accuracy of the results usually varies from 95 to 99 percent. This implies that based on the outcome of the investigations, the probability of paternity is presumed to be higher. In cases where there is a conflict in conclusivity of evidence, the judiciary must rely on this important scientific tool in deciding the case.

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REFERENCES:

11. Walker RH, Pohl BA. Paternity testing with an absent mother. The probability of exclusion of red cell surface antigen, Gm, Hp, and HLA systems in North American whites and blacks. Transfusion. 1989;29(1);31-5.


17. Paternity tests on the rise in city. Times of India. 2011 May 9.


ABSTRACT:
Background: Knowledge of the blood group in a victim would reduce the number of antemortem records to be screened. Blood groups are not only expressed in the RBC’s but also by other cells of the body which can be utilized to identify the blood group of the individual.

Objectives: The study was conducted to determine the reliability of use of dental pulp in determining the ABO blood group.

Material and Methods: 44 samples of extirpated pulp were obtained from teeth of a patient undergoing RCT due to trauma. The blood group was determined from the pulp tissue using absorption-elution method.

Results: The results showed 85% accuracy to determine the correct blood group, from normal pulp which was processed immediately whereas, pulp placed under hydrostatic pressure for 48 hours showed marginally 79.1% accuracy.

Conclusion: The pulpal tissue is well protected inside the teeth and could resist adverse environmental conditions where the blood group antigen from pulp remains stable for long. Thus, the high potential value of dental pulpal tissue is highlighted in this study.

KEYWORDS: ABO Blood Group, Dental Pulp, Dentin, Absorption–Elution Method, Forensic Odontology

INTRODUCTION:
Accurate identification is the key to any investigation. Interpretation of the biological evidence which leads to confirmatory identification is an elaborate, expensive and time consuming process. Through the ages forensic identification has continuously evolved into a science involving various specialties. Amongst them, Forensic dentistry involves the use of dental evidence for the processing, review, evaluation and presentation with the purpose of contributing scientific and objective data in legal processes[1]. The teeth being virtually the hardest of all human tissues can withstand insult and therefore are preserved for a longer duration relative to other tissues.

Amongst the recent advances in the branch of forensic dentistry, blood grouping could aid in the personal identification of an individual or at least narrow down the search population. The term 'blood group' is applied to inherited antigens detected on the red cell surface by specific antibodies[2].

The use of blood group in medico-legal cases is based on a fact that the blood group remains unchanged throughout the life of an individual. Also, since most child-births these days occur in hospital settings, the blood group of a child is known and recorded at birth. The most common method of assessing blood group is by drawing blood from a finger prick and determining blood group antigens on RBC’s. Besides blood, antigens are also found in various other body secretions such as saliva, gastric juice, nasal secretions, sweat, tears and urine etc, from which blood group can be determined[3]. Pulp also shows the evidence of blood group antigens and thus may be an important source of tissue for blood grouping in the event of narrowing down the identity of the deceased. Dental pulp is a vital tissue containing numerous blood vessels and is protected and surrounded from all sides by dental hard tissue. This property enables the retrieval of the pulp tissue from deceased with mutilated features that otherwise prevent their recognition. This will be especially useful in cases of burn, drowning and victims with facial trauma.

MATERIAL AND METHODS:
The present study was conducted in the Department of Oral Pathology and Microbiology, MCODS, Mangalore with support from the Department of Conservative dentistry and Endodontics and Department of Paedodontics MCODS, Mangalore. The study was commenced after seeking
approval from the institutional ethics committee. 44 samples of fresh pulp were extirpated from teeth of patients with undergoing root canal therapy(for trauma and/or irreversible pulptis). Third molar teeth scheduled for extraction even in the absence of pulpal involvement were included in the study. Grossly decayed teeth with scanty necrosed pulp were excluded from our study. The details regarding the age, gender were noted from the patient records. Following patients consent, two drops of blood was collected by finger prick method to estimate blood group using antibodies. The collected pulpal tissue was divided into two groups.

Group I (N=20) in which pulpal tissue was placed in normal saline under weighted pressure for more than 48 hours (to simulate drowning/immersion in water).

Group II (N=24) in which pulpal tissues was immediately processed to determine the blood group.

Blood group was determined by the absorption elution test used by Ballal et al.[2]

Materials used : The materials used in our study were RBC Suspension, 10 ml Anti-A and Anti-B monoclonal antibodies and bovine serum albumin.

Preparation of RBC suspension : 3-5 ml of blood from the patient or donor sample was added to the test tube. The remaining test tube was filled with saline to re-suspend the cells (avoid contamination of tubes when dispensing saline into several tubes). The saline and blood were centrifuged for 2000 rpm for 5 minutes. The supernatant was then discarded and the sediment containing red blood cells were separated and used for blood grouping.

Absorption-Elution Method : The extirpated pulp was bisected and processed in to two test tubes labeled as 'A' and 'B'. To each of these test tubes three drops of antiserum A (blue in colour) and B (yellow in colour) were added respectively, allowing the pulp to be in contact with antiserum for 2½ hours at room temperature for the antibodies to combine with their specific antigens (Figure 1).

After removing antiserum, each sample was washed three times with cold saline solution, centrifuged and the supernatant was drawn with pipette to remove the non-reacted serum. Then two drops of fresh saline was added to the sample and the test tubes were heated in a water bath at 56°C for 10 min to elute the antibodies. A drop of 0.5% A and B group red cell suspension was immediately placed into respective test tubes marked A and B to combine the eluted antibodies with known red blood cells. This results in agglutination of respective antibodies to the group antigen present in the cell surface of red cells. The suspension was further incubated at 37°C for 30 min to enhance agglutination, and then was centrifuged at 1500-2000 rpm for 1 min to allow formation of flocculation. The presence or absence of red cell agglutination (Figure 2) was observed with naked eye and confirmed under a microscope at magnification of ×40[2].

RESULTS :

Amongst the 44 samples considered in our study, 20 cases were from the fresh pulp and 24 were from the pulp preserved for more than 48 hours. 17 out of 20 cases from the fresh pulp (immediate processing) were correctly classified by the absorption-elution method with an accuracy of 85% and a Kappa value of 0.746. 19 out of 24 cases from pulp preserved for more than 48 hours (under hydrostatic pressure) showed an accuracy of 79.1% and a Kappa value of 0.717.

The overall results (36 out of 44) cases showed correct identification of the blood groups with an accuracy of 81.81% and Kappa value of 0.752. Among all the blood groups, O and A blood groups were the best to be detected and blood group AB showed highest percentage of errors being misidentified as O and A groups.

DISCUSSION :

In 1900, Landsteiner first described ABO blood grouping which is in practice for both clinical and forensic purpose. Numerous other blood grouping systems have been described like, MN, Rh, P, Lutheran, Kell, Lewis, Duffy, Kidd, Deigo, Yt, Li, Xg, Dombrock which are of less importance owing to the weak antigenicity and corresponding antibodies are not normally present and appear only after multiple transfusions[3]. Absorption elution technique was proposed by Siracus a in 1923 to identify the blood group antigens from the dried stains, tissues, secretions and teeth. Recent studies have suggested that pulp is a highly vascular tissue which contains blood group antigens and can determine ABO blood grouping when subjected to Absorption elution technique. This technique is considered to be very sensitive, highly specific and less interference. However, effect of autolysis, dehydration, loss of pulp antigens, or high number of errors due to foreign antigen borne by bacteria in carious teeth may lead to variation in the study. Therefore, in order to validate the study in determining the ABO blood grouping, samples of fresh pulp and pulp preserved for more than 48 hours (under hydrostatic pressure) were obtained[4].

In our study, the samples collected from freshly extirpated pulp showed an accuracy of 85%, whereas pulp preserved for more than 48 hours showed an accuracy of 79.1%. The overall accuracy of the samples was 81.81% and a kappa value of 0.752 with an error of 18%. The ABO blood grouping could also be established from pulp when induced to hydrostatic pressure. The negative results obtained could be attributed due to the presence of aerobic gram negative oral flora, which alters the antigenicity or due to increased
calcification of the canal which leads to lesser pulp tissue for assessment.

Similar findings were noted in studies conducted by Shetty M, Shetty P and Ballal S, David MP where they obtained 60 and 30 samples of extracted teeth and were stored for 180 days to determine ABO blood grouping from the pulp and dentin. Their results showed an 96.7% and 90% accuracy in relation to the control, whereas the antigenicity from dentin could not be expressed in both the studies.[1-2].

Studies conducted by Aswath N et al and Sood S et al on 60 and 100 extracted teeth to determine the ABO blood grouping and Rhesus factor, showed an accuracy of 95% and 89% respectively, in determining the accurate blood group.[3-4]. Ramnarayan BK assessed 60 samples of extracted teeth to detect the ABO blood group substances from soft and hard tissues of teeth and to evaluate the reliability of teeth stored for a relatively long period as a source of blood group substances by absorption–elution technique. Their results from pulp and hard tissue showed an accuracy of 93% and 79% in comparison to the blood obtained from the patient.[5]

The positive results obtained from the pulp to determine the ABO blood grouping leads to a fact that pulp possess high potential value for application in forensic odontology.

CONCLUSION:

Thus, we must remain cognizant that ABO blood grouping can be determined from fresh pulp and pulp under hydrostatic pressure. The accuracy was slightly higher from fresh pulp when compared to later, which could be attributed due to presence of infection or putrefaction. Our study is unique as it simulates the pulp tissue which would be obtained from water prone accidents or homicides. Pulp obtained from such cases may show partial necrosis and still express the antigenicity enabling us to identify the blood groups.

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REFERENCES:

INTRODUCTION:

Fatalities with poisoning are a matter of concern throughout the world as poisoning is one of the leading causes of death amongst humans. There is an extensive account of poisoning related deaths in the world[1]. In India, around 50,000 deaths are reported every year due to ignorance, lack of proper protective measures and easy availability of highly toxic pesticides[2]. A survey report by the National Crime Records Bureau based on accidental deaths and suicides has also pointed 6.3% deaths due to poisoning in India in year 2015[3]. Epidemiological data related to poisoning in a particular region will help in planning the requirement for dealing effectively and efficiently with such types of incidences[4]. Literature survey revealed few data reports[5-10] on poisoning cases from Himachal Pradesh, especially the recent one[5] where southern area of Himachal Pradesh was retrospectively studied for poisoning cases. In continuation to their findings, the present study was aimed to explore types and trends of human deaths due to chemical poisoning in Shimla and Solan districts during 2015-16.

METHODS:

Himachal Pradesh is predominantly a hilly state situated in the Northern region of India. Cases of human poisoning reported from Shimla and Solan districts during 2015-16 were surveyed from the State Forensic Science Laboratory (Now called Directorate of Forensic Sciences), Shimla Hills, Junga (Himachal Pradesh) with the kind permission of authority. Shimla is the most urbanized district of Himachal Pradesh. This is also third most populous district comprising population more than 8 lakhs in an area of 5,131 km². While the adjacent Solan district has an area of 1936 km² and population around 5,76,670. The present database involved scrutiny of toxicology reports with affirmed poisoning. Reports were based on chemical and instrumental analysis of toxic substances from viscera and other biological samples. Different parameters were applied to extract vital piece of information on types and trends of poisoning. Epidemiological parameters used to generate database of poisoning related cases involved, frequency of cases reported in year 2015 & 2016, gender difference, locality (urban & rural) involved, age groups affected, time (day and night) of incidence, mode of poisoning, occupation of the victims, marital status, death site (brought dead and hospitalized) and types of toxicants traced.

RESULTS:

Total 369 positive cases (208 from Shimla and 161 cases from...
Solan) have been reported (Table 1).

Table 1: Year Wise Distribution of Poisoning Cases.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number (Shimla)</th>
<th>Number (Solan)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>116</td>
<td>83</td>
<td>199</td>
</tr>
<tr>
<td>2016</td>
<td>92</td>
<td>78</td>
<td>170</td>
</tr>
<tr>
<td>Total</td>
<td>208</td>
<td>161</td>
<td>369</td>
</tr>
</tbody>
</table>

Poisoning affected more than 87% males in both districts whereas involvement of females in such types of cases went highest up to 11.53%. One case each where gender was not specified also came from both the districts. Gender (male/female) based ratio of victims from both study areas was nearly 8:1 (Table 2).

Table 2: Gender Wise Distribution of Poisoning Cases

<table>
<thead>
<tr>
<th>Shimla</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>%age</th>
<th>Ratio (M/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>98</td>
<td>85</td>
<td>183</td>
<td>87.98</td>
<td>7.6:1</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>07</td>
<td>24</td>
<td>11.53</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>92</td>
<td>208</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solan</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>%age</th>
<th>Ratio (M/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>72</td>
<td>71</td>
<td>143</td>
<td>88.81</td>
<td>8.4:1</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>06</td>
<td>17</td>
<td>10.55</td>
<td></td>
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<tr>
<td>Unknown</td>
<td>00</td>
<td>01</td>
<td>01</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>78</td>
<td>161</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Involvement of rural areas was significantly higher in poisoning related incidences. Almost 3:1 ratio was noted in urban and rural areas (Table 3).

Table 3: Locality-Wise Distribution of Poisoning Cases

<table>
<thead>
<tr>
<th>Shimla</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>%age</th>
<th>Ratio (R/U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>95</td>
<td>69</td>
<td>164</td>
<td>78.85</td>
<td>3.7:1</td>
</tr>
<tr>
<td>Urban</td>
<td>21</td>
<td>23</td>
<td>44</td>
<td>21.15</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>92</td>
<td>208</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solan</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>%age</th>
<th>Ratio (R/U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>64</td>
<td>56</td>
<td>120</td>
<td>74.53</td>
<td>2.9:1</td>
</tr>
<tr>
<td>Urban</td>
<td>19</td>
<td>22</td>
<td>41</td>
<td>25.47</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>78</td>
<td>161</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

More than 35% cases belonged to aged between 26-40 years. Nearly 2% cases reported in children (less than 1 up to 14 years) (Table 4).

Data revealed more deaths with poisoning during night from Shimla during 2015 in comparison to year 2016 where most (50) fatalities came in day time. Records from Solan district also showed similar pattern but overall percentage of deaths during day and night was same collectively. In 72 cases from both districts the timing of death was not specified (Table 5).

Table 5: Distribution of Cases as per Timings of Death

<table>
<thead>
<tr>
<th>SHIMLA</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>%age</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>25</td>
<td>50</td>
<td>75</td>
<td>36.05</td>
<td></td>
</tr>
<tr>
<td>Night</td>
<td>73</td>
<td>27</td>
<td>100</td>
<td>48.07</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>18</td>
<td>15</td>
<td>33</td>
<td>15.88</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>92</td>
<td>208</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOLAN</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>%age</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>26</td>
<td>35</td>
<td>61</td>
<td>37.89</td>
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</tr>
<tr>
<td>Night</td>
<td>37</td>
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<td>61</td>
<td>37.89</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>20</td>
<td>19</td>
<td>39</td>
<td>24.22</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>78</td>
<td>161</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accidental poisoning was highest as more than 55% cases came under this category followed by suicidal poisoning where 60 and 40 cases came from Shimla and Solan respectively. Numbers of homicide casualties were lowest in both districts. In around 9% of cases the mode of death was not given as per records (Table 6).

