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From Editor's Desk

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Namaskar!

With your blessings and good wishes, I have been elected to serve you as the Editor, Journal of Indian Academy of Forensic Medicine, for the period 2016 - 2019. This, I promise to do with all my sincerity and dedication. I have been getting unstinted support of the Ex Editor, **Prof Mukesh Yadav** and his team comprising of **Prof Pooja Rastogi & Dr Akashdeep Aggarwal**, in this endeavour. **Dr Manish Nigam**, the Joint Editor, will be there to shoulder this burden.

With the permission of the General Secretary and his team, I have included 2 colleagues **Dr Amandeep Singh** (Associate Prof, Dept. FMT, GMCH, Chandigarh) & **Dr Chittranjan Behera** (Associate Prof, Dept. FMT, AIIMS, Delhi) as members of the Editorial Team to help me with this mammoth responsibility. I have also taken the liberty of building a team of reviewers for reviewing the numerous articles that are being sent for publication in your journal. The list of the reviewers for the year will be published in the 4th issue of each year.

The articles sent for publication in your journal will undergo a two stage review. The first review will be done by one team. Once the comments are received from the reviewers, the same will be communicated to the authors with request to make the changes needed. The amended article will then be sent to a second team of reviewers with the comments by the first team. Once the second team OKs the article, you will be sent the Acceptance letter and asked to submit the Transfer of Copy Right and No Conflict certificate. You will then be asked to deposit the handling charges and will be told which issue your article will be published in.

Prof Mukesh has sent me this issue completely formatted. My only contribution to this issue is to get it printed and bring it to your hands. Most of the articles published in this issue were processed by him and his team. He has also sent me a backlog of 75 more articles which take precedence over the articles received by me. We are increasing the number of pages in each issue of the journal to 132 from the present 112 to accomodate more papers per issue, with effect from this issue.

This, in brief, will be the review process which will be an endeavour to improve the standard of the Journal and further help in Indexing with the renowned indexing agencies like PUB MED, etc .

Please bear with us.

Dr. Dasari Harish
Editor, JIAFM

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Special Editorial

The Revised Guidelines of the Medical Council of India for Academic Promotions: Need for a Rethink

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For the Indian Association of Medical Journal Editors*

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Measuring academic achievements is never an easy task. This is particularly so when individuals are assessed for promotions in several fields with differing job descriptions. Assessment by peers is time-consuming and may be prone to bias; thus, objective criteria are required to minimize these concerns.

The Medical Council of India (MCI) has laid down guidelines for appointments and promotions of teachers in medical institutions in India. Among the criteria used for promotions, publication of research is an essential requirement. Though the need for this requirement has been debated, it is believed that the quality of teaching improves when medical teachers are involved in research. Many countries have made it mandatory for their medical faculty to do research; some other countries incentivize the conduct and publication of research. Reports have also lamented that the physician–scientist might become an endangered species [1, 2]. Thus, linking publications with promotions might benefit both the individual and society. The flip side is that the time spent on research might take teachers away from teaching or clinical duties, particularly in under-staffed specialty departments. Further, the quality of research is likely to be poor when the resources and training in research are lacking [3]. Poor quality may even discredit research as a professional activity. Insistence on a certain amount of published research to maintain teaching credentials may lead to the phenomenon of ‘publish or perish’ [4]. Finally, it is important to consider that biomedical research may, at times, be relevant to non-biomedical journals and criteria for awarding credit to such publications should also be devised.

The MCI requires that the medical faculty engages in research. One measure to achieve this goal is the mandatory ‘thesis’ for postgraduate (Masters; MD/MS/ DNB) and post-doctoral (DM/MCh/DNB) courses. Each student, regardless of specialty, is required to undertake a research study with a faculty member as the guide and often one-to-a-few faculty members from the same or related subjects as co-guides. Apart from providing training in doing research, the thesis is expected to inculcate an appreciation for research methodology and critical analysis. This experience is relevant to students who will become full-time researchers, and is also beneficial to medical practitioners who may never conduct further research but should be able to discern the merits of newer management options for their patients.

The MCI’s initial guidelines for promotion to the position of Associate Professor and Professor required publication of at least two research papers by the candidates [5]. In September 2015, the MCI issued a **PUBLICATION POLICY FOR PROMOTIONS IN INDIA**.

PUBLICATION POLICY FOR PROMOTIONS IN INDIA

‘Clarification’ on what constitutes ‘research publications’ for promotion of teaching faculty of medical colleges/ institutions in India (**Box 1**) [6]. This ‘clarification’ raises the following issues:

E-JOURNALS

The new guidelines stipulate that publications in e-journals will not be considered for promotion. This guideline is probably in response to the proliferation of predatory journals, almost exclusively among e-journals, over the past five years. It is worrying that the largest number of authors and publishers seem to be from India [7]. Predatory publishing is perhaps a manifestation of the ‘publish or perish’ phenomenon with authors willing to pay for a publication [7].

While the MCI’s corrective measure is laudable, the definition of ‘e-journals’ is variable [8]. We assume that the MCI implies e-journals are those that do not have a print version. This guideline would exclude many high-quality journals that are published only in the electronic format, e.g. the PLoS group of journals, the Biomed Central (BMC) journals, *British Journal of Clinical Pharmacology*, and *New Zealand Medical Journal*. It might also exclude journals that publish papers in a longer e-version and a shorter

print version (*BMJ*). Many believe that 'paper journals' of niche specialties (with limited circulation) may soon cease to appear. Publishing is rapidly shifting to the electronic format and an explosive growth in e-journals is envisaged. Thus, the embargo on all e-journals seems unfair. The main objective of this guideline appears to be to limit predatory publishing and to ensure quality. This can be achieved by insisting on other criteria such as indexing, because reputed indexes are unlikely to include predatory journals.

Box 1: Guidelines for Counting Research Publications for Promotion of Teaching Faculty of Medical Colleges/Institutions in India As Laid Down In an Order By Medical Council of India in September 2015

- a. **Index agencies:** Scopus, PubMed, Medline, Embase/Excerpta Medica, Index Medicus and Index Copernicus
 - b. **Types of articles to be considered:** Original research articles and original research papers.
 - c. **Criteria for National/International journal:** Published by a National/International–specialty journal/journal of a national/ international society provided it is included in one of the indexes mentioned above.
 - d. **Authorship:** First author, second author
 - e. **E-journals:** E-journals not included
- The above would also be applicable for 'accepted for publication' papers/articles.

Indexing:

Indexation or inclusion in select databases is an imperfect surrogate for quality. A more direct measure would probably be an assessment of each individual journal by peers. Till such an evaluation is available, we agree with the MCI's requirement that the journal of publication be listed in a recognized database. However, we suggest that the list of databases provided in the MCI's order needs a re-look. For example, Index Copernicus was last updated in 2014 [9]. Some journals listed on this index, and their publishers appear on Beall's list of potentially predatory journals [10]. In fact, Beall's blog says "Index Copernicus has no value" [11]. Although the MCI's order lists Medline and Index Medicus separately, these are actually one database. Similarly, PubMed is not a database but a search engine that searches various databases including Medline and PubMed Central. More important is the omission of Science Citation Index, an important database currently published by Thomson Reuters and of IndMed, a database of Indian medical journals, curated by the Indian Council of Medical Research. We suggest the following list of acceptable databases: Medline, PubMed Central, Science Citation Index, Embase/Excerpta Medica, Scopus and IndMed.

Article Types:

The MCI guideline states that only 'Original research articles' and 'Original research papers' will be eligible for consideration. The objective here appears to be to include papers with original data and to exclude case-reports and reviews or opinions. However, this guideline is not precise because different journals classify original research variously under these two and some other sections, such as brief communications, short reports, etc. Further, this clause discredits meta-analyses and systematic reviews that involve scientific interpretation of original data. Instead of prescribing specific article-type labels, the MCI could suggest that the paper should report 'original research data or its interpretation in a meta-analysis or systematic review [12].' The guidelines' implication that case reports, reviews and opinion pieces should not carry any value remains debatable since these are an important part of scientific dialogue.

National versus International Journals:

The distinction between 'national' and 'international' journals is unclear. The inclusion of words such as 'India' or 'Indian' in the title does not necessarily make a journal of lesser quality. Similarly, the presence of words such as 'international', 'global' or 'world' in a journal's name does not confer it with a higher quality. National journals are in fact more likely to publish research that is relevant to the local population. Again, this discrimination by the MCI appears to be a surrogate marker for quality. Since indexing has already been included as a criterion, the terms 'national' and 'international' have little value. We also suggest that the criterion of society journals be removed as indexation covers the quality requirements. The quality of a number of non-society journals (for example *The Lancet*) is widely recognized.

Place in Authorship Sequence:

Finally, the MCI guideline of limiting credit to only the first two authors of a paper is too restrictive. This guideline seems to be an attempt to weed out the malpractice of gift authorship. Again, the MCI's aim is laudable but the implementation can result in greater harm. The first name in a paper is generally associated with the person who did the maximum work and the last name being that of the supervising senior [13]. The MCI guideline suggests that other names except the first two on the byline are those of 'guests'. The research scenario has moved towards collaborative and multidisciplinary projects conducted by large teams. To publish a paper in a high-quality journal, a researcher needs to look at a research problem from diverse aspects (e.g. clinical, laboratory, genetics, and immunology). Hence, good papers often have multiple authors with equal contribution, and all of them deserve equal credit.