Occupation wise the victims were divided into government and private employees (police personnel, defense personnel, retired personnel, sub divisional officers, engineers, public works department, advocates, private job, advocates and teachers), workers (fruit seller, pheriwala, carpenter, kabadia, guards, sweepers, cable operator, shopkeeper, misteri, helpers, courier boys, machine operators, cloth merchants,
Occupation Wise Distribution of Poisoning Cases

<table>
<thead>
<tr>
<th>Occupation</th>
<th>SHIMLA 2015</th>
<th>SHIMLA 2016</th>
<th>SHIMLA Total</th>
<th>SHIMLA %age</th>
<th>SOLAN 2015</th>
<th>SOLAN 2016</th>
<th>SOLAN Total</th>
<th>SOLAN %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transporter</td>
<td>23</td>
<td>21</td>
<td>44</td>
<td>21.1</td>
<td>12</td>
<td>08</td>
<td>20</td>
<td>12.4</td>
</tr>
<tr>
<td>Govt. &amp; Private Employees</td>
<td>11</td>
<td>12</td>
<td>23</td>
<td>11.0</td>
<td>16</td>
<td>10</td>
<td>26</td>
<td>16.1</td>
</tr>
<tr>
<td>Students</td>
<td>07</td>
<td>13</td>
<td>20</td>
<td>9.6</td>
<td>04</td>
<td>02</td>
<td>06</td>
<td>3.7</td>
</tr>
<tr>
<td>Farmers</td>
<td>04</td>
<td>12</td>
<td>16</td>
<td>7.7</td>
<td>09</td>
<td>02</td>
<td>11</td>
<td>6.8</td>
</tr>
<tr>
<td>Workers</td>
<td>09</td>
<td>04</td>
<td>13</td>
<td>6.2</td>
<td>08</td>
<td>02</td>
<td>10</td>
<td>6.2</td>
</tr>
<tr>
<td>Businessmen</td>
<td>05</td>
<td>04</td>
<td>09</td>
<td>4.3</td>
<td>04</td>
<td>00</td>
<td>04</td>
<td>2.4</td>
</tr>
<tr>
<td>Labour</td>
<td>02</td>
<td>02</td>
<td>04</td>
<td>1.9</td>
<td>05</td>
<td>00</td>
<td>05</td>
<td>3.1</td>
</tr>
<tr>
<td>Unemployed etc.</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>0.4</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>0.6</td>
</tr>
<tr>
<td>Housewives</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>0.0</td>
<td>02</td>
<td>00</td>
<td>02</td>
<td>1.2</td>
</tr>
<tr>
<td>Occupation not specified</td>
<td>54</td>
<td>24</td>
<td>78</td>
<td>37.5</td>
<td>22</td>
<td>54</td>
<td>76</td>
<td>47.2</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>92</td>
<td>208</td>
<td>100</td>
<td>83</td>
<td>78</td>
<td>161</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 7: Occupation Wise Distribution of Poisoning Cases

victims who suffered from poisoning lost their lives after being hospitalized (Table 9).

Table 9: Comparison of Deaths Occurred While Brought Dead and in Hospital From Shimla and Solan

Ethyl alcohol as individual intoxicant identified in more than 62% of cases. Although the involvement of ethyl alcohol was highest amongst the deceased but it may not be ascertained as real or direct cause of death as most of these victims met the road accident. Apart from this ethyl alcohol was also traced in 10% of the victims who entailed hanging, strangulation, heart failure, shooting and drowning (Table 10).

Table 8: Marital Status Wise Distribution of Poisoning Cases

more than 71% of the victims of poisoning were married. Involvement of unmarried category was 10.09% from Shimla and 16.14% from Solan district. Ratio wise Shimla disclosed a highest ratio (7:1) than Solan with 4.4:1 ratio. In more than 12% cases marital status was not specified from both the study sites (Table 8).

More than 95% of the cases death had already occurred before being hospitalized (brought dead). Averagely, 3%

More than 95% of the cases death had already occurred before being hospitalized (brought dead). Averagely, 3%
In 11 cases from Shimla, blend of a few pesticides and solvents like toluene and xylene with ethyl alcohol was also noted. Singly or blend of Organo-phosphorus (Chloropyriphos, Phorate, Malathion) Organo-chloro (Paraquat dichloride), Carbamates, Herbicides, Pyrethroids including Cypermethrin and Deltamethrin etc were second in use from both the study sites. Phosphine (from AIP) was also detected in 7 cases from each district Shimla and Solan. It was observed that ethyl alcohol (in form of liquor) was used as a vehicle prior to consumption of several of such toxicants. Toxicants like Carbon monoxide, kerosene, amoxicillin, clonazepam, and nicotine were also identified in a few cases (Table-10).

DISCUSSIONS:

Data presented earlier on the poisoning cases have a vital correlation with the findings of the current study. Similar pattern of ethyl alcohol has been observed in most of the studies. An exception has been noted in the gender as in a five year retrospective (1998-2002) study regarding 130 poisoning cases reported to Forensic Medicine Department IGMC Shimla[11] observed male/female ratio around 1.65:1. Their study was comparative to us as the use of organo-phosphorus pesticides was found to be most common used poison. Around 87% of all cases were suicidal deaths. Gender wise the males were mostly (62.30%) affected victims, particularly young adults of 21-25 years age group. It was also observed that out of total 130 cases, around 33.85% could not get the medical treatment and they died on way to the hospital or were found already dead whereas out of those which were hospitalized around 44% died within 24 hours. A similar study (2010-14) conducted[4] scrutinized the toxicology cases from Forensic Science Laboratory, Junga (Shimla). Their results revealed that maximum fatalities with poisoning from Shimla followed by Solan. Gender (male and female) and locality (urban and rural) based data also revealed maximum involvement of males from rural localities. They also reported highest mortality in elderly adult age group (26-40 years) and least in in children (up to 14 years). Ethyl alcohol was utterly detected in 52% cases from all districts during 2010-14. Use of pesticide including Dichlorovos and Paraquat was reported in majority (30%) of cases. The most affected age group was an elderly adult involving 552 cases, inclusive of 317 cases of ethyl alcohol followed by pesticide (147) phosphate (39), blend of alcohol and pesticide (36) and other (13) during 2010-14. Database uncovered insignificant difference in suicidal (48.95%) and accidental (46.71%) cases of poisoning. Homicidal poisoning was observed least common reason of deaths cases. Gender based difference was yet again notable as 98.34% males were registered with accidental poisoning followed by men involved in homicidal (84.37%) and suicidal (65.50%) poisoning.

Similar was also evident from the present data as Shimla district was more affected than Solan in terms of poisoning related deaths. Involvement of married males from rural areas was more than female in both the districts. Many of these victims including male and female were in the age of 26-40 years. Most of these causalities happened during day time. Although in most of the cases ethyl alcohol was detected but it cannot be directly mentioned real cause of death. Use of alcohol was also at large level with the blend of various other toxicants like pesticides and sleeping pills etc. Use of

---

<table>
<thead>
<tr>
<th>Toxicants</th>
<th>Shimla</th>
<th>Solan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethyl Alcohol</td>
<td>71 60 131</td>
<td>62.9</td>
</tr>
<tr>
<td>Pesticides and Insecticides (OP/OC/Carbamates/Pyrethroids/Herbicides)</td>
<td>19 18 37</td>
<td>17.7</td>
</tr>
<tr>
<td>Ethyl Alcohol + Hanging + Strangulation + Heart Failure + Shooting + Drowning</td>
<td>10 07 17</td>
<td>8.1</td>
</tr>
<tr>
<td>Ethyl Alcohol + (Pesticides/Insecticides &amp; Poisonous Solvents like Toluene/Xylene)</td>
<td>07 04 11</td>
<td>5.2</td>
</tr>
<tr>
<td>Phosphine</td>
<td>07 00 07</td>
<td>3.3</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>01 02 03</td>
<td>1.4</td>
</tr>
<tr>
<td>Others (Kerosene Oil, Amoxicillin, Clonazepam, Nicotine + Calcium Hydroxide etc.)</td>
<td>01 01 02</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>116 92 208</strong></td>
<td>****</td>
</tr>
</tbody>
</table>
pesticides/insecticides was higher. More than 50% people died with accidental poisoning. Transporters including drivers and conductors were highly affected with poisoning especially ethyl alcohol. It is obvious that accidental deaths amongst drunk drivers might have a big contribution in these causalities.

CONCLUSION:
The epidemiology of poisoning can be learnt from different perspectives. It can help in understanding the patterns of poisoning, developing prevention strategies and reducing the risks of poisoning. The data presented here can be of immense help for the researchers, academicians, and other related legal agencies for the purpose of strategizing poisoning related fatalities.

ACKNOWLEDGEMENT:
We express deepest regard to the Directorate of Forensic Science, Junga (Shimla), Himachal Pradesh for permitting to collect the relevant data records.

REFERENCES:
Radiological Age Estimation From The Fusion of Medial Epiphysis of Clavicle

1. Jatinder Pal Singh, Senior Resident, Department of Forensic Medicine, Govt. Medical College, Amritsar.
2. Ashok Chanana, Associate Professor, Department of Forensic Medicine, Govt. Medical College, Amritsar.

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

KEYWORDS: Radiological age, X-Ray, Fusion, Epiphysis, Clavicle.

Introduction:
Identification of a person dead or alive is of utmost interest to Forensic experts. Estimation and approximation of age is one of the important parameters of fixing the complete or partial individuality of person. Various experts including Pathologists, Physicians, dentists, Anatomist and Anthropologist contribute a lot to this [1-2].
Forensic age estimation constitutes a field of expertise in forensic medicine which aims at defining as accurately as possible the chronological age of individuals [3-4]. Although numerous age estimation techniques have been developed in the fields of Forensic Anthropology and Forensic Odontology, there is still no consensus on what method should be applied when the age of presumed minor is to be estimated [5-8]. The two main anatomic aspects, which are traditionally examined, are teeth [69] and the hand-wrist bones [10,41] but their applicability in the forensic field is relatively limited particularly for the purpose of assessing the 18th year of age. Because they are either fully developed for the hand-wrist bones and as regards teeth, only the third molars are still developing which has variability. Therefore to confirm the dental evaluation, skeletal parameters are also considered [6,48].
Various bones and their time of ossification are frequently used for estimation of age of an individual. Clavicle is one of them used for estimation of age & sex of an individual because out of all the long bones in the human skeleton, clavicle displays the longest period of growth related activity, rendering it useful for the estimation of age in the earlier years. Determination of the stage of ossification of the medial clavicular epiphysis plays a crucial part in age estimation when evaluating living subjects over 18 years of age [11-18]. In most of the bones during growth, the epiphyses unite to the diaphyses between 11 and 20 years of age & in females fusion commences a couple of years earlier than males. The only exception is the clavicle, in which fusion occurs during the second decade and traces of its union sometimes extend into the late 20's [19].
Clavicle: - Clavicle is a modified long bone having received its name from the Latin: clavicula ("little key"). Like all long bones, it has two ends. The lateral end articulates with the acromion process of scapula and the medial end articulates with the sternum and first costal cartilage. The clavicle is subcutaneous throughout its length and can easily be seen in all subjects. The lateral end of bone is formed by intramembranous ossification while medially it is formed by endochondral ossification. The bone is formed via two ossification centres, one medial and one lateral, which fuses later on [6,13,18]. The clavicle is the first fetal bone to undergo primary ossification, and its medial epiphysis is the last to fuse [19], thus making it important in age estimation. Clavicle has two primary ossification centres which appear by the 6th week of intrauterine life and fuse together about one week later [19,21]. The ossification...
In the present study, in the age group of 16-18 years- Out of 31 epiphysis of left side of clavicle was studied and the following years extending up to 21 years and stage 4 at 21 years and by 26 years all were fused. In females stage 1 first observed at 16 years extending up to 21 years, complete fusion first observed at 16 years in males which extends to 24 and 19 years in females extending up to 21 years, complete fusion first observed at 21 years and beyond in both sexes and by 26 years all were found fused.

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

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

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

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

The observations are comparative with the study conducted by Singh Pardeep et al. by using X-Ray examination in which epiphyseal union in males was at 22-23 years and earliest had occurred at 20 years and females show union at 22-23 years of age and the earliest union at 20 years and one month. The observations of the present study are well in accordance with the study conducted by Schulz, Muhler et al. (2005) using CT scan to determine fusion by using 5 phase scoring system. In which stage 2 was first noted at age 15 years in both sexes, earliest union of stage 3 was noted at age 17 years, 16 years and complete fusion was at age 22 years and 21 years in males and females respectively. In the present study stage 3 was observed at 18 years and 19 years and complete fusion was observed at age 21 years in males and females respectively.

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

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

Funding : None
Conflict of interest : None
Ethical Clearance : From Ethical Committee of Government Medical College Amritsar.
REFERENCES:


22. Singh P, Gorea RK, Oberoi SS, Kapila AK. Age estimation from medial end of clavicle by X-Ray examination. JIAFM; 32(1).


Table 1: Showing Total Number of Cases Studied in Different Age Groups with Stage of Fusion of Medial end of Clavicle of Left Side.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Age Group in Years</th>
<th>Stage of Fusion (Left)</th>
<th>Total No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stage 1</td>
<td>Stage 2</td>
</tr>
<tr>
<td>1</td>
<td>16-18</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>18-20</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>20-22</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>22-24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>24-26</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total No. of Cases</td>
<td>9</td>
<td>28</td>
<td>58</td>
</tr>
</tbody>
</table>

\[ x^2 = 192.475; df = 12; p < 0.001; \text{ Highly significant} \]
Table 2: Showing Sex Wise Distribution of Different Stages of Fusion of Medial End of Clavicle of Left Side.

<table>
<thead>
<tr>
<th>Age Group (Years)</th>
<th>Stage of Fusion in Males</th>
<th>Total Males</th>
<th>Stage of Fusion in Females</th>
<th>Total Females</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stage 1</td>
<td>Stage 2</td>
<td>Stage 3</td>
<td>Stage 4</td>
<td></td>
</tr>
<tr>
<td>16-18</td>
<td>7</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>18-20</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>20-22</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>22-24</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>24-26</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Total No. of Cases</td>
<td>7</td>
<td>12</td>
<td>39</td>
<td>41</td>
<td>99</td>
</tr>
</tbody>
</table>

\[ x^2 = 108.019; \text{df}=12; p<0.001; \text{Highly Significant} \]

\[ x^2 = 92.901; \text{df}=12; p<0.001; \text{Highly Significant} \]

Table 3: Showing Stage of Fusion With Mean Age in Both the Sexes.

<table>
<thead>
<tr>
<th>Stage of Fusion</th>
<th>No.</th>
<th>Age (in Years) Mean ± SD</th>
<th>Range (in Years)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>9</td>
<td>16.11 ± 0.33</td>
<td>16-17</td>
<td>F Value = 145.21; p&lt;0.001; Highly Significant</td>
</tr>
<tr>
<td>Stage 2</td>
<td>28</td>
<td>17.64 ± 1.39</td>
<td>16-21</td>
<td></td>
</tr>
<tr>
<td>Stage 3</td>
<td>58</td>
<td>20.24 ± 1.58</td>
<td>18-24</td>
<td></td>
</tr>
<tr>
<td>Stage 4</td>
<td>74</td>
<td>23.41 ± 1.57</td>
<td>21-26</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
<td>20.98 ± 2.85</td>
<td>16-26</td>
<td></td>
</tr>
</tbody>
</table>

Graph 1: Showing Association of Age with Stage of Fusion.
ABSTRACT:

Background: Lip prints are the normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip, between the inner labial mucosa and outer skin. Yasuo Tsuchihashi presented a standardized classification of his own, for different types of lip print. He has classified lip prints into five types, which forms the basis of categorizing lip prints. Personal identification plays an inevitable role in forensic investigation. Lip print is one of the evidences that can be left in the crime scene, which helps in identification purpose.