The MCI guideline may not only deny credit to all those who have contributed, it may even encourage the practice of denying first authorship, and credit, to junior researchers whose contribution is often the maximum. Experience of many medical editors shows that it is not uncommon to find the senior-most author as the first author (even in case reports) due to the premium placed on this position [14]. Therefore, we suggest that this guideline should be removed, and all the authors of a paper should receive credit for it.

We appreciate the MCI's intention to give research its due recognition in academic institutions as well as for streamlining the process of promotion of teachers. Our suggestions to amend the existing guidelines, summarized in **Box 2**, can help remove ambiguities in the new MCI guidelines. These could also serve as the starting point of a wider consultation on the evaluation of research performance of medical teachers in India.

Box 2: OUR SUGGESTIONS

- **Acceptable databases:**
Medline, PubMed Central, Science Citation Index, Embase/Excerpta Medica, Scopus and IndMed
- **Types of articles to be considered:**
Articles reporting original research data or their interpretation in a meta-analysis or systematic review
- **Authorship: All authors**

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Annexure:

The following members of the Indian Association of Medical Journal Editors (IAMJE) also endorse this editorial:

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Corrigendum

The Title of the Paper "Patient Autonomy and Informed Consent: The core of Modern Day Ethical Medical" in the Journal of Indian Academy of Forensic Medicine. 2016 is incomplete

Should be read as:

"Patient Autonomy and Informed Consent: The core of Modern Day Ethical Medical Practice"

It should be quoted as

Harish D, Kumar A, Singh A. Patient autonomy and informed consent: the core of modern day ethical medical practice. Journal of Indian Academy of Forensic Medicine. 2016;37(1):410-414.

The error is regretted.

EDITOR JIAFM

Original Research Paper

Profile of Death in Burn Cases: A Post-mortem Study

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Abstract

Deaths due to fire or burns usually result from application of dry heat to the body. In India there are several thousands of deaths occurring due to fire or burns. Unfortunately vast majority of these cases occur in the home and are due to smoking, defective electrical wiring, defective kerosene stove bursts, attempted suicides by self-immolation, homicidal burns of young women by husband or in-laws (Dowry deaths/bride burning). The present study was based on retrospective analysis of burn cases in the period from January 2013 to December 2013 from autopsies done in the Department of Forensic Medicine and Toxicology, SAIMS Medical College & PG Institute, Indore, M.P. It was observed that more than half of the victims died of burn injuries were married women. Females are mostly involved in cooking and most common cause is accidental burn. Burns having total body surface area (TBSA) more than 40% were fatal. The different aspects of burn deaths are analyzed and discussed in detail.

Key Words: Burn, Autopsy, Accidental, Homicidal Burn, Married Women

Introduction:

Burn may be defined as the traumatic effects of application of physical heat in any form to the body. Fire deaths are some of the most challenging fatalities, both from the investigative and the autopsy aspect.

One reason is the multifactorial investigative team approach to a fire death and the inevitable contamination of the scene. The first wave of investigators is the fire department personnel armed with powerful hoses, followed by the police, and then the medical examiner and his/her investigator staff.

In between, one has to deal with the news media and the curious immediate public.

Over 95% of fatal fire-related burns occur in low- and middle-income countries. South-East Asia alone accounts for just over one-half of the total number of fire-related deaths worldwide and females in this region have the highest fire-related burn mortality rates globally. Among the various age groups, children under 5 years and older people (i.e. those aged over 70 years) have the highest fire-related burn mortality rates.

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In addition to those who die, millions more are left with lifelong disabilities and disfigurements, often with resulting stigma and rejection.

Material and Method:

This study was based on retrospective analysis of 95 burn deaths from 1st January 2013 to 31st December 2013 from the post-mortems done in the Department of Forensic Medicine and Toxicology; SAIMS Medical College & Post graduate Institute, Indore, Madhya Pradesh.

The data represents all age groups. Proforma for study was prepared and various information and findings were collected from the post-mortem reports and hospital record like age, sex, religion, cause of death, duration of death, hospitalization and survival time was noted. The information was compiled, tabulated and analyzed.