Aim: Present study was undertaken to provide deeper inside view of use of cheiloscopy in personal identification, focusing on sex variability of lip print patterns. This study was conducted to identify the pattern of lip prints and whether any sexual difference exists in lip prints in north India.

Materials And Methods: Among the medical students studying in SGRR medical college, Dehradun who were native of north India were selected for the study. The cross-sectional study was conducted among 119 (65 males and 54 females) subjects of age 20-28 years, residing in different areas of north India. Frequency distribution and Chi-square test were used for data analysis by SPSS software. Applying the Chi-Square test, statistically significant differences (p < 0.001) were observed between male and female lip print patterns in middle 10 mm of the lower lip.

Results: The most common lip print pattern in entire population was Type I (38%). Significant difference was found in the distribution of lip print patterns among males and females in the entire population, group I and group II, respectively (P < 0.001).

Conclusion: This study shows that there is significant relationship in the pattern of lip print with sex which can serve as an important tool in forensic for personal identification and criminal investigation, thus, narrowing down the scope of investigation to almost half.

INTRODUCTION:

Globally, as well as in India, crimes are increasing day by day with the variety of different type of nature and technology as criminals and elites of the society are using sophisticated technology while committing crime. Their main aim to save themselves by keeping the police, forensic and the public off the scene. For this reason, the position of crime scene detectives has become challenging than ever in this civilized modern world. As the crime scene investigation procedures are becoming more scientific and methodical, criminals are evolving novel and latest techniques to beat them\(^1\). Identification of a person is of vital importance in a medico-legal exploration. A wide range of methods is available for this purpose out of which one of the best and most often used is fingerprints. This is the reason; the awareness of fingerprints is very high in the general population especially in criminals, not to leave behind fingerprints at a crime scene. According to the Locard's exchange principle, when two objects come into contact, there is always a transfer of material from each other. And result is that some traces from the scene may be carried away with the person and at the
same time may be left at the site\(^2\). Lip print is one of the evidences that if left at the crime scene, then can be utilized for identification purpose\(^3\). This is an alternative mode of identification -Cheiloscopy.

The term “Cheiloscopy” is derived from the Greek words cheilos meaning 'lips' and e skopein meaning 'to see'; which is the study of the grooves and furrows present on the red part of the human lips. Lip prints are the characteristic pattern of the fissures (sulci laborum) in the form of elevations and depressions on the labial mucosa present in the zone of transition, between the inner labial mucosa and the outer skin. These grooves occur as distinct patterns or types and are unique to each individual and thus can be used to fix the identity of a person. Cheiloscopy is one of the most interesting emerging fields which find its roots in criminal and forensic practices\(^4\). Lip prints are important because of their uniqueness and permanence\(^5\). This is unique for individuals like the finger prints. The oil and moist secretions from salivary and sebaceous glands located at the vermilion border enables the formation of a latent lip print whenever there is contact\(^6\) and is likely to be encountered and should be suspected to be present on the crime scene. Various physical evidences at the crime spot such as clothing - shirt, handkerchief, cigarette butts, tissue paper, wipes, photographs, letters, fruit skin or peel, glass, window panes, cups and even biological resources such as skin where lip prints may be found\(^7\). A lip print recovered from the scene of crime can be a basis for conclusions as to the fixation of identity, the number of people involved, sexes, habits, occupational traits, cosmetics used and the pathological changes of the lips\(^7\).

This biological phenomenon of furrows on the red part of the human lips was first noted and described by anthropologist Fischer\(^8\). However, until 1930, anthropology merely mentioned the existence of furrows without suggesting a practical use for the phenomena. Edmond Locard was one of the France's greatest criminologists who first recommended the use of lip prints in personal identification and criminalization. In the early 1950s, a forensic expert Le Moyne Snyder\(^9\) introduced a concept that utilized the wrinkles and grooves of the lips as a method of identification. Many researchers observed these in the 1960s and 70s. Many previous studies have shown that lip prints can positively distinguish individuals and hence have potential use in human identification\(^10-12\).

Yasuo Tsuchihashi classified the lip prints into six types according to the shape and course of the grooves. These were:

**Type I**: clear-cut grooves running vertically across the lip.

**Type II**: the grooves are straight, but disappear halfway.

**Type III**: the grooves intersect.

**Type IV**: the grooves are reticular

**Type V**: the grooves do not fall into any of the types I to IV.

In the past, kind of researches have been conducted to study lip print stability\(^13-14\), sex determinations\(^15-16\), and various morphological patterns\(^17-18\) in India and other countries\(^14,19\).

This study has been planned to study the lip prints of different individuals to set up further facts and truth and throw more lights on lip print with an object of providing additional information about lip print to police and investigator in the field of forensics, to help in law and justice.

**MATERIAL AND METHOD:**

This cross-sectional study was conducted in 2017 on 119 people (65 males and 54 females) of age 20-28 years, residing in different areas of north India, who are the medical student at SGRR medical college Dehradun. All the participants were briefed about the purpose of the study, and informed consent was obtained from them. Study was approved by ethical committee of institute.

Inclusion/exclusion criteria-Participants who were present at the time of the study, those who wanted to take part in the study willingly, and those whose lips were free of any active and passive lesions were included. Subjects with any inflammation, trauma, congenital deformity, or any other disease of lips or known hypersensitivity were excluded.

All the lip prints were taken by a single examiner who was calibrated by and against a “senior examiner” in a pilot study of 20 participants during a 1-week period. The method of taking of lip prints and visualization was done in the Department of Forensic medicine and toxicology, Shri guru ram rai institute of medical and health sciences, Dehrdun.

Recording the lip prints – We have used the lipstick-cellophane method to record the prints. The materials used were dark-shaded non-glossy lipstick, ear buds, cellophane tape, A-4 sized paper, scissors, magnifying lens, and tissue paper to wipe lipstick. Each lip print was recorded on the A-4 sized paper using the above-mentioned materials and assigned a specific code. For recording lip prints, the lips of the individuals were cleaned and sufficiently dark-shaded non-glossy lipstick for the upper lip was taken at one end of the earbud and was applied in a single stroke. Similarly, for the lower lip, the other end of the earbud was used and discarded thereafter, thus maintaining the decorum of asepsis. The participants were asked to close the mouth, and lip prints were obtained in the relaxed position. A strip of cellophane tape slightly more than the breadth of subject's lips was taken. The strip of tape was uniformly pressed from
the left end to the right end of the lip, taking care that the lips of the subject should be closed and relaxed. The tape was taken out in a single jerky motion and was pasted on the A-4 size paper. At least three lip prints were taken from each subject, taking into account the pressure differences, and the print displaying sufficient characteristics for examination was chosen, which was then visualized carefully with the help of magnifying glasses.

**Classification Used:** Analysis of lip prints was done as per the classification proposed by Suzuki and Tsuchihashi, which is as follows: Type I, complete vertical pattern; 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. Middle 10 mm of the lower lip was the area to be studied. This was chosen because the center portion of the lower lip is the area that is most frequently found at a crime scene. The triple blinding technique was used at the time of analyzing the lip prints. All the data were entered in the Microsoft Excel sheet. Statistical Package for Social Software (SPSS) was used for statistical analysis. The frequency of each type of lip print was tabulated and the percentage of each type was calculated. The chi-square test was used to compare the lip prints. P < 0.001 was considered as significant.

**RESULTS:**

Out of total 119 participants, 55% Males (65) and 45% females (54) respectively, all belongs to the age group 19-26 years. The study showed that most common lip print pattern in males (group 1) was type III, intersect type (37%) and least common type IV, reticular Type (3%). While type I (26%), Type I’ (5%), Type II fork type (18%) and Type V (11%) while most common lip print pattern in females (group 2) was type I, clear-cut grooves running vertically across the lip (52%) and least common type I’ and IV (4%). And type II, Type III and Type V were 17%, 19% and 6% respectively. If we analyzed entire population then most common lip print pattern all subjects was type I clear-cut grooves running vertically across the lip (38%) and least common type IV (3%). While type I’ (4%), Type II (18%), Type III (29%) and Type V (8%).

Chi-square analysis revealed very highly significant difference in the distribution of lip print patterns among males and females in the entire population (P < 0.001).

**DISCUSSION:**

It has already been stated that traces from the scene may be carried away on the person and at the same time may be left at the crime scene. Lip print is one of the evidence that can be left at the crime scene. The prints can then be lifted from the substrate or photographed directly for identification. This may be attributed to the fact that the edges of the lips have sebaceous glands with sweat glands in between; therefore, secretion of oil and moisture enables development of latent lip prints, analogous to fingerprints. Lack of comprehensive database may become an obstacle for the identification purpose. In such a situation, the sex and age variability of lip prints could help in narrowing down the investigation.

In spite of the few studies available, the current study utilizes the standard classification proposed by Suzuki and Tsuchihashi to establish facts, so as to aid in getting further details of lip prints. In the current study, the lip prints were recorded in relaxed and closed positions. This may be due to the fact that the uniqueness of lip prints depends upon the relaxation of muscle to produce a particular pattern. It was found that lips exhibit well-defined groves in closed mouth position as compared to open mouth position. The middle portion of the lower lip, of width 10 mm, was taken as the study area in this study as per the classification proposed by Sivapathasundaram et al., because this area is almost always visible in any trace and determination of pattern depends on the numerical superiority of the line of current study.

In the present study, no two lip print patterns matched each other, thus establishing the uniqueness of lip prints, which is in accordance to the detailed study by Tsuchihashi on 1364 Japanese subjects (757 males and 607 females) where no lip print showed the same pattern in the investigation.

In the present study, the most common lip print pattern found among males was Type I, followed by Type III and Type II, respectively. While among females, Type I was the most commonly found lip print, followed by Type III and Type II. These findings are in agreement with previous studies that documented diversity in the pattern of lip prints among individuals. Gondivkar et al. reported in their study that the most predominant pattern among males was Type III and among females was Type II. Various studies reported different results. Vahanwalla and Parekh reported in their study that Type III pattern was commonly found among males and type II among females. While Sivapathasundaram, Manipady and Sandhu et al. reported in their study that Type III, Type II and Type I was the predominant lip print patterns found among males and females, respectively.

In the study, overall, Type I long vertical type was the most frequently observed pattern in the examined subjects of the North India. The result were in agreement with the results of the studies conducted by Koneru et al. on Kerala and Manipur population and by Vahanwala and Parekh on the Mumbai population, who also found the Type I pattern to be most predominant, while Type I’ was observed to be the least common type. Sivapathasundharam, Prakash and Sivakumar studied the lip prints of 200 Indo-Dravidian persons and they followed Tsuchihashi’s classification of type I to V. They also found that...
type III was predominant. On the other side Tsuchihashi\(^{13}\) found that Type III was predominant among the Japanese subjects. Verghese et al\(^{17}\), in their study on Kerala population, found that Type IV pattern was predominant.

**CONCLUSION:**

The study revealed that lip print Type I (38%) and Type IV (3%) were the most and least predominant (respectively) among the North state in India. In males Type III (37%) and in females Type I (52%) was found to be most prevalent and Type IV least seen in both sexes. Further studies on similar grounds considering different populations should be done in order to create a comprehensive database so that the hidden potential of lip prints as an important source of information can be utilized optimally. Thus, it can be concluded from the present study that lip prints can be used as one of the important forensic tools for personal identification among populations.

Longitudinal studies with larger sample need to be conducted in future to validate the above conclusion. Studies on the lip print patterns should be carried out focusing on assessing the variability of lip prints with respect to climatic change, as well as other factors. There is a need to develop a standardized system of the classification, method of registration, and analysis with the help of software that will aid the law enforcement agencies to bring up the new vista of forensic anthropology. Recording of teeth and restorations as antemortem records may lead to difficulty in comparing the antemortem records and post-mortem records in cases of loss of teeth and destruction of restorations. Apart from the teeth and restorations, soft tissues of the oral cavity may help for personal identification. Anatomical structures like Palatine Rugae and lip prints remain constantly and this can be included in the antemortem records and can be recorded and used as evidence in personal identification and criminalization.

**REFERENCES:**

20. Alvarez Segui M, Miquel Feucht M, Castello Ponce A,


Area of Study Lip Print Pattern

Table-Showing Pattern of Lip Prints

<table>
<thead>
<tr>
<th>Type of lip print</th>
<th>Male</th>
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<td>%</td>
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</tr>
<tr>
<td>Type I</td>
<td>17</td>
<td>26%</td>
<td>28</td>
</tr>
<tr>
<td>Type I’</td>
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<tr>
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</tr>
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<td>24</td>
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</tr>
<tr>
<td>Type IV</td>
<td>2</td>
<td>3%</td>
<td>2</td>
</tr>
<tr>
<td>Type V</td>
<td>7</td>
<td>11%</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>65</td>
<td>100%</td>
<td>54</td>
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</table>
Effect of Preservation on DNA and its Profiling from Sternum Bone from Unidentified Bodies

ABSTRACT:
There are certain chemicals which are used to preserve the unknown human body parts, taken for identification via DNA analysis. Formalin is a common preservative which is used either in the case of an aborted fetus or other skeletal remains but such exhibits do not remain suitable for further DNA examination. Degradation of tissues leads to the concatenation of events which ultimately results in reduced DNA quantity. Quantitation of DNA plays an important role in the analysis of forensic samples like bone, tissues or any other biological material so that optimum quantity of extracted DNA would be taken for amplification and profiling. Stochastic effects are common to the PCR if the DNA quantity varies from the limit as in the case of excess DNA. Alleles were found off ladder whereas allele dropout occurs due to less DNA quantity. Generally, two types of sternum bones are received in the Forensic lab in missing identity cases, one wet bone with tissues attached to bone and preserved in nonporous container while another type is, wrapped in gauze/cloth and kept in an envelope to let it dry in normal environmental condition. A comparative data of 30 such sterna had been prepared from the samples examined in the laboratory after 3 to 4 years of sample collection. The result of this study showed the way, Sternum bone was taken and preserved for identification, may affect the quantity and quality of DNA and its profiling. The dry sternum bone gave better quantity of DNA and complete DNA profiling comparative to wet sternum kept in a plastic container. The wet sternum gave multiple peaks on small size markers and allele drops out on big size markers.

INTRODUCTION:

Delhi being the capital of India having more the 1.50 crore populations, second largest metropolitan city after Mumbai. People migrate to the urban area due to various socio-economic or political reasons. Several people die due to hunger, cold or road accidents and sometimes, their identity becomes a challenge for the police. In such cases, Autopsy surgeon preserves the sternum bone, teeth or blood on gauze piece for DNA profiling of such individuals for the purpose of identification. No doubt sternum bone is a good source for DNA analysis and DNA profiling, even after several years after death[1]. DNA analysis depends on how it has been preserved. Human remains can play an important role in identity establishment in the cases where the body is completely degraded and it is not possible to identify the body on the basis of facial structure. The technique RFLP failed to isolate the DNA from degraded samples.

The public is aware of the pros and cons of DNA technique with TV programs like CID and CSI[2]. A layman regards the DNA report and believes that it is precise and legitimate but misinterpretation and contamination may result in adulteration leading to a false result[3] The need of the hour is that the experts must be trained the skill of DNA examination and they must conform to the procedure of accredited laboratory during the examination.

In last two decades, DNA technology witnessed extraordinary developments in the STR technology and thus are capable of generating the profile in the highly degraded samples and the DNA may be amplified up to the level of 100 picograms. Isolation of DNA from a bone is a lengthy, slow process to be done with great perfection and single-mindedness, due to the calcareous nature. In the process of decalcification, bone powder was dissolved in 0.5m EDTA to enhance the DNA quantity. Influence of environmental factors such as temperature, humidity, storage conditions and time are minor on bones in comparison with other body tissues and fluids. Bone is a hard structure and therefore, it is a prolonged process to degrade in comparison with the soft tissue material and is able to generate microgram quantity from the gram of bone[4]. DNA is generally found in aqueous form in vivo and in-vitro and will completely degrade at 190 degree Celsius[5]. Degradation of the samples is because of the harsh environment, moreover, there is an inhibition of calcium in bone samples. In such cases of body identification in missing...
identity, wherein bone has been preserved with tissue with highly degraded tissue material attached to it. During the DNA profiling, it becomes more complicated to identify the actual peaks or false peaks. Three peaks are very common on small size marker (80 to 200 base pairs) due to degradation or contamination. Contamination may also take place inside laboratory due to the rigid handling of a sample or allelic ladder. In cases like the mass disaster or missing identity, it becomes very important to take the tooth along with bone sternal for purpose of identification, or if the body is highly decomposed and selection of correct tooth may enhance the quantity and purity of DNA. All three qualities can be checked by the quantification of DNA by RT-PCR (Real-time PCR) if inhibitors are detected in such bone samples, one must try to clean the inhibitors. This DNA technology is one of the most robust and powerful tools in the prevailing technology standards for criminal justice system.

MATERIALS AND METHODS:

DNA Extraction: Wet and Dry Manubrium received in the laboratory were taken for isolation of DNA. Wet manubrium was dried first to avoid contamination during handling of samples. Both types of manubrium were put in falcon tube filled with milli-Q water and kept on a rotator for 4 to 5 days to remove the tissues from the surface of the bone. Water was changed on daily basis in 15 ml tube in order to remove any possible contamination. After proper washing with water, manubrium was wrapped in whatman paper/clean tissue paper for proper drying at room temperature. It may be kept at 40-degree celsius temperature in the incubator for the fast dry. After proper drying, samples were crushed to powder form by using tissue crusher. The bone powder, around 50gms was taken for DNA isolation process and put in 0.5ml EDTA in a 2ml Eppendorf tube for 4 to 5 days for decalcification. Supernatant EDTA was frequently changed on daily basis to remove calcium from the bone powder, as EDTA is also inhibitor. Then it was washed with normal saline and further by milliQ water. The powdered bone is taken in fresh lysate tube and freshly made PrepFiler BTA™ lysis solution is added to it. After 5 minutes vortex and brief centrifuge, incubated it in the thermal shaker at 56°C temperature for at least 4 hours. After incubation, Centrifuge the lysate tube for 5 minutes at 12,000 rpm and then transferred the clear (no sediment) lysate to a new sample tube. Afterward proceeded directly for the automated extraction. After proper washing samples were taken for isolation by using the AutoMate Express™ Forensic DNA Extraction System. It is easy to use, robust bench-top instrument advantage of this technique is that it has beads which bind with DNA. Instrument allow to utilizes PrepFiler Express BTA™ chemistry that is packaged in pre-filled, foil sealed cartridges. The tube chamber of instruments to be cleaned with alcohol to avoid contamination. This is designed specifically for forensic samples to extract better quantity and quality of DNA without any handling error, inhibition and the further process of PCR and STR analysis can provide better DNA profiles. The study had shown that this technology has the power to enhance the quantity of DNA by using the PrepFiler BTA Kit on the Automate Express TM.

AutoMate Express™ can isolate 13 samples in 30 minutes. This method is better to the time-consuming process of organic extraction, moreover least inhibition due to magnetic beads.

QUANTIFICATION OF DNA:

Both types of samples were quantified using the Quantifier® Duo DNA Quantification kit (Applied Biosystems). Duo reaction Mix and Primer Mix (12.5ul and 10.5ul per sample respectively) were mixed and added to wells plate provided by manufacturer “Applied Biosystems” and mixed thoroughly. Then 2ul sample is added to the same sample well. The total volume of the PCR reaction system is 25ul. It is covered by a transparent adhesive film on the plate to avoid contamination of the sample. Quantification was done to know the quantity of DNA in each sample. Applied Biosystems’ 7500 Fast Real-Time PCR System was used. Quantification standards and samples were run in as per manufacturer protocols. Standards for DNA quantification were prepared and applied for determining the DNA concentration of the samples. The Applied biosystems Quantifier® Duo kit contains three types of dye-labeled Taq Man® probes which tell human-specific Ribonuclease RNA and Component H1 gene, human male-specific Sex-determining region Y (SRY) gene, and for inhibition an internal positive control. The final volume of eluted DNA was 50ul. Kit helped to ascertained that the sample contain human as well as male DNA in the sample. Using of this duuo kit may avoid misrepresentation of Female sample to the male sample. STR kits include the primer for amelogenin gene system. It allows individualization and gender identification. The studies suggest the deletion of Y allele in amelogenin marker and may misrepresent the gender as female in place of a male. RT-PCR is the only source which can tell the gender with the help of Quantifier® Duo kit.

RESULTS:

The quantitative analysis of the sample of bone was done and it showed the quantity of DNA isolated from dry sternum was from 0.90 to 4.02ng per microlitre while the wet sternum was able to give maximum quantity 1.06 and minimum were 0.1ng/ul and DNA was 0 in three samples (Table-1). Accurate profile was generated from the dry sternum and were not able to generate complete DNA profile from the wet sternum. There was allele drop in the big size marker even in some samples were having multiple peaks on short size marker due to long time exposure to the wet condition.

DISCUSSION & CONCLUSIONS:

The lack of expertise, equipment, and manpower are the major factors for prolonging the analysis of forensic samples due to the big amount of already pending cases. We can reduce the cost of the analysis of samples only if it is done within a short period of time after it is reported to the laboratory. DNA tends to degrade in moist conditions and therefore the advancement of quantitative PCR helped a lot in forensic sciences, especially in cases wherein the quality of samples was degraded and inhibitors were present in samples. Moreover, it is the best way to determine the gender of the sample. In such degraded samples, different STR techniques have further helped to extract an accurate profile. New methods have been discovered for accurate DNA profiling such as Identifier, minifiler, and Y-filer. It is normal of alleles on larger size loci to
be missing in degraded samples and the main reason for this degradation is careless towards the moist bones with high water and tissue content. Moreover, if the wet tissues found on the bone are kept in non-porous containers, the samples become even more degraded. In this study, two different types of samples, containing the sternum bone were taken, the first being the one in which the bones were kept in a plastic container without any preservative along with tissues attached to the bone and the second being the one in which the bone was wrapped in gauze cloth and kept in a porous container (like paper envelope). It was observed that degradation was lesser in the sternum taken in the porous container like cloth or envelope and dried in natural process than the wet bone preserved in a plastic container. During Quantification of isolated DNA samples, it was found that the bone which dried in the natural process had a better quality and quantity of DNA comparatively to the sternum bone which was preserved along with tissues in the plastic container.

REFERENCES:


<table>
<thead>
<tr>
<th>S. No.</th>
<th>DNA Quantity in Dry Sternum Bone (Nanogram)</th>
<th>DNA Quantity in Wet Sternum Bone (Nanogram)</th>
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<tr>
<td>1.</td>
<td>1.00</td>
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<tr>
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<td>15.</td>
<td>0.90</td>
<td>0.38</td>
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</table>

(Table-1) Quantitative Chart from Sternum Bones
Estimation of Age Group (11-21 Years) By Roentgenologic Study of Epiphyseal Fusion of Long Bones At Knee And Ankle Joints

1. Arindam Chatterjee, Junior Resident*
2. OP Aggarwal, Ex Professor and Head*
3. Harpreet Singh, Professor*
4. Munish Kumar, Junior Resident*

* Department of Forensic Medicine, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR) Mullana, Ambala, Haryana, India

ABSTRACT:
Estimation of age is an important task and a valuable tool to assist in many civil and criminal procedures. Age being one of the primary characteristics in establishing the identity of the individual, its estimation becomes an important task for forensic expert especially in developing countries where birth records are not well maintained. Ossification and the union of epiphyses gives relatively reliable results of age estimation with less minimal error and is therefore more appropriate and acceptable to both medical and legal personnel. X-rays of all cases were studied and divided among 4 categories (Degree 0- Degree 3) depending on the status of fusion of long bones. 100% of males and females showed complete fusion at distal end of femur at the age group of 17-18 and 15-16, Proximal end of tibia at the age group of 17-18 and 16-17, proximal end of fibula at the age group of 18-19 and 15-16, distal end of tibia at the age group of 16-17 and 14-15 and distal end of fibula at the age group of 16-17 and 14-15 respectively

KEYWORDS: Age Estimation, Distal End of Femur, Tibia, Fibula, Proximal End of Tibia and Fibula.

INTRODUCTION:
Age determination is needed in the administration of justice, employment, marriage, forensic investigations and identification. The exact age of individuals can only be obtained from certified documents. However, in their absence, there is a need to verify whether an individual should be a juvenile or adult. For providing the exact chronological age and biological age estimation, it is necessary to combine information from physical and dental examination and examination of as many bones epiphyses as possible. The multi-factorial methods based on current research are helpful for accurate estimation of age that minimizes the error of estimation. Bones increase in length and size as the growth of a human being progresses from childhood to adulthood. Such type of changes can be analysed by roentgenologic study. Epiphyses of bones unite at a particular age and these changes in epiphyseal union help to find the skeletal age, which when analysed with age-based models give a chronological age estimation.

Various methods are required to estimate the age of the person for medico-legal cause in both civil and criminal matters. Macroscopic and microscopic methods can be categorized to find out the real age of a human being mainly by the medical expertise. The microscopic method (Osteon counting) depends upon remodelling of long bones and the other is dependent on dental micro structure. Macroscopic means include-dental growth, analysis of general physical development (Height and Weight), puberty changes (Secondary sexual characters) and bones ossification. Skiagraphy is the method to find out ossification and epiphyseal union of long bones in live human being. The appearance of secondary ossification centres are used for analysing age in the epiphyseal union timing. The lower limb long bones play a vital role in age calculation both in live and dead persons. There is immense difference in the data not only in India but also abroad owing to different environmental situations and socio-economic pattern.

Forensic experts have a wide range of parameters for age estimation available to them. These parameters are physically examined by a suitably qualified medical expert. If it is not
clear that the person attained age of 21, conventional roentgenological study, Computed Tomography of the inner end of clavicle bones should be performed to determine the age\(^{[4]}\). The femur is the strongest and longest bone of the skeleton. The femur, like other long bones, is divisible into two extremities and shaft. The femur ossifies from five centres; one each for the shaft, head, greater and lesser trochanters and the distal end. The epiphyses fuse independently. Soon after puberty the lesser trochanter and then the greater trochanter. In the 14\(^{th}\) year the head in females, in males in 17\(^{th}\) and in the 16\(^{th}\) year the distal end fuses in females, in males at 18\(^{th}\)\(^{[5]}\).

The tibia lies medial to the fibula and is engaged directly in the transmission of weight and has a shaft and two extremities. It starts from three centres, one each for the upper and lower end and one for the shaft. Ossification starts in mid shaft at about an intrauterine seventh week. The proximal epiphysis fuses in females in the 16\(^{th}\) year and in males in the 18\(^{th}\) year and in males in the 17\(^{th}\)\(^{[6]}\).

The fibula is very lean than the tibia and is not involved directly in the transmission of weight. It has a proximal head, a long shaft, a narrow neck, and a distal lateral malleolus. The shaft unites with the distal epiphysis in females at about fifteenth year and in males in the seventeenth, whereas the proximal epiphysis does not unite about the seventeenth year in females and the nineteenth in males, despite having appeared earlier\(^{[7]}\).

So ossification of secondary centres and their display is usually used for age estimation that is the time of epiphyseal fusion. Countable differences may be analysed in the fusion activities and appearance of ossification centres based upon race, sex, and geographical distribution. The food, nutritional status, habit, and presence of some diseases, physical activity and hormonal and metabolic disorders may also control the ossification process\(^{[8]}\).

**MATERIAL AND METHODS:**

The present study was carried at Forensic Medicine and Radiology department of M.M.I.M.S.R, Mullana, Ambala from December 2015 to May 2017 on 200 cases (100 males and 100 females) in the age group of 11-21 years. Cases were selected by using random sampling and confirming the age by Aadhar card, birth certificate, ration card, passport, matriculation certificate of whosoever came for x-ray. Individuals with musculo-skeletal disorder, fractures at the joint, nutritional disorders and chronic illnesses were excluded from the studies.

X-rays of knee and ankle joints in anterior-posterior (AP) view were taken and the status of fusion of the epiphyses was noted. Age was estimated by criteria of union as follows:

**Degree 0:** A dark radiolucent line seen throughout the length of the epiphyseal and metaphyseal joining surfaces (Fusion not yet commenced) (Figure 1)

**Degree 1:** Radio-opaque area is seen in the middle or on either side of the epiphyseal and metaphyseal joining surfaces (Fusion commenced) (Figure 2)
Degree 2: Radio-opaque area is more than half of the epiphyseal and metaphyseal joining surfaces (Fusion incomplete) (Figure 3)

Degree 3: Radio-opaque area is seen in the entire length of the epiphyseal and metaphyseal joining surfaces (Fusion Complete) (Figure 4)

SPSS (Statistical Package for the Social Sciences) version 20.0 was applied and the results were analyzed. The values were represented in Number (%) and Mean ± SD.

RESULTS:
Table No. 1: Presents the chronological age (years) range, mean age and standard deviation values for the youngest and oldest subjects recorded at each degree of fusion for each of the five bone ends at the knee and ankle joint for males. The youngest subject recorded as having a beginning fusion of the distal end of femur was aged 14 years and the oldest was 15 years. The mean age of beginning fusion was 14.42 years. The youngest subject recorded as having a beginning fusion of the proximal end of tibia was aged 14 years and the oldest was 15 years. The mean age of male subjects showing beginning fusion was 14.42 years. The youngest subject recorded as having a beginning fusion of the proximal end of fibula was aged 15 years and the oldest was 16 years. The mean age of male subjects showing beginning fusion was 15.69 years. Further, the youngest subject recorded as having a beginning fusion of the distal end of tibia was aged 14 years and the oldest was also 14 years. The mean age of male subjects showing beginning fusion was 14 years.

Further, the youngest subject recorded as having a beginning fusion of the distal end of fibula was aged 14 years and the oldest was also 14 years. The mean age of male subjects showing beginning fusion was 14 years.

<table>
<thead>
<tr>
<th>Bone End</th>
<th>Number</th>
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<td>12.1 ± 0.9</td>
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<td>56</td>
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<td>15.69 ± 0.5</td>
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<td>17.63 ± 0.5</td>
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<td>14-14</td>
<td>14 ± 0</td>
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<td>16</td>
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<td>15.69 ± 0.5</td>
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<td>67</td>
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<td>18.75 ± 1.3</td>
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<td>67</td>
<td>3</td>
<td>16-21</td>
<td>18.75 ± 1.3</td>
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</table>
Table No. 2: Presents the chronological age (years) range, mean age and standard deviation values for the youngest and oldest subjects recorded at each degree of fusion for each of the five bones at the knee and ankle joint for females. In females, the youngest subject recorded as having a beginning fusion of the distal end of femur was aged 13 years and the oldest was 14 years. The mean age of showing beginning of fusion was 13.57 years. The youngest subject having a beginning fusion of the proximal end of tibia was aged 15 years and the oldest was also 15 years. The mean age was 13 years. Further, the youngest subject having a beginning fusion of the distal end of fibula was aged 13 years and the oldest was also 13 years. The youngest subject having a beginning fusion of the proximal end of fibula was aged 13 years and the oldest was also 13 years. The mean age was 13 years. Further, the youngest subject having a beginning fusion of the distal end of fibula was aged 13 years and the oldest was also 13 years. The mean age was 13 years. Further, the youngest subject having a beginning fusion of the proximal end of fibula was aged 13 years and the oldest was also 13 years. The mean age was 13 years. Further, the youngest subject having a beginning fusion of the proximal end of fibula was aged 13 years and the oldest was also 13 years. The mean age was 13 years. Further, the youngest subject having a beginning fusion of the proximal end of fibula was aged 13 years and the oldest was also 13 years. The mean age was 13 years.