Observations and Results:

During one year study period from 1st January 2013 to 31st December 2013, total 260 autopsies were conducted, out of which 95 cases (36.5%) were due to burn. (Graph 1)

There was predominance of females with 64 cases (67.4%) and 31 cases (32.6%) were male and Male: female ratio was 1: 2.06. (Table 1) Burn injuries can occur at any age but the most affected age group in this study was between 21-30 years i.e. 43 cases (45.3%), followed by 31-40 years i.e. 30 cases (31.6%). Least number of cases were from >40 yrs and <10 years. (Table 2)

Majority of victims in present study were Hindus (86.3%), with predominance of females

in both Hindu and Muslim religions. (Table 3) Majority of victims (80%) were married and among them, 56 (73.7%) were females in our study. (Table 4) Among females, 10.9% were pregnant with gravid uterus. (Table 5)

In present study out of all burn cases, five cases (5.3%) were having carbon soot particles in trachea. (Graph 2) Among all burn victims, 87 cases (91.6%) were hospitalized while eight cases (8.4%) were brought dead. (Table 6) Among hospitalized cases, 8 cases (8.4%) died within 24 hours, 13 cases (13.7%) died within 1- 2 days, 27 cases (28.4%) died within 3- 6 days, and 21 cases (22.1%) died within 7- 10 days while 18 cases (18.9%) died 10 days after hospitalization. (Table 7)

In majority of burn cases (49.5% cases), total body surface area involved was between 40- 70 %, followed by 36.8% cases with 70-100% body surface area. Only 4.2% cases died with total body surface area less than 30%. In this study, majority of victims died due to shock (40% cases), followed by septicemia (31.6%) and exhaustion in 28.4% cases (Table 9)

Discussion:

In the present study, there is a predominance of female victims than males in burn cases and a majority of them were in the reproductive age group 21-30 years, which is similar to the findings of other similar studies. [1-4] The age group 21-30 years is the young adult group and is the most common age for marriage in this area of study.

Most of the victims were working women and they do not follow the safety measures due to lack of time or knowledge resulting in such incidents. Most of the victims were female and belong to the Hindu community, which is similar to the findings of previous studies. [2-6]

The reason for the Hindu predominance is that in this part of the world Hinduism is the most commonly followed religion and so is the increase in the Hindu victims. Majority of victims were married (80%) and among them, 73.7% were females. As for the female predominance, females are mostly involved in cooking, especially after marriage. In contrast, Memchoubi et al [7] reported slight male preponderance in their study.

Soot particles are found in trachea in 5.55% of cases, which is different from the finding of Dr. K.C. Das [2], who found soot particles in trachea in 18.05% cases and D. Nath [3] who found in 34.07% cases and A. Mazumdar [4], who found soot particles in trachea in 19% cases.

Most of the victims died in the hospital after receiving treatment, which include intravenous fluid and also some oral medication. This might be the cause of absence of soot particles in the trachea in most of the victims.

In the present series, the overwhelming majority (86.3%) of the victims had more than 40% of total body surface area (TBSA) burn indicating the incompatibility with life even at a tertiary care center.

Studies from Angola [8] revealed 100% mortality over 40% TBSA, and similarly 80% mortality rate in burn over 40–50% TBSA has been reported from Jaipur. [9] Shock is found to be the most common cause of death in most of the victims (40% cases), which is similar to other studies. [2-4]

Shock (neurogenic, hypovolemic) is more common in 1-2 day period after burn injury. Most of the cases (59 %) succumbed to death within week. Concurrent to this study, 60.8 % of cases and 58 % of cases died within a week in studies done by Kumar V [10] and Ragheb et al [11] respectively indicating that burns are rapidly fatal. Most of the injuries were epidermal to dermo-epidermal in nature, which were most painful resulting in neurogenic shock.

Any kind of injury including burn injury was the common source of infection, which resulted in septicemia and septicaemic death in 30 cases (31.6%). Harish D [12] reported in their study that 84 % of cases died due to septicemia as a result of burns.

Conclusion:

The epidemiological factors for burn injuries vary in different countries. In this study, more than half of the victims died of burn injuries were married women. Females are mostly involved in cooking and most common cause is accidental burn. Mass education and following safety instructions will definitely reduce the incidence of burn injuries.

Prevention is better than cure and effective prevention requires a good understanding of major risk factors. Government, NGO'S and other organizations need to intensify their efforts in raising the awareness of public at large.

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Table1: Gender-wise Distribution of Burn Cases

Sex	Burn Cases	Percentage
Male	31	32.6
Female	64	67.4
Total	95	100

Table 2: Age wise Distribution of Burn Cases

Age Grps (Yrs)	Cases	Percentage (%)
0-10	3	3.2
11-20	10	9.5
21-30	43	45.3
31-40	30	31.6
41-50	4	4.2
51-60	2	2.1
61-70	1	1.05
71-80	2	2.1
Total	95	100

Table 3: Religion-wise Distribution of Burn Cases

Religion	Male	Female	Total (Percentage)
Hindu	26	56	82 (86.3%)
Muslim	5	8	13 (13.7%)
Total	31	64	95 (100%)

Table 4: Marital Status

Gender	Married	Unmarried	Percentage
Male	20	11	31 (32.6%)
Female	56	8	64 (67.4%)
Total	76 (80%)	19 (20%)	95 (100%)

Table 5: Female Burn Victims with Gravid Uterus

Religion	Cases	Gravid uterus	Percentage
Hindu Female	56	6	10.7
Muslim Female	8	1	12.5
Total	64	7	10.9

Table 6: Brought Dead or Died in Hospital

Hospitalized/Brought dead	Cases	Percentage
Hospitalized	87	91.6
Brought dead	8	8.4
Total	95	100

Table 7: Survival Period

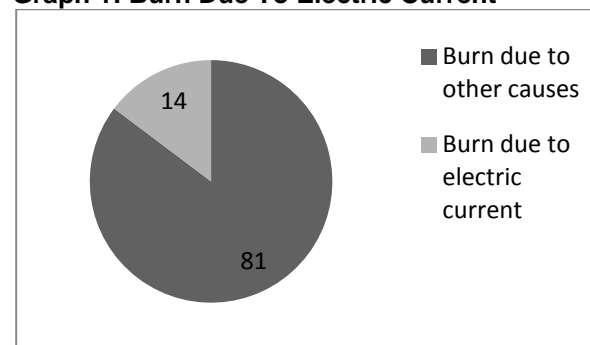
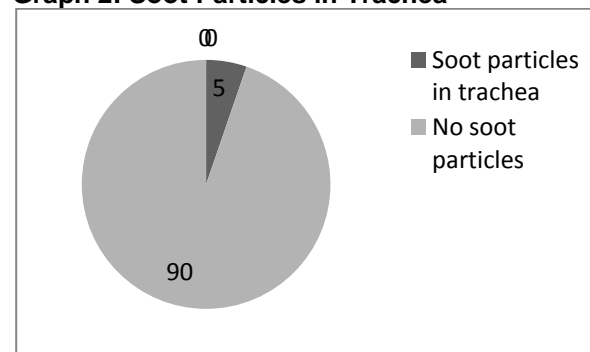
Period of Survival	Cases	Percentage
Brought dead	8	8.4
<12 hrs	3	3.2
12- 24hrs	5	5.3
1- 2 days	13	13.7
3- 4 days	9	9.5
5- 6 days	18	18.9
7- 8 days	9	9.5
9- 10 days	12	12.6
>10 days	18	18.9
Total	95	100%

Table 8: Body Surface Area Involved

Total Body surface area involved (%)	cases	Percentage
10- 20%	0	0
20- 30%	4	4.2
30- 40%	9	9.5
40- 50%	11	11.6
50- 60%	21	22.1
60- 70%	15	15.8
70- 80%	12	12.6
80- 90%	11	11.6
90- 100%	12	12.6
Total	95	100

Table 9: Cause of Death

Cause of Death	Cases	Percentage (%)
Septicemia	30	31.6
Exhaustion	27	28.4
Shock	38	40
Total	95	100

Graph 1: Burn Due To Electric Current**Graph 2: Soot Particles in Trachea**

Original Research Paper

Retrospective Study of Poisoning Cases at Tertiary Care Hospital in Western Uttar Pradesh

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Abstract

Poisoning is a medical emergency and a patient is always invariably rushed to the casualty of the hospital at the earliest possible moment, irrespective of the amount and nature of poison ingested. This study was carried out on poisoning cases reported to casualty of Sharda Hospital, SMS&R Greater Noida in two year duration from 1st January 2013 to 31st December 2014. The main objectives of the study were to analyze pattern and demographic variables of poisoning cases. Out of total 1214 medico-legal cases 128 were poisoning cases. Males (57.8%) outnumbered females and maximum cases were of age group 21-30 yrs. (39.84%). More cases from rural area (59.4%) were reported, July month saw maximum number of cases (16.4%). Maximum admissions (47.7%) were done from 8 AM to 4 PM; maximum incidence was also reported at this time only (46.1%). Poisoning by agrochemicals was seen in maximum cases (48%) and in maximum cases manner of poisoning was of suicidal in nature (62.5%). Maximum patients reported to casualty in conscious state (55.5%), 40.6% cases were successfully discharged and Mortality rate was 10.2%. Such studies of poisoning cases will help authorities for planning, prevention and treatment of these cases.