Table No. 2

<table>
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<tr>
<th>Bone End</th>
<th>Number</th>
<th>Degree of Union</th>
<th>Range (Years)</th>
<th>Mean ± SD</th>
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<td>13.57±0.5</td>
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<td>15±0</td>
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<td>79</td>
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<td>18.27±1.6</td>
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<td>11-12</td>
<td>11.67±0.5</td>
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<td>87</td>
<td>3</td>
<td>15-21</td>
<td>17.97±1.8</td>
</tr>
</tbody>
</table>

DISCUSSION:

Table No. 3 shown in the present study, complete fusion of distal end of femur bone was noticed in the age group 17-18 years in males and the age groups 16-17 years in females. With regard to complete fusion of proximal end of Tibia in males, this finding was consistent with studies done by Singh et al,[9], Schaeafer & Black[10] and Connor JE & Bogue C[11]. The same findings of Singh et al[9] (Uttar Pradesh) and present study (Haryana) might be due to migration of people from one state to another as they are neighbour states. With regard to complete fusion of distal end of femur in females, these findings are consistent with studies done by Aggarwal & Pathak[12].

Table 3: Comparison of Fusion of Epiphysis At Distal End of Femur with Earlier Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Region</th>
<th>Age of fusion of distal end of femur (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Indian Studies</td>
<td></td>
<td></td>
</tr>
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<td>Pillai[13] 1936</td>
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<td>Bengalics</td>
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<td>-</td>
</tr>
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<td>Narain &amp; Bajaj[16] 1957</td>
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<td>Singh et al[21] 2014</td>
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<td>Haryana</td>
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<td>Foreign Studies</td>
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<td>14-19</td>
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</table>

Table No. 4 shown in the present study, complete fusion of proximal end of Tibia bone was noticed in the age group 17-18 years in males and the age groups 16-17 years in females. With regard to complete fusion of proximal end of Tibia in males, this finding was consistent with studies done by Bokariya et al[9], Schaeafer & Black[10] and Ebeye O A et al[4]. With regard to complete fusion of proximal end of Tibia in females, this finding was consistent with studies done by Saxena & Vyas[19], Singh et al[9] and Johnston[20].

Table No. 5 shown in the present study, complete fusion of proximal end of fibula bone was noticed in the age group 18-19 years in males and the age groups 15-16 years in females. With regard to complete fusion of proximal end of fibula in males, this finding was consistent with studies done by Narain & Bajaj[16], Saxena & Vyas[19], Bokariya et al[9] and Johnston[20]. With regard to complete fusion of proximal end of fibula in females, this finding was consistent with studies done by Aggarwal & Pathak[12].
### Table 4: Comparison of Fusion of Epiphysis at Proximal End of Tibia with Earlier Studies

<table>
<thead>
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<th>Study</th>
<th>Region</th>
<th>Age of fusion of distal end of femur (years)</th>
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<td>Bokariya et al[26] 2009</td>
<td>Rajastan</td>
<td>17-18</td>
<td>15-17</td>
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<tr>
<td>Nemade et al[27] 2012</td>
<td>Vidarbha</td>
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### Table 5: Comparison of Fusion of Epiphysis at Proximal End of Fibula with Earlier Studies

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### Table 6: Comparison of Fusion of Epiphysis at Distal End of Tibia With Earlier Studies

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### Table 7: Comparison of Fusion of Distal End of Fibula With Earlier Studies

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<th>Female</th>
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### Conflict of Interest:
None Declared
### Table 7: Comparison of Fusion of Epiphysis At Distal End of Fibula with Earlier Studies

<table>
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<th>Study</th>
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<th>Female</th>
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<td>Bokariya et al.(19) 2009</td>
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### REFERENCES:

18. Flecker H. Roentgenographic observations of the times of appearance of epiphyses and their fusion with the diaphyses. J Anat. 1933; 67: 118-64.


Separation and Identification of Arteether In Forensic Samples Using GC-MS

1. Neha Tomar, Amity Institute of Forensic Sciences, Amity University, Uttar Pradesh
2. S.K. Shukla, Amity Institute of Forensic Sciences, Amity University, Uttar Pradesh
3. Madhulika Sharma, Forensic Science Laboratory, G.N.C.T, New Delhi

ABSTRACT:
Arteether, a sesquiterpene artemisinin derivative is the first line of treatment of Malaria. Malaria is an endemic disease and is a major cause of mortality in developing nations like India, Africa etc. Although the drug is rapid acting but has some pernicious effects associated with it. The cases of drugs induced toxicity has arisen tremendously in the past few decades. This pernicious effect is attributed to over dosage and drug reactions. A simple method has been developed for extracting Arteether from vomit and gastric lavage. Drug residues were extracted from gastric lavage and vomit with the help of liquid-liquid extraction followed by protein precipitation to remove the fat residues. Drug residues obtained were separated by Agilent Gas chromatograph column and detected by mass selective detector (GC-MS). The method is found to be accurate, precise, sensitive and specific.

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Amity University,
Uttar Pradesh
Contact No.: 8130321327
Email- tomarneh@gmail.com/

KEYWORDS: Arteether, Gastric lavage, GC-MS

1. INTRODUCTION:
Arteether (C17H28O5), a sesquiterpene lactone endoperoxide, is an ethyl ether derivative of artemisinin, the active constituent of the plant, Artemisia annua. It is used for treating severe resistant malaria cases. The large scale preclinical, toxicological and regulatory studies show that the drug is rapid acting, blood schizonticidal agent which kills the erythrocytic stage of malaria in blood. Arteether is available in India as α/β-Arteether (Rapither AB; M/S Ipca Laboratories Ltd., Mumbai, India; Emal; M/S Themis Medicare Ltd., Vapi, Gujarat, India) and β-Arteether (Betamotil). Arteether as an anomic mixture of α/β (30:70) was developed by Central Drug Research Institute in Lucknow and has been marketed in India since August 1997, well ahead of production by WHO. Since artemisinin derivatives are short acting drugs so in order to delay and prevent the resistance, The World Health Organization has recommended that all antimalarial drugs should consist of a combination of an artemisinin derivative with a co-drug such as Lumefantrine, Amodiaquine, or Mefloquine. Arteether has a short half-life and is rapidly metabolized in body into dihydrotetemisin and polar metabolites by extensive hydroxylation. Gas chromatography is a powerful technique for separating mixtures of volatile organic components into individual components for identification. Separation is achieved in a column located in a temperature-controlled oven. The separation profile of the sample components depends on their relative affinities for the stationary and mobile phases. The retention time of a component is the time from injection to peak maxima. In the mass spectrometer, the component molecules are bombarded by a stream of high-energy electrons, converting some of the molecules to ions. The ions are accelerated in an electric field. The accelerated ions enter the mass analyzer, in this case a quadrupole, where the ions are separated according to their mass-to-charge ratios. Finally, the number of ions with a particular mass-to-charge ratio is counted. The result is a mass spectrum of the number of particles detected as a function of mass-to-charge ratio. The analysis is such cases of toxicity become difficult for forensic scientist. So GC-MS was adopted for the detection and determination of the drug from biological fluids.

Figure -1 : Structure of Arteether
2. MATERIALS AND METHODS:

2.1 Materials: Standard samples of Arteether were obtained from authentic sources. Gastric lavage (50 ml) & Vomit (50 ml) were collected in sterile plastic Containers from patients suffering from Malaria. Analytical grade reagents were used for preparation of reagents.

2.2 Extraction of sample: 50 ml of gastric lavage was taken and 50 ml of 0.1 N acetic acid was added to it. The contents were filtered and the filtrate was extracted with 30 ml of Chloroform: Ether (1:3) at pH 9. The pH 9 was achieved by adding NH4OH dropwise to the contents till the desired pH was obtained. The extraction was repeated twice and organic solvent layer was collected, passed through anhydrous Na2SO4 to remove the moisture and solvent was evaporated to dryness. The residue was dissolved in 1 ml methanol and subjected to further analysis.

2.3 Purification of Sample: The extract obtained was purified using Preparative Thin Layer chromatography. 0.25 mm Silica gel –G plate was prepared by spreading the slurry evenly. The plate was dried and activated in oven. Spots of control Arteether and extract were marked and allowed to air dry. The TLC developing tank was placed by its base and 50 ml of the developing solvent system (Methanol: Strong Ammonia) was poured in the tank. Spotted TLC plates were developed in the solvent system for 10 cm from the spotting point. The spots were visualized under UV light of 254 nm/366 nm. The spot was then scraped from TLC plate and dissolved in methanol. The organic layer containing purified extract was then used for the injection in GC column.

2.4 Preparation of Arteether standard solution: Arteether was dissolved in 1 ml methanol and subjected to gas chromatography as a control sample.

2.5 Gas chromatography – Mass Spectrometry: An Agilent 6890 Gas chromatograph with column dimensions 30m X 0.25mm DB-5MS was used to perform the analysis. Film thickness was kept 0.25 mm and a constant flow rate was maintained at 1.0 ml/min.

Samples were introduced in a split injection port (10:1 split ratio), and was thermal desorped from mixed bed trap at 300 °C for 5 minutes. Detection was performed with the help of 5795 Mass selective detector.

3. RESULTS AND DISCUSSION:

The column oven was programmed with an initial column oven temperature of 35 °C for 5 minute, which was raised to 150 °C @ 10 °C per minute till 300°C @ 15°C/min and held for 5 minutes. The separation of Arteether was achieved at optimum. Total ion chromatogram was obtained which represents the entire range of masses being detected at every point in the analysis. The major peak is observed is at 755 and is of Arteether.

Method Validation was performed based on the International Conference on Harmonization guideline. From the stock solution of Arteether, different aliquots of 10, 20, 30, 40 µg/ml were made and evaporated to dryness to obtain the extract. The Calibration curves for concentration versus peak area was plotted, and the obtained data was subjected to linear regression analysis. The curve obtained was a linear curve (R²≥0.9713).

![Graph depicting linear relationship between concentration and peak area.](image)

**Figure 2:** Graph depicting linear relationship between concentration and peak area.

Samples at three concentration levels were analyzed to access the accuracy and precision of the method. The intra- and inter day precision percentage RSD values were lower than 2.0%, demonstrating the significant precision of the method. Accuracy was tested by recovery experiments. The recovery test was performed by analyzing a spiked placebo. Mean recovery of Arteether was found to be 99.5% indicating the accuracy of the method. Specificity of the method was evaluated by injecting Arteether reference standard solution (control solution) and extracted drug solutions both separately and mixed. The chromatogram obtained showed no peak interference which proves that this method can be used for quantification of Arteether.

Limit of Detection and limit of Quantification were estimated from the calibration curve. The LoD and LoQ for Arteether were calculated to be 0.08 µg/mL and 0.27 µg/mL, respectively, indicating the sensitivity of the method.

Injector temperature, column temperature, pressure and temperature gradient were studied for assessing the
robustness. Arteether standard solution and extracted solution were prepared and analyzed under varied analytical parameters as 35°C (5 min.) to 150°C @10°C/min.; to 300°C @15°C/min; held for 5 min. at 300°C. Chromatographic resolution, retention time (RT), peak asymmetry (As), peak area of Arteether, and LoD for Arteether extract were evaluated under each condition.

4. CONCLUSION: The present study concludes that the proposed method is simple, sensitive, precise, accurate and robust. This method can be successfully applied for detection and determination of Arteether in vomit, gastric lavage and urine.

5. CONFLICT OF INTEREST: None declared

6. REFERENCES:
Drug Trafficking Through Body Packers

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ABSTRACT:
Drug trafficking is a serious global issue leading to law and order problems in the affected countries. A 29 year old, female, Zambian citizen was brought to Guru Nanak Dev Hospital, Amritsar, Punjab by Indian Border Security Force in semi-conscious state from Indo-Pak International Border, Wagah, Amritsar. Initially which was thought to be a case of sexual assault but later on, during her post-mortem examination, 50 large cylindrical hard shelled capsules were recovered from her gastro-intestinal tract and surprisingly it turned out to be a case of drug trafficking by body packer and poisoning of the deliriant cerebral group of drug cocaine, from ruptured capsules was the ultimate cause of death. In this case postmortem examination not only helped in establishing the cause of death, mode and manner of death but also had exposed almost fatal new mode of drug trafficking by body packing, across the international border, without arousing any suspicion to the police or intelligence agencies.

KEYWORDS: Drug Peddler, Drug Trafficking, Body packers, International border, Cylindrical capsules.

INTRODUCTION:
According to a latest World Drug Report 2017 of United Nations Office On Drugs And Crime data, drug trafficking is a global illicit trade involving the cultivation, manufacture, distribution and sale of substances which are subject to drug prohibition laws. These drug traffickers are also called body packers. Body packers are persons who, voluntarily or through coercion, swallow, or insert drug-filled packets into a body cavity, generally in an attempt to smuggle them across secure international borders.

CASE HISTORY: This is a unique case, in which a 29 year old Zambian female citizen who was repatriated back to India by Pakistani officials on the pretext that she had entered their country without valid visa after a stay for one night in Pakistan. She was found by Indian Border Security Force Personnel in semi-conscious state on the Indian side of Indo-Pak International border at Wagah Amritsar, moving under suspicious circumstances. District administration had advised for her treatment at Govt. Hospital, as it was thought to be a case of sexual assault in Pakistan. She was admitted in medical ward of Guru Nanak Dev Hospital, Govt. Medical College, Amritsar, where she was medically examined and found semi-conscious, ill looking, irritable, delirious and having irrelevant talks, was not responding to verbal commands, tachypoenic and her pulse was 106 / min, B.P. was 110/70 mm of Hg. Patient was having generalised tonic - clonic seizures with frothy secretions coming out of her mouth. There was no voluntary bladder/bowel control. Her routine investigations and X-ray's of whole body were advised. As the patient didn't cooperate to get her X-ray's done, rest of investigations were
Chemical analysis and the cause of death was kept pending for chemical examination. Her visceral organs were also sent for histopathological examination along with inquest papers to mortuary of Department of Forensic Medicine and Toxicology, Govt. Medical College, Amritsar for postmortem examination.

During Her Post-Mortem Examination the External Autopsy Findings were:
She was well built and moderately nourished female, wearing brownish printed frock up to knee length and dark blue shorts. Her clothes were found wet. Eyes and mouth were closed. Eyes, face, lips and fingernail beds were congested. Lips found dried and brownish red discoloured. Postmortem staining was pinkish in colour. Surprisingly, there was no evidence of sexual assault.

Following two non-fatal injuries were present on her body:
1. Reddish Brown Bruise, size - 2.2 x 1.0 cm, was present over the front of left leg, 6.1 cm below tibial tuberosity.
2. Reddish Brown Bruise in an area of 3x3 cm, was present over the front and inner aspect of left leg in its upper part, 4 cm inner to tibial tuberosity.