Key Words: Poisoning, Mortality, Organophosphorus, Agrochemical poisons

Introduction:

Poisoning is a qualitative term used to define the potential of a chemical substance in acting adversely or deleteriously on the body. Poison is a substance capable of producing damage or dysfunction in the body by its chemical activity. [1]

According to WHO, three million acute poisoning cases with 2, 20, 000 deaths occur annually. Out of these, 90% of fatal poisoning occurs in developing countries particularly among agricultural workers. It is estimated that more than 50,000 people die every year from toxic exposure in India. [2]

Massive use of pesticides in agriculture [3], as it is being the major profession in the rural areas of India also exposes farmers with these compounds

Introduction of a variety of newer drugs for treatment, exposure to hazardous chemical products due to rapid industrialization, unhealthy dietary habits and increases in alcohol consumption have led to a wide spectrum of toxic products to which people are exposed. [4]

The cases of poisoning by Corrosives, Sedatives & hypnotics, Alcohol, Dhatura, Oleanders, Snake bite etc. are also frequently reported in adults and poisoning by Kerosene and cleaning agents is more common in children. [4] Profile of poisoning in an area depends upon a variety of factors, ranging from access to and availability of poison, socio-economic status of the individual, cultural and religious influences, etc. Poisoning forms a major problem in developing countries.

Easy availability and low cost of hazardous chemicals play a major role in suicidal homicidal and accidental poisoning in developing countries. [4]

This study is being conducted in Greater Noida, which is situated in NCR region of Uttar Pradesh. It is an educational hub for professional students and very rich in agricultural land and both students and farmers are vulnerable for exposure that's why profiling of poisoning cases is essential.

Aims and Objectives:

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1. To analyze pattern of poisoning cases
2. To study demographic variables of Poisoning cases
3. To suggest preventive measures which would possibly reduce incidence of these case

Material and Methods:

This retrospective study was conducted on poisoning cases reported to the casualty of Sharda hospital, SMS&R Sharda University, Greater Noida, which is a tertiary care hospital.

The study was conducted for two years duration from 1st January 2013 to 31st December 2014. General information regarding demographic profile, socioeconomic status etc. of each case was confirmed from causality & hospital records. Brought dead cases were not included in this study. The collected data were statistically analyzed in form of ratio & frequencies and compared with other studies.

Observation and Results:

In our study out of total 128 poisoning cases 57.8% were males and 42.2% were females. Male female ratio was 1.37:1. In age group analysis maximum incidence was seen in age group of 21-30 years comprising (39.8%) cases, followed by 11-20 years (27.3%).

Combining both factors it is very clear that teens and young adult constitutes major chunk of poisoning cases. (Table 1)

Present study showed that rural population (59.4%) were more affected than urban which comprised of (39.8%) of total cases. (Table 2) Maximum cases were reported in Rainy season i.e. in the month of July (16.4%) followed by June (11.7%). (Table 3)

In this study maximum cases (47.7%) reported to casualty between 8 AM to 4PM in the evening followed by 4PM-12AM (46.1%). Least cases were seen during midnight to early morning. (Table 4)

In present study we observed that maximum cases (48%) were of agrochemicals poisons. Among those Organophosphates, Aluminum phosphide and Zinc Phosphide constituted the maximum cases.

This was followed by drugs which constituted 15% of total cases in which benzodiazepine was the biggest group. Corrosive & addictive group constituted 7% each, followed by hair dye (4%), hydrocarbons (4%) and animal bites cases (3%) respectively.

No information about type of poison was available in 12% of cases. In our study total 17 cases were positive for alcohol on clinical examination. Out of these 41.17% presented as alcohol intoxication while 58.82% presented with

associated poisoning cases. (Table 5) In majority of cases (96.87%) poisoning was through oral route while in four cases exposure was with inhalation of insecticide (3) and diesel (1) respectively. (Table 6)

Our Study Showed the maximum incidences were of suicidal poisoning (62.5%) followed by accidental (32.81%) and 1.6% was of homicidal in nature. Out of 80 suicide cases, in 55% cases reason was not known, 28.75% belonged to family problems followed by psychiatric illness (11.25%) and study related problems (8.75%). (Table 7)

In this study maximum 60.2% cases stayed in hospital for one to five days duration, followed by patient who stayed for less than one day (26.6%). (Table 8)

In our study 55.5% of cases were conscious when reported to casualty. Semiconscious patients constituted 29.7% and they were clubbed with disoriented cases also. 14.8% of cases reached causality in unconscious state.

In present study majority of cases were discharged (40.6%) after improvement, only 1.6% was referred to higher centers, 24.2% cases left the hospital against the medical advice and 10.2% cases died. Maximum cases were between 21-30 yrs. of age who died.