Internal Findings: General visceral congestion was present, membranes were tensed, Meninges and brain matter were oedematous and congested. Her stomach was grossly enlarged and irregular in shape. On opening the stomach, greyish - red mucoid material with pungent odour was present. Twenty two (22) plastic material whitish elongated, large cylindrical cocoon shape hard shelled white capsules were recovered. Twenty eight (28) similar whitish elongated cylindrical capsules were present in the small intestine, large intestine, rectum and anal canal. In total 50 capsules containing white powder and each capsule was tied along with a long thread with boric acid. Prostitutes inject a solution of cocaine into the vagina. This gives the individual a sense of local constriction and exhilarating systematic feeling. In fact, cocaine is so hard on the body that it is often mixed with heroin to dampen its harsh effects. This combination is called speed ball and can be dangerous to life. Inhalation exposure can result in cough, hemoptysis, reactive airway, pneumonitis.

Cocaine is also used to increase the duration of the sexual act by paralysing the sensory nerves of the glans penis. Hence, young men indulge in its use by applying locally on glans. When observed in the blood cocaine first stimulates and then depresses central nervous system, in descending order from the cortex to the medulla and death occurs from respiratory failure.

Alcohol is probably the substance most commonly used in conjunction with cocaine. Chronic cocaine use causes significant loss of libido and adversely affect reproductive functions. Impotence and gynaecomastia has been observed in male drug abusers, women reported major derangements...
in menstrual cycle function into galactorrhoea, amenorrhoea and infertility. Cocaine abuse by pregnant women has been associated with both an increased risk of congenital malformations in the foetus and perinatal cardiovascular and cerebrovascular disease in the mother. Chronic cocaine poisoning leads to anorexia, loss of weight, weakness, tremors, impotence, moral deterioration and insanity. The effect of cocaine leads to increase erotic tension in women and nymphomania. In men, the condition leads to many sexual perversions, mainly homosexuality, or occasionally shameless libidinous outrages. Insanity is characterized by many delusions of persecution and hallucinations, chiefly tactile and visual. Magnan's symptom, the feeling if grains of sand are lying under the skin (cocaine bugs) or small insects cocaine bugs are creeping on the skin, is the most characteristic tactile hallucination.

The addict disregards conventions, customs and feelings of others. Physical degeneration manifests in careless habits in crimes which the addict commits to get the supply of this drug. Death from accidental overdose and infection is common. Illicit drug are frequently admixed with additional chemicals either to increase the apparent quantity of the street drug or to enhance its effects, for example 8-20% of stimulants available on the street contain cocaine and Methamphetamine hydrochloride. Other adulterants may include quinine, talc, ascorbic acid, boric acid, chalk, laundry detergent, laxatives and lactose.

According to a study of WHO, a majority of addicts are neurotic individuals with personality problems. They use the drugs just for 'kick' or to escape from the realities of life. Repeated use of the drug leads to tolerance and the addict must have it under any circumstances, and by any means, including crime, sexual perversions and prostitution, which is a matter of grave concern. Addiction is harmful to the individual because it leads to mental and physical degeneration. It is harmful to the society as it leads to moral degeneration. Mental degeneration manifests itself in careless behaviour.

According to Dr. Krishan Vij, couriers agree to swallow packets of drugs in one country and transport the same to the other country. At the end of journey laxatives are consumed and packets are retrieved. However, danger of rupture of packets always exists where a large amount of drug will find its way into the circulation. Body packers who smuggle cocaine by intra corporeal route wrap cocaine in plastic bags and smuggle or insert the drug in body orifices. The packages may break and large amount of cocaine drug may be spilled with fatal results, similar to the case being reported.

A potential source of poisoning and death unique to illicit drug is the phenomenon of body packing and stuffing. This refers to the practice of smuggling these drugs by making them up into small packets, which are then swallowed for later retrieval from vomitus or faeces. There exists a grave risk of over dosage should one or more packets burst allowing absorption through the intestine, vaginal or rectal mucosae. In addition to the hazard of leaching out of the drug while traversing the gut, the body packer is at risk of acute abdominal obstruction. Death due to mechanical or chemical intoxication of heroin body packers, thanks to continuous improvement in packing techniques, are increasingly rare and almost all the cases reported in the literature refer to drug swallower.

The current recommended treatment of cocaine ‘body packers’ is surgical removal of the drug packages to prevent death due to cocaine poisoning. Differential diagnosis of cocaine poisoning are Lithium toxicity, Cyclic antidepressants toxicity, neuroleptic malignant syndrome, thyroid storm and other hyperadrenergic states.

According to Baselt Cocaine blood level in the fatal cases vary widely, but typical ranges may extend from 1 to 21 mg per litre, with mean of 5.2 mg / Litre. Fatal dose of the cocaine is 1.50 gm orally and 1 gm parenterally. Fatal period is from within a few minutes to half an hours.

CONCLUSION:

This case is unique in the sense that cause of death was intoxication caused by leakage of the drug cocaine from damaged capsules detected at autopsy and demonstrates that smuggling of drugs by body packing is an existing problem in India. The awareness should be created among the people that such methods of smuggling by packing in the body cavities can prove to be fatal in life. Every suspicious post-mortem examination should be conducted with due care and keeping in mind the possibility of the person being drug peddler and drug being smuggled by packing in the body cavities/orifices, specially in international border area/airports. Increased incidence of body packing and stuffing is a warning bell to the law enforcing agencies. Tourism is increasing in India and drug peddlers have utilized it as a channel of smuggling. Govt. immigration and borders agency officials need to have modern screening methods so that to avoid smuggling of drugs from notorious nations like Pakistan and Afghanistan as this money is mostly used for funding terrorism in our country and other illegal activities. Autopsy surgeon need to be aware of the legal and medical protocols to be followed in such cases so international guidelines should be.
prepared by World Health Organization for making a way to deal such cases.

REFERENCES:

Figure 1: Stomach Full of Drug Capsules
Figure 2: Stomach Full of Drug Capsules
Figure 3: Drug Capsules with Thread Containing Cocaine in the Form of White Powder
Case Report

Criminal Poisoning with Aluminium Phosphide

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ABSTRACT:
Aluminium Phosphide poisoning is one of the leading causes of suicidal deaths in India. Death may also occur due to accidental exposure to Aluminium Phosphide /Phosphine. A number of deaths due to Aluminium Phosphide poisoning are reported all over India. Here in this article, we have discussed about its passage through placenta and subsequently fatal effect on the fetus.

INTRODUCTION:
Aluminium Phosphide is a solid fumigant pesticide, insecticide and rodenticide. Its name appears in the list of insecticides registered on regular basis under section 9 [3] of the insecticide act, 1968. It is available in India under various trade names like Alphos, Celphos, Quickphos, Fumigran and a number of other names. It is available in the form of grayish green tablets of 3 gm. each and is available in the air tight sealed containers. Each tablet may liberate about 1 gm. of Phosphine gas [PH3] when comes in contact with air and moisture. Phosphine is a systemic poison and affects all the organs of the body. The reaction is accelerated by presence of Hydrochloric acid in the stomach. Phosphine exposure may also occur due to Zinc phosphide poisoning.

CASE HISTORY:
As per police inquest, an unmarried pregnant girl of gestational period about 34 weeks allegedly consumed poison [Half Sulphos tablet] and was brought to the Hospital by the family members where gastric lavage was done and she was started treatment for Aluminium Phosphide poisoning. On the same day, she delivered a female baby after about six to seven hours of consumption of poison by normal vaginal delivery. The mother who consumed the poison was treated for Aluminium Phosphide poisoning; she survived and was discharged from the Hospital after five days. As per hospital record the neonate born was a girl, born alive, cried at birth, Heart rate=140/min, no obvious congenital anomaly was present, orifice count was normal and was advised spoon feed 10-12 ml/2 hours. The next morning [after about 18 hours of birth]the relatives reported that the neonate was vomiting and bleeding from mouth and nostrils and was brought for check up to Pediatrician and died after about 4-5 hours of starting of symptoms. Breast feed was not given as per history and available medical record. The autopsy was performed on the neonate and had all the findings which are usually observed in Phosphine gas poisoning.

POST MORTEM APPEARANCE:
1. All the features of live Birth were present.
2. Features of viability were consistent with about 8 months intrauterine foetal life.
3. Clotted blood was present around nostrils, mouth.
4. Nails showed bluish discoloration.
5. No ante mortem fatal injury was present on the body of the deceased.
6. Strong garlicy odor was appreciable on opening the peritoneal cavity.
8. All the Organs were deeply congested.
9. Fine blood tinged froth was coming out on dissection of right Lung.
10. Viscera and blood was sent for Chemical analysis.

Chemical Analysis Report: Phosphine gas was detected in the viscera and blood of deceased.
DISCUSSION:
The cause of death was given as Phosphine gas poisoning. Prior to Thalidomide tragedy, it was believed that Placental barrier protects the foetus from the drugs given to the mother; however, now it is a known fact that Pharmacological substances and other chemicals can readily pass from maternal blood to the foetal blood. The most rapid passage occurs with the chemicals that are lipophilic and non-ionized at physiological pH. The chemical half-life determines whether it can travel from site of metabolism, usually the maternal liver, to the embryonic tissue. Very reactive intermediates are unstable and react at the site of formation. Other compounds may pass through the maternal blood and be activated by foeto-placental tissue.
So more stringent measures are required to be enforced to prevent the misuse of Aluminium Phoshide and all other Agro Chemical poisons which are easily available these days.

REFERENCES:
Case Report

Cerebral Lesions - The Cause of Sudden Death

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2. Vetheeanvesha Gupta, Tutor, Department of Forensic Medicine, Dr. R.P. Govt. Medical College, Kangra at Tanda, Himachal Pradesh.

ABSTRACT:

Although most of the times dead bodies brought for autopsy by the police to Forensic Medicine department are the cases of unnatural deaths but the incidence of cases of natural deaths brought for medico legal autopsy due to suspicion and sudden nature of death are also increasing. In a thorough autopsy, findings observed with naked eye along with history, if available; may sometimes be very important in finding the cause of death. Although majority of tumours involving Central Nervous System are diagnosed clinically within time, yet occasions may be there where primary or secondary involvement of the system may become evident after an apparently sudden death.

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KEYWORDS: Sudden death, Subdural Hygroma, Central Nervous system

INTRODUCTION:

Death is said to be sudden or unexpected when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness. Some authors limit sudden deaths as those occurring instantaneously or within one hour of onset of symptoms. Emphasis is placed more on the unexpected character, rather than suddenness of death. No period in life is exempt[1-3].

The purpose of medicolegal autopsy in sudden deaths is to determine whether violence or poisoning has been in any way responsible for the death. Absence of external evidence of injury does not preclude death from physical violence. The age of the deceased, authentic information as to past health status and the presence or absence of witnesses at the time of death are all helpful in deciding the necessity for an autopsy. Sudden deaths are more frequent in older individuals and they usually take place under circumstances which arouse no suspicion. It is the sudden death of younger individuals that invariably arouses suspicion. Medical officers must never issue death certificate in a case of sudden death, and instead must suggest that an autopsy be done.

Central Nervous System lesions cause 10-18% of sudden deaths. It could be due to Cerebral haemorrhage, Cerebellar haemorrhage, Pontine haemorrhage, Subarachnoid haemorrhage, Cerebral thrombosis or embolism, Carotid artery thrombosis, Brain abscess, Brain tumour, Meningitis, Acute Polio encephalitis, Cyst of 3rd or 4th ventricle, Epilepsy etc.

Amongst the Brain tumours causing sudden death, 50% are in the astrocytoma-glioblastoma category. The remaining may include Oligodendrogliomas, meningiomas, colloid cyst, teratomas, medulloblastomas.

Subdural Hygroma is one such lesion in which there is CSF accumulation in the subdural space. In many cases it is considered the epiphenomenon of head injury when it is called traumatic Subdural Hygroma. They generally occur along the supratentorial cerebral convexities; occurrence in the posterior fossa is generally rare. In Pediatric patients the aetiology is idiopathic. Spontaneous intracranial hypotension is one of the aetiologies of Subdural Hygroma. Cases of post meningitis Subdural Hygroma in children are also reported in literature[4-6].

CASE HISTORY:

A 10 year old boy was brought to the mortuary for post mortem examination with the history of sudden death. The child slept with the parents in the night and was noticed by her mother that he is lying on the floor in the early morning hours. The boy was not responding to any commands and was taken to the nearest Govt. hospital; where doctor declared him...
brought dead and informed the police suspecting it as un
natural death. The body was brought by police for post
mortem examination.

The accompanying persons gave history of one episode of
convulsions a few years back and had slight weakness of left
upper arm since then. There was no history of injury to the
scalp/head. Some local doctor was consulted at that time
only once but neither any investigations were done nor any
treatment was taken after that episode.

Post Mortem Findings: There were two very small
abrasions present on the back side of left hand at a distance of
0.3 c.m. from each other. There was no sign of inflammation
around the abrasions, no bleeding. No other ante mortem
injury was present on the body, neck, oral cavity. All the
organs were congested. Both Lungs were congested and
pulmonary oedema was present. Under surface of
pericardium and Heart had multiple small petechial
haemorrhages. Spleen was enlarged.

There was no injury over the scalp, forehead or face. On
opening the skull cavity, Membranes and Brain were
congested. Brain was also oedematous. A depressed lesion
measuring 6.0x4.0 c.m. was present on the right cerebral
hemisphere on its outer aspect in the parieto-temporal region
and was lying open posteriorly and some straw coloured fluid
was present inside it. The whole Brain was sent for Histo
pathological examination. The viscera, blood and skin tissue
from the area of abrasions [back of hand] were sent for
chemical analysis to rule out intoxication or any snake
venom.

Chemical Examination Report: No poison/narcotic drug
and Psychotropic substance could be detected.

Histopathology Report: Right temporo-parietal region
showed a depressed region. No cyst wall lining/atypical
features or organisms seen in the sections examined.

Cause of Death: In the absence of any fatal injury, absence
of poison or any other significant finding which could cause
death and the presence of depressed area in the Brain, the
cause of death in this case in our opinion was the Brain lesion
detected in autopsy or some of its complications. The Histo
pathology report could not confirm the exact nature of this
lesion but the review of literature gives an idea that it could be
Subdural Hygroma.

DISCUSSION:
Sudden unexpected death may be associated with an un
diagnosed primary Brain tumour. In 10,995 consecutive
medico legal autopsies in Dallas, Texas, Di Maio et al
reported 19 sudden, unexpected deaths due to primary intra
cranial neoplasms, an incidence of 0.17%.[6]

In another study of DiMaio and DiMaio[7] of 17,404 autopsies

1. Vij K, Textbook of Forensic Medicine and Toxicology,
Elsevier India Pvt. Ltd. New Delhi: 102-03
2. Reddy KSN, Murthy OP, The Essentials of Forensic
Brothers Medical Publishers Pvt. Ltd: 150
3. Pillay V V, Textbook of Forensic Medicine and
Toxicology, 2016, 17th edition, Paras Medical
Publisher, Hyderabad: 293-95
4. Sharma P, Mishra A et al, Post meningitis subdural
Hygroma: Anatomical and functional evaluation with
99m Tc-ethylene cysteine dimer single photon emission
tomography/computed tomography. Indian Journal of
Nuclear Medicine, 2013;28:23-5
6. DiMaio VJM, Dana SE, Handbook of Forensic
New Delhi: 45-50
7. Di Maio DJ, DiMaio VJM, Forensic Pathology, 1993,
CRC Press, Florida: 57-72
INTRODUCTION:
The Delhi High Court, on September 22 this year, issued a slew of directions to the States of Delhi, Punjab, Haryana, Rajasthan and Uttar Pradesh, highlighting the urgency of the need to check air pollution arising out of crop burning. The Court had taken suo motu cognizance of the deteriorating air quality in the Capital and the National Capital Region. Again on October 09 this year, the Supreme Court suspended the sale and use of firecrackers in Delhi and NCR till 1st November, 2017 in a bid to test whether a Deepavali without firecrackers this year will have a “positive effect” on health of citizens and steadily deteriorating air quality and fortunately the ban reduced pollution levels significantly.

We cry over alarming rise in air pollution levels at the time of Deepavali and harvesting seasons of Rabi and Kharif crops. Pollution caused by bursting of fire crackers remains only for a few days. Air pollution caused by burning of rice husk in the months of October and November and by thrashing process of wheat crop in April and May stays for a month or so but air pollution caused by continuous vehicular emissions coupled with dust particles is chemically more toxic and stays round the year in the cities and along the highways.

The air pollution generated by five major sources is manageable but has direct bearing on human health and resources, invites discussion and demands remedial measures by law of the land, the legislature, the medical and health professions along with the experts of medico-legal field.

HUMAN EFFECTS:
Air Pollution occurs when harmful substances including particulates and biological molecules are introduced into Earth's atmosphere\(^\text{[1]}\). It may cause diseases, allergies or death of humans; it may also cause harm to other living organisms such as animals and food crops, and may damage the natural or built environment. Human activity and natural processes can both generate air pollution. Indoor air pollution and poor urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report\(^\text{[2]}\). According to the 2014 World health Organization report, air pollution in 2012 caused the deaths of around 7 million people worldwide\(^\text{[3]}\), an estimate roughly echoed by one from the International Energy Agency\(^\text{[4-5]}\). Air pollution is a significant risk factor for a number of pollution related diseases and health conditions including respiratory infections, heart disease, COPD, stroke and lung cancer\(^\text{[3]}\).

The health effects caused by air pollution may include difficulty in breathing, wheezing, coughing, asthma and worsening of existing respiratory and cardiac conditions. These effects can result in increased medication use, increased doctor or emergency room visits, more hospital admissions and premature death. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the...
individual's health status and genetics.  

**MORTALITY:**  
The World Health Organization estimated in 2014 that every year air pollution causes the premature death of some 7 million people worldwide. India has the highest death rate due to air pollution. India also has more deaths from asthma than any other nation according to the World Health Organization. In December 2013 air pollution was estimated to kill 500,000 people in China each year. There is a positive correlation between pneumonia related deaths and air pollution from motor vehicle emissions.  

**CARDIOVASCULAR DISEASES:**  
A 2007 review of evidence found ambient air pollution exposure is a risk factor correlating with increased total mortality from cardiovascular events (range: 12% to 14% per 10 microg/m3 increase). Air pollution is also emerging as a risk factor for stroke, particularly in developing countries where pollutant levels are highest. A 2007 study found that in women, air pollution is not associated with hemorrhagic but with ischemic stroke. Air pollution was also found to be associated with increased incidence and mortality from coronary stroke in a cohort study in 2011. Associations are believed to be causal and effects may be mediated by vasoconstriction, low-grade inflammation and atherosclerosis. Other mechanisms such as autonomic nervous system imbalance have also been suggested.

**LUNG DISEASES:**  
Research has demonstrated increased risk of developing asthma and COPD from increased exposure to traffic-related air pollution. Additionally, air pollution has been associated with increased hospitalization and mortality from asthma and COPD. Chronic obstructive pulmonary disease (COPD) includes diseases such as chronic bronchitis and emphysema.

More recent studies have shown that air pollution exposure from traffic reduces lung function development in children and lung function may be compromised by air pollution even at low concentrations. Air pollution exposure also causes lung cancer in non-smokers.

It is believed that much like cystic fibrosis, by living in a more urban environment serious health hazards become more apparent. Studies have shown that in urban areas patients suffer mucus hyper secretion, lower levels of lung function, and more self-diagnosis of chronic bronchitis and emphysema.

**CANCER:**  
A review of evidence regarding whether ambient air pollution exposure is a risk factor for cancer in 2007 found solid data to conclude that long-term exposure to PM 2.5 (fine particulates) increases the overall risk of non-accidental mortality by 6% per a 10 microg/m3 increase. Exposure to PM 2.5 was also associated with an increased risk of mortality from lung cancer (range: 15% to 21% per 10 microg/m3 increase) and total cardiovascular mortality (range: 12% to 14% per a 10 microg/m3 increase). The review further noted that living close to busy traffic appears to be associated with elevated risks of these three outcomes --- increase in lung cancer deaths, cardiovascular deaths, and overall non-accidental deaths. The reviewers also found suggestive evidence that exposure to PM 2.5 is positively associated with mortality from coronary heart diseases and exposure to SO2 increases mortality from lung cancer, but the data was insufficient to provide solid conclusions.

In 2011, a large Danish epidemiological study found an increased risk of lung cancer for patients who lived in areas with high nitrogen oxide concentrations. In this study, the association was higher for non-smokers than smokers. In December 2015, medical scientists reported that cancer is overwhelmingly a result of environmental factors, and not largely down to bad luck. Maintaining a healthy weight, eating a healthy diet, minimizing alcohol and eliminating smoking reduce the risk of developing the disease, according to the researchers.

**CHILDREN AND INFANTS:**  
In the United States, despite the passage of the Clean Air Act in 1970, in 2002 at least 146 million Americans were living in non-attainment areas - regions in which the concentration of certain air pollutants exceeded federal standards. These dangerous pollutants are known as the criteria pollutants, and include ozone, particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead. Protective measures to ensure children's health are being taken in cities such as New Delhi, India where buses now use compressed natural gas to help eliminate the “pea-soup” smog. A recent study in Europe has found that exposure to ultrafine particles can increase blood pressure.

Ambient levels of air pollution have been associated with preterm birth and low birth weight. A 2014 WHO worldwide survey on maternal and perinatal health found a statistically significant association between low birth weights (LBW) and increased levels of exposure to PM 2.5. Women in regions with greater than average PM 2.5 levels had statistically significant higher odds of pregnancy resulting in a low-birth weight infant even when adjusted for country-related variables. The effect is thought to be from stimulating inflammation and increasing oxidative stress.

A study by the University of York found that in 2010 exposure to PM 2.5 was strongly associated with 18% of preterm births.
globally, which was approximately 2.7 million premature births. The countries with the highest air pollution associated preterm births were in South and East Asia, the Middle East, North Africa, and West sub-Saharan Africa.

A study performed by Wang, et al. between the years of 1988 and 1991 has found a correlation between Sulfur Dioxide (SO2) and total suspended particulates (TSP) and preterm births and low birth weights in Beijing. The proportion of low birth weight attributable to air pollution was 13%. This is the largest attributable risk ever reported for the known risk factors of low birth weight.

Brauer et al. studied the relationship between air pollution and proximity to a highway with pregnancy outcomes in a Vancouver cohort of pregnant women using addresses to estimate exposure during pregnancy. Exposure to NO, NO2, CO PM 10 and PM 2.5 were associated with infants born small for gestational age (SGA). Women living <50 meters away from an expressway or highway were 26% more likely to give birth to a SGA infant.

CENTRAL NERVOUS SYSTEM:

In a June 2014 study conducted by researchers at the University of Rochester Medical Center, it was discovered that early exposure to air pollution causes the same damaging changes in the brain as autism and schizophrenia. The study also shows that air pollution also affected short-term memory, learning ability, and impulsivity. The findings add to the growing body of evidence that air pollution may play a role in autism, as well as in other neurodevelopment disorders. Air pollution has a more significant negative effect on males than on females.

MAJOR AIR POLLUTANTS:

Pollutants are classified as primary or secondary. Primary pollutants are usually produced from a process, such as ash from a volcanic eruption and secondary pollutants form in the air when primary pollutants react or interact.

A. Primary pollutants produced by human activity include:

Sulfur Oxides: Coal and petroleum often contain sulfur compounds, and their combustion generates sulfur dioxide.

Nitrogen Oxides: expelled from high temperature combustion, and are also produced during thunderstorms by electric discharge.

Carbon Monoxide: It is a product of incomplete combustion of fuel such as natural gas, coal or wood. Vehicular exhaust is a major source of carbon monoxide.

Volatile Organic Compounds: Under this group, methane is an extremely efficient greenhouse gas which contributes to enhance global warming. The aromatic NMVOCs benzene, toluene and xylene are suspected carcinogens and may lead to leukemia with prolonged exposure.

Chlorofluorocarbons: harmful to ozone layer, emitted from products are currently banned from use. These are the gases released from air conditioners, refrigerators, aerosol sprays.

Particulate Matter or fine particles are tiny particles of solids or liquids suspended in air.

Ammonia: emitted from agriculture processes.

Odours: such as garbage, sewerage and industrial processes.

Radioactive Pollutants: Produced by nuclear explosions, nuclear events, war explosives and natural processes such as the radioactive decay of radon.

B. Secondary Pollutants Include:

Particulates created from gaseous pollutants and compounds in photochemical smog.

Ground level ozone (O3) formed from NOx and VOCs. Ozone is a key constituent of the troposphere. At abnormally high concentrations brought about by human activities (largely by combustion of fossil fuel), it is a pollutant and a constituent of smog.

Peroxyacetyl Nitrate (PAN): Similarly formed from NOx and VOCs.

GLOBAL SCENARIO:

- Some 3 million deaths a year are linked to exposure to outdoor air pollution. Indoor air pollution can be just as deadly.
- In 2012, an estimated 6.5 million deaths (11.6% of global deaths) were associated with indoor and outdoor air pollution together.
- Nearly 90% of air pollution-related deaths occur in low and middle-income countries, with nearly 2 out of 3 occurring in WHO's South-East Asia and Western Pacific regions.
- Ninety-four per cent are due to non-communicable diseases—notably cardiovascular diseases, stroke, chronic obstructive pulmonary disease and lung cancer.
- Air pollution also increases the risks for acute respiratory infections.
- WHO air quality model confirms that 92% of the world's population lives in places where air quality levels exceed "particulate matter WHO's Ambient Air Quality Guidelines" for annual mean of particulate matter with a
diameter of less than 2.5 micrometers (PM 2.5).

**LEGISLATIVE MEASURES TO CHECK AIR POLLUTION:**

The International Summit on Air Pollution – Health Advisories, held in New Delhi on 10th March 2017, has proposed the following legislations to prevent air pollution:

1. To shift all factories and industries responsible for formation of smoke from thickly populated cities and towns.
2. To completely abolish lead added petrol.
3. To reduce the number of vehicles – particularly heavy vehicles during peak hours from major roads.
4. Common facility for biomedical waste disposal only to be allowed and biomedical waste disposal units to be exempted from taxes.
5. Traditional practice of burning farm based to be replaced by process which will reduce burning and air pollution.
6. Household burning of wood for cooking has to be completely eliminated by providing cooking gas free of cost to all families.
7. Forest fires should be completely eliminated or it has to be done under regulated controlled manner.
8. Strict norms are to be enforced regarding chumminess in thermal plants and fertilizer plants.
9. Vehicular emissions both from diesel and petrol vehicles should be brought under strict norms to prevent air pollution.
10. Use of plastic bags, cups, wrappers, should be prohibited and only recyclable plastic should be made available in the market. Common household waste production should be minimized through appropriate education on the public. Household waste should be disposed through scientific processes like segregation of recyclable waste, autoclaving and STP processes.
11. Gradually the use of petrol diesel and LPG has to be replaced by CNG (Compressed Natural Gas) and battery operated vehicles.
12. Energy / power production has to be gradually switched on to minor hydroelectric projects, atomic energy, wing energy and solar energy.
13. Adequate funds are to be set apart for research to replace conventional sources of energy by less polluting energy production.
14. Dust pollution can be easily checked by directing the residents to pave or grass the surface lying between the road edge and the building line along with at least 25% construction of the vacant plots.

**CONCLUSION:**

Air pollution is not an intractable problem and is manageable. The central and state governments will have to prepare short term as well as long term plans to reduce air pollution by adopting the aforesaid measures. If the governments continue to maintain their lethargic approach then the only alternative left to save citizens from this scourge is to start living away from cities. Wearing of masks across your face will prevent only the entry of suspended particulate and not the toxic gases adulterated in the air and making the air of the country pollution free must be the joint responsibility of all citizens.

**REFERENCES:**

1. Air Pollution: https://en.wikipedia.org/wiki/Air_pollution
4. "Study Links 6.5 Million Deaths Each Year to Air Pollution"
8. Mr Chen’s claim was made in The Lancet (December 2013 issue) and reported in The Daily Telegraph 8th January 2014 page 15 ‘Air pollution killing up to 500,000 Chinese each year, admits former health minister.


15. Louwies, T; Int Panis, L; Kicinski, M; De Boever, P; Nawrot, Tim S (2013). "Retinal Microvascular Responses to Short-Term Changes in Particulate Air Pollution in Healthy Adults". Environmental Health Perspectives. 121: 737–42.


35. The International Summit on Air Pollution – Health Advisories, held on 10th March 2017 in New Delhi, India. Malik RN; Mishra M; The Tribune: 27 October 2017;
Preventable After Discharge Fatal Scalds in Elderly: An Overview of Multifactorial Variables

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ABSTRACT:
We reported here a case of seventy-five-year-old male who was brought dead to our hospital after sustaining fatal scald injuries due to hot water. History revealed that he was suffering for unspecific myalgia for which he was advised local hot water fomentation. Factors like proper discharge instructions together with carefulness and knowledge of the patient and their attenders could have prevented such adverse effects and deaths.

INTRODUCTION:
Burns are currently a global public health concern, annually on average accounting 265000 deaths\(^{[1]}\). According to World Health Organization in 2004, global incidence of deaths as a result of injuries due to fire was 10.9 million\(^{[2]}\). In India, annually over 1 million people are burnt moderately or severely\(^{[1]}\). Young children and elders are principally vulnerable to burn-associated injury and death as their skin is thinner than other age groups and can suffer grievous deep burns instantly\(^{[3-4]}\). In children aged between 1–9 years, burns are the eleventh leading cause of death as well as, it is the fifth major cause of non-fatal childhood injuries\(^{[3]}\). Majority of fatal burns are caused by flame burns followed by scalds or electrical or chemical burns\(^{[3-8]}\). It was observed that scald injuries are predominant in age group less than five-year-old when compared with other causes of burns\(^{[9-13]}\). Global occurrence of scalds is approximately 5% of all burn deaths, but they account for a much higher fraction of nonfatal burns\(^{[12]}\). Burns are also a common in men over 65 years old\(^{[13-14]}\). In a study conducted by Keck M et al., majority of burns in the elderly are caused by flame burns and scalds or scalds alone; incidence being most common at home, especially in the kitchen and bathroom\(^{[16-17]}\).

The high incidence of mortality due to burns in the elderly, in particular scalds is caused by a myriad of factors, like diminished alertness, impaired mobility, physical disability, sluggish response time, preexisting conditions and collapse\(^{[16-20]}\). Patients’ literacy, language barrier and understanding between patient and health care provider, elderly abuse and lack of supervision by care takers, improper discharge instructions including unjustified and omitted medication or advice in the discharge summary by the health care providers have also contributed in elderly morbidity and mortality\(^{[21-27]}\).