Majority of the cases died due to agrochemicals (61.53%) in which Aluminum phosphide was the biggest cause. (Table 9)

Discussion:

In the present study of total 1214 medico-legal cases reported to the causality during two year duration 128 poisoning case were recorded. In our study males (57.8%) outnumbered females (42.2%) and maximum patient belonged to the age group 11-30 years (67%). Involvement of young male is because of impulsiveness and mental vulnerability, exam stress, failure in love life, problems in families etc. Our findings were similar to other studies. [2-7]

But different to Arun M et al [13] study in which maximum cases were above 60 years of age only. In this study rural population (59.4%) was affected more than urban population (39.8%) similar to other author's findings. [5, 6, 8,9] This is because of demographic situation of the hospital. Greater Noida is rich in agricultural land and farmers are at risk of exposure of poisonous compounds.

In our study maximum cases were reported in rainy season because of crop failure in summer followed by losses in rainy season, beginning of new session of study so more

stress on students, more hot and humid conditions effects behavior leads to increased irritability. Our findings were consistent with Deepak Pokhrel, study [1] but different from B. Maharani et al [10] and Shreemanta Kumar Dashet al [11] studies where majority of cases were reported during summer while in geriatric study [12] winter was the commonest season.

Maximum case reported to the hospital during 8AM-12AM and same scenario was seen during incidence of these cases in this study. [10, 11] While in Deepak Pokhrel study [1] more cases were reported during night time. Reason for poisoning during day time could be alone at home as house wives and also unintentional exposure is more because of working hours.

Maximum cases were of agrochemicals constituting 48% of the total cases in our study. Out of these Organophosphates, Aluminum phosphide and Zinc Phosphide constituted the maximum cases similar to others studies. [2, 3, 5, 7-12] This could be explained easily as Greater Noida is agriculture and educational hub so farmers are more exposed to these compounds intentionally or unintentionally.

Easy availability and no restriction on the sale and supply of these compounds is main reason for high incidences.

In Drugs poisoning benzodiazepine was the biggest group. [11] Reason being the more stress and strain in professional education life and these drugs are available over the counter easily. Most of the cases in this study were suicidal (62.5%) while accidental were (32.81%) and least common were homicidal (1.6%).

These findings are consistent with other studies. [3, 5, 6, 8] suicidal poisoning was more commonly seen in adults as poisoning is supposed to cause painless death.

Accidental cases are more in children by household poison or where person is unintentionally exposed to harmful substances as in agriculture. Maximum suicide cases belonged to family problems (17.1%) followed by psychiatric illness (7.03%) consistent with other studies [3, 4] while in K.N. Ramesha et al study [7] major reason was psychiatric illness.

Majority of family problems are because of nuclear family, break in family support system, impulsiveness and stress due to job. Depression is more because of high expectations at academic, financial or social front.

In our study majority cases (60.2%) stayed in hospital for one to five days like others. [1,7] maximum cases (55.5%) were conscious when reported to casualty in this study which was in contrast to N S Patel et al [3] study where altered sensorium cases were more. This is due

to the close proximity of the hospital so patient reached hospital earlier than the presentation of grave signs.

Majority of cases were discharged (40.6%) after improvement because of timely intervention, proper care and better conditions in hospital to tackle poisoning cases. Few cases (1.6%) were referred to higher centers. These findings were similar to previous studies [2, 9]

In present study Mortality rate was 10.2% similar to other studies. [4, 9] in majority of cases (46%) mortality was due to Aluminum phosphide. [4]

Conclusion:

In our study the incidence of poisoning cases in casualty was 10.54% of all medico-legal cases and Mortality rate was 10.2% of poisoning cases. Authentic data on poisoning was not available not only from India but from entire SEAR (South East Asia Region).

WHO states that many cases go unnoticed and mortality may actually be higher. Involvement of young males group which is most active and most productive puts huge burden on economy and social loss to the country.

Following measures should be taken by government and medical personnel to reduce the incidence of poisoning cases and plan preventive measures:

1. Better and Prompt medical management by Improvement in ICU, Appropriate supportive conditions and Separate Toxicology Unit establishment.
2. Establishment of a Poison Information Center for better management & prevention of poisoning cases.
3. Restrict the sales of most toxic Agrochemicals and Educate farmers regarding their handling and use
4. Educate people regarding prevention of common household poison and Schools & colleges should have councilor.
5. People suffering from depression or psychiatric problem should be given counseling and over the counter sale of drugs should be banned.

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Table 1: Age and Sex wise Distribution

Age Grps. (Yrs)	Sex		Total (%)	Sex Ratio
	Male	Female		
Up to 10	8	3	11(8.59)	2.66:1
11-20	18	17	35(27.34)	1.05:1
21-30	30	21	51(39.84)	1.42:1
31-40	9	7	16(12.5)	1.28:1
41-50	7	4	11(8.59)	1.75:1
51-60	2	1	3(2.34)	2:1
>60	0	1	1(0.78)	0:1
Total	74	54	128(100)	1.37:1

Table 2: Residential Status of Cases

Residence	Cases	Percentage
Urban	51	39.8
Rural	76	59.4
Unknown	1	0.8
Total	128	100.0

Table 3: Month and Year Wise Distribution

Month	Cases		Total (%)
	2013	2014	
January	7	4	11(8.59)
February	6	0	6(4.68)
March	2	6	8(6.25)
April	4	1	5(3.9)
May	5	7	12(9.37)
June	8	5	13(10.15)
July	7	14	21(16.4)
August	5	5	10(7.81)
September	5	6	11(8.59)
October	4	4	8(6.25)
November	4	8	12(9.37)
December	5	6	11(8.59)

Table 4: Arrival Time of Patient

Arrival Time	Cases	Percentage
8.00AM- 4.00PM	61	47.7
4.00PM-12.00AM	59	46.1
12.00AM- 8.00AM	8	6.3
Total	128	100.0

Table 5: Types of Poison

Poison	Cases	Percentage
Agrochemicals (48%)		
a) Organophosphorus	18	14.06
b) Aluminum phosphide	16	12.50
c) Rat poison	11	8.59
d) Mosquito Repellent	10	7.81
e) Lice poison	5	3.91
f) Scabies lotion	1	0.78
Corrosives (7%)		
a) Acids	6	4.69
b) Toilet cleaner	2	1.56
c) Dettol	1	0.78
Hydrocarbons (4%)		
a) Kerosene	4	3.13
b) Diesel	1	0.78
Addictive (7%)		
a) Alcohol	7	5.47
b) Cannabis	2	1.56
Drugs (15%)		
a) Benzodiazepine	11	8.59
b) Zolpidem	2	1.56
c) Paracetamol	1	0.78
d) Ephedrine	1	0.78
e) Warfarin	1	0.78
f) Unknown drug	3	2.34
Animal Bites (3%)		
a) Snake bite	3	2.34
b) Insect bite	1	0.78
Hair dye	5	3.91
Unknown poisoning	15	11.72
Total	128	100

Table 6: Route of Exposure

Route of Exposure	Cases	Percentage
Oral	124	96.87
Inhalation	4	3.12
Total	128	100

Table 7: Reason for Poisoning

Reason of Poisoning	Cases	Percentage
Accidental	42	32.81
Homicidal	2	1.6
Suicidal	80	62.5
• Reason not known	(44)	(55)
• Family Problem	(23)	(28.75)
• Psychiatric illness	(9)	(11.25)
• Study related problem	(7)	(8.75)
• Unmarried with H/O Amenorrhea	(1)	(1.25)
Total	128	100

Table 8: Duration of Stay in Hospital

Days	Cases	Percentage
<1 day	34	26.6
1-5 days	77	60.2
6-10 days	11	8.6
11-15 days	4	3.1
>16 days	2	1.6
Total	128	100.0

Table 9: Outcome of Patient

Outcome	Cases	Percentage
Discharged	52	40.6
Lama	31	24.2
Died	13	10.2
Referred	2	1.6
Not admitted	30	23.4
Total	128	100

Original Research Paper

Cheiloscopy: A Tool for Personal and Forensic Identification

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Abstract

Skin over the lips is known to have patterns of ridges and furrows, study of which is known as cheiloscopy. Besides the traditional methods of identification like finger printing, sex determination, age determination, anthropometry and DNA analysis, cheiloscopy is gaining popularity among researchers because of a hassle free methodology and reliable results with developments in the fields of Forensic Medicine and Odontology, proving itself as a credible method of identification. To study the significance of studying lip prints in personal identification, a study of lip prints was conducted in Department of Anatomy, in collaboration with Department of Forensic Medicine, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha; on 100 undergraduate medical students aged between 17 to 20 years. The lip prints were studied with the help of a magnifying lens using Suzuki and Tsuchihashi classification. The study concluded that lip prints are unique for every individual, and cheiloscopy can be practised as a reliable method for personal and Forensic identification.

Key Words: Lip Prints, Cheiloscopy, Identification, Odontology

Introduction:

Lip prints are normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip, between inner labial mucosa and outer skin, and are based on physical properties of an individual.

The study of lip prints is known as “Cheiloscopy”, derived from Greek words “cheilos” meaning “lips” and “eskopein” meaning “to see”. It