Preventable adverse effects and deaths after discharge in elders were mentioned previously in various studies\(^{[28-32]}\). Iatrogenic scald injuries in children during treatment in hospital were reported earlier\(^{[33-34]}\). In this paper, we present a case of an elderly male whose death was attributed to such factors, following sustained scald injuries due to pouring of hot water.

CASE HISTORY:
A seventy-five-year-old male person was brought dead to our hospital and sent to mortuary for autopsy. On enquiring with relatives and police and going through hospital case records, history revealed that he was suffering for unspecific myalgia of right leg for which he was admitted in private hospital and during discharge, he was advised to do hot water fomentation.

He was neglected by his kin, and was not even accompanied by them during his stay in hospital or discharge. Further, he was staying alone at his residence at the time of incidence. When he experienced sudden increase of pain, instead of advised hot water fomentation, he poured hot water directly on his leg and sustained scalds injury. This was noticed by neighbors who
took him to nearby government primary health care hospital. But as his condition deteriorated, he was referred to tertiary care hospital, but he was brought dead to emergency department of our hospital after 9 hours of incident. A medico-legal case registered on police-intimation, and the body shifted to the mortuary for post-mortem examination.

**External Examination:**
- Congestion and edema of conjunctiva.
- Oozing out of serosanguinous fluid from both nostrils and mouth.
- Penile and scrotal edema was noted.
- Diffuse edematous swelling of entire right lower limb was noted with blisters over right buttock, front and back of thigh and upper one-third of right leg (Figure 1-2).

![Figure 1: Scald with Blisters Seen Over Front of Right Lower Limb.](image)

![Figure 2: Scald with Blisters Seen Over Back of Right Lower Limb.](image)

- The blisters were filled with clear fluid. The base of ruptured blisters appeared reddish in colour.
- On palpation, the whole right lower limb was firm in consistency and expressed clear fluid on incision.

**Internal Examination:** Brain and lungs were congested and edematous. Abdominal organs were congested.

**Chemical Examination Report:** Negative for any toxic substances including alcohol.

**Histopathological Examination Report:** Features of edema in lungs Present, Congestion of adrenals, Rest of organs were unremarkable.

**Final Opinion:** On perusal of hospital records, autopsy findings and histopathological findings, the cause of death was opined as complications of 10-15% scalds.

**DISCUSSION:**
An important goal in the health care delivery of elderly people is multifactorial assessment and directed intervention to prevent adverse effects and deaths following discharge and to achieve improved health outcomes. The procedure of communication between patients and caregivers is generally acknowledged as a significant component of high-quality patient care.[35-36] Written instructions during discharge must be delivered in patient's language and at an applicable reading level. Before the patient leaves the hospital, understanding should be confirmed. Patients' failure to read written instructions contribute to the identified deficits.[36-39] Rapid screening tools for health literacy can assist in assessing the needs to protect patient safety.[40-42] There remains a substantial number who fail to completely comprehend the diagnosis, treatment and discharge directives. This subset can be benefited by the using lay terminology instead of professional medical terminology health care providers, especially nurses.[33-43] To enhance recall of instructions, patients require structured content, explained verbally, with visual and written cues. Studies revealed that by supplementation of free texts with pictographs or videos, patients exhibited improved comprehension and recall of discharge instructions.[44-45] Family support was a major factor in maintaining domestic and medical care and assistance in elderly people at home following discharge[29]. This was lacking in the present case where he was non-dependent and neglected without support, care or assistant by his family during admission or discharge. It was observed that dementia is associated with diminished precision of the elder patient's decreased comprehension of discharge instructions.[46]. Provision of high support discharge care team for assistance during the discharge and follow-ups was found to be effective to avoid preventable adverse effects and deaths.[38,46,47] Similar observation was noted in a study conducted by Thomas EJ and Brennan TA where patients aged more than 65 years experienced more preventable disability and deaths compared to other age groups after discharge[28]. Discharge instructions with proper written summaries to patients, caregivers and referral health care providers together with interventions in detailing the plans, goal progression, ongoing concerns and follow-ups were also found to be effective for improved health outcomes.[46-49]

**CONCLUSION:**
Proper assessment and directed intervention of these myriad of factors existing in the patient, health care providers and care takers will help in subsiding of this preventable morbidity and
mortality in the elderly patients, and as perceived in our case.

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REFERENCES:
24. Caplan GA, Williams AJ, Daly B, Abraham K. A randomized, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after...


Respected Sir,

With due respect it is humbly requested that specialists of forensic medicine working in the state medical colleges have brought to the notice of the academy (PAFMAT) that dead bodies are being referred by medical officers for postmortem examination throughout the state of Punjab to respective medical colleges at Patiala, Amritsar and Faridkot without a justifiable cause, proper procedure or jurisdiction and the Civil Surgeons are repeated being requested to instruct the medical officers to stop this practice in public interest but this system of referral is going on unchecked.

In general, the dead bodies are referred due to “putrefied condition” which is not a criterion for referring a dead body because of the fact that

1. Postmortem in such cases is just a physical examination with collection of desired evidence and can be easily done by a medical officer in any District Hospital but the body is referred just to avoid examination due to the decomposed condition and smell from the dead body.

2. Some dead bodies are referred on very flimsy grounds like "For DNA Fingerprinting" etc., but this facility is not available in state medical colleges and for this purpose the samples are required to be collected from the dead body by the doctor/s conducting postmortem and sent to the Forensic Science Laboratories (FSLs) of the state and not to the medical colleges.

3. Some medical officers merely mention "referral in the interest of justice" which is rather an injustice to the relatives by harassment in transporting the dead bodies to distant medical colleges, long delays in postmortem examination with sometimes loss of crucial evidence, delay in cremation of the dead body which is inhumane and financial burden in transportation especially on poor relatives. It also results in huge time wastage of the police officials due to transportation and delay in postmortem, in already burdened mortuaries in medical colleges apart from security threat during transportation.

4. Some districts have medical officers with specialty of forensic medicine (forensic specialist) posted in their jurisdiction who can conduct postmortem examination of such dead bodies but these specialist doctors are not being assigned full time postmortem and medico legal examination duties or even sometimes dead bodies are referred to avoid postmortem due to decomposition.

5. Even in desired cases, medical officers sometimes refer the dead bodies to medical colleges out of jurisdiction or without following the proper procedure with consent, knowledge and countersignature of their higher authorities. It has also been noted that the sometimes the police officials bring the dead bodies to medical colleges even on verbal instructions or guidance or refusal by medical officer/s on duty.

6. Referring of dead bodies unnecessarily to medical colleges causes a lot of harassment to the public and police and also amounts to “disrespect to the dead” and “the law”. As per Section 174 CrPC para 3(v), the postmortem examination is to be done by taking the dead body to the nearest Civil Surgeon or other qualified medical man appointed in this by the state Government, if the state of weather and the distance admit of it being so forwarded without risk of such putrefaction on the road as would render such examination useless.

The legal provision of nearest hospital and jurisdiction cannot be bypassed as per wisdom of senior forensic medicine experts of the state.

7. Recently a letter by the Director Health Services Punjab has been sent to Civil Surgeons (dated 3.10.17) which refers to the orders of National Commission of Women (dated 25-8-2017) which had stated that "in such (burns in females) alleged murder / suicide cases the postmortem be conducted by specialized forensic teams at District / State level hospitals". This letter is being misinterpreted and used by Medical Officers to cause undue harassment to public and police, by referring all cases to medical colleges without application of mind.

8. It is further brought to your kind notice that the doctors in medical colleges are already burdened with postmortem examination workload apart from 24 hours emergency / casualty medico-legal examination duty, court evidences, video conferencing, undergraduate and postgraduate teaching, and NHRC / PSHRC custodial death cases, etc. Frequently unknown dead bodies are being kept in mortuary by the police for 72 hours for identification purposes, meaning the mortuaries as well as the doctors
dealing with postmortem cases in medical colleges are already overburdened.

9. If medical officers choose to refer all murder / suicide cases to medical colleges in accordance with the circular of Health Department referred above, it will create a chaos and public / police will be on roads just transporting dead bodies for postmortem to medical colleges from here and there. As per National Crime Record Bureau data, the murder / suicide cases in Punjab total about 2000 annually (apart from 3000 odd similar cases), and this would imply that every day 6-14 bodies would be on roads just for postmortem. The three teaching medical colleges remain inadequate to handle such an exigency. Further it may lead to deterioration in the quality of work in cases which actually require attention of forensic medicine experts.

10. The department of forensic medicine in state medical colleges with senior faculty is required for providing expert opinions in the interest of justice rather to waste time on simple manageable cases sent by medical officers.

Hence, in the best interest of the public, to avoid harassment to the relatives and police, to save time in postmortem and avoid delay in cremation of the dead and to avoid overburden on the state medical colleges, urgent instructions are required to be given to the concerned authorities of the state health department with suggestions as below:-

a. Postmortem examination must be done as per law in the nearest health department facility.

b. Dead bodies should be referred to medical colleges only in exceptional cases by the medical officers after consultation with and guidance from their higher authorities.

c. The medical officers with forensic medicine specialty must only be appointed in district hospitals with full time postmortem and medico-legal examination duties.

d. Coordination and consultation of the state Directorate of Health Services with State Medico-Legal Advisor and senior faculty of forensic medicine of medical colleges in all matters pertaining to medico legal work and functioning, which at present is entirely lacking, must be ensured in the interest of justice.

e. Senior forensic medicine faculty working in medical colleges should be involved on priority for improvement in medico legal services in the health department under the state Government.
INSTRUCTIONS TO AUTHORS

Preparing a Manuscript For Submission to Journal of Punjab Academy of Forensic Medicine and Toxicology

Unpublished, Ethical, Un-Plagiarised original manuscript written in English should be sent to: Dr. Parmod Kumar Goyal, Editor-in-Chief, Journal of Punjab Academy of Forensic Medicine and Toxicology by email at: drparmodgoyal@gmail.com

The Publication Particulars

The JPAFMAT is the official publication of the Punjab Academy of Forensic Medicine & Toxicology, published since 2001.

The Contents of the Journal

The journal accepts a range of articles of interest, under several feature sections as follows:

Original Papers: Includes conventional observational and experimental research.

Commentary: Intended for Reviews, Case Reports, Preliminary Report and Scientific Correspondences.

Letter to the Editor

Designed to be an avenue for dialogue between the authors of the papers published in the journal and the readers restricted to the options expressing reviews, criticisms etc. It could also publish letters on behalf of the current affairs in the field of Forensic Medicine in the country.

Editorial

Intended as a platform, for the Editor-in-Chief and for others with a keen interest in forensic medicine that wished to comment on the current affairs.

Special Features

In the History of Indian Forensic Medicine, Book Review, Abstracts, Announcement etc, which appear frequently, but not necessarily in every issue.

News and Notes

Intended for providing information of members and activities of the Academy and other such other organizations affiliated to the Academy may appear frequently and not in every issue.

General Principles

The text of observational and experimental articles is usually (but not necessarily) divided into the following sections: Introduction, Methods, Results, and Discussion. This so-called “IMRAD” structure is not an arbitrary publication format but rather a direct reflection of the process of scientific discovery. Long articles may need subheadings within some sections (especially Results and Discussion) to clarify their content. Other types of articles, such as case reports, reviews, and editorials, probably need to be formatted differently. Electronic formats have created opportunities for adding details or whole sections, layering information, cross linking or extracting portions of articles, and the like only in the electronic version. Double spacing all portions of the manuscript—including the title page, abstract, text, acknowledgments, references, individual tables, and legends—and generous margins make it possible for editors and reviewers to edit the text line by line and add comments and queries directly on the paper copy. If manuscripts are submitted electronically, the files should be double-spaced to facilitate printing for reviewing and editing. Authors should number all of the pages of the manuscript consecutively, beginning with the title page, to facilitate the editorial process.

International Uniform Requirements

Please visit http://www.icmje.org/ for detailed instructions for manuscript submission.

Note: Manuscript handling charges Rs. 1000/- to be paid after acceptance.
Format of Application for Membership

To
The General Secretary
Punjab Academy of Forensic Medicine & Toxicology (PAFMAT)

Dear Sir,

I wish to become a Life Member / Annual Member of PAFMAT. I am furnishing the required particulars below with a request to enrol me in the academy. The fee of Rs. 1000 / Rs. ---- for Life Membership / Annul Membership is enclosed as a Demand Draft with No________________ of _______________________________________ Bank, in the name of PAFMAT along with my two passport size photographs. I have gone / will go through the rules and regulations of the academy and I agree to abide by the same.

PARTICULARS

1. Full Name ( in block letters )
2. Father's / Husband's name
3. Date of Birth
4. Qualification ( with name of university & date of passing )
5. Official Designation & Place of Posting
6. Permanent Address
7. Address for Correspondence ( subsequent change of address to be intimated)
8. Phone No. & Email

Place                                                                                                                     Date

Yours Sincerely

(Signature)

FOR USE OF PAFMAT

Membership Accepted with Life / Annual membership No.                   / PAFMAT /                   /

Dated

Treasurer                                                         Secretary                                                     President

Note : Payment can be made by NEFT in the account of academy after telephonic talk with President/Secretary/Treasurer. Scanned copy of the filled form can be sent by email to Secretary.
Punjab Academy of Forensic Medicine & Toxicology

Undertaking format for organizing PAFMATCON

(To be prepared in duplicate)

To

The President / General Secretary
Punjab Academy of Forensic Medicine & Toxicology

Subject: Consent for Holding the Conference.

Dear Sir

As discussed and decided in the general / executive body meeting of the academy dated ………………………at ...................................................................................................................(name the venue), I give my consent to hold the ………………annual conference of Punjab Academy of Forensic Medicine & Toxicology on .....................................................(Tentative date) in ..................................................... (Name of the medical college / venue)

Subject to the following:-

a.  The conference and / or the CME programme shall be under the auspices of Punjab Academy of Forensic Medicine & Toxicology. The banner showing the same will be displayed at a suitable area on the main venue.

b.  The President and the General Secretary of the Academy will be suitably seated on the dais during the inaugural programme. The President will address the gathering about the policies, programs or other relevant aspects of the Academy. The General Secretary will read out the annual report.

c.  The registration of the President, General Secretary, Secretary Finance and the Editor-in-Chief of the Academy will be complimentary.

d.  The conference will get accredited with at least 4 CME Credit hours from Punjab Medical Council.

e.  The President and / or General Secretary of the Academy along with one member of Punjab Medical Council will be the signatory to the certificate issued to delegate attending the conference / CME / workshop.

f.  The organizing committee will send formal invitation to all the office bearers of the academy.

g.  The Journal of the Academy will be released during the inaugural programme. The Editor-in-Chief and the Joint Editor will be invited to the dais for the release ceremony.

h.  The Organizing Secretary of the programme will hand over the list of the delegates to the General Secretary of the Academy at the end of the conference.

i.  The Organizing Committee will collect Rs. 100/- (Rupees one hundred only) per delegate of the programme and will deposit the collected amount in the account of the Journal of PAFMAT / hand over the Cheque for the collected amount favoring Journal of Pb. Aca. Of Forensic Med. & Toxicology to the Editor-in-Chief after the conference.

Sd/-

Organizing Chairman / Secretary
Name:
| LM/PAFMAT/1/1998 | Dr. R.K. Gorea | LM/PAFMAT/10/2001 | Dr. Virender Pal Singh |
| LM/PAFMAT/2/1998 | Late Dr. Sat Pal Garg | LM/PAFMAT/11/2001 | Dr. Ashok Chanana |
| LM/PAFMAT/5/2001 | Dr. Hakumat Rai | LM/PAFMAT/14/2002 | Dr. R.S. Parsad |
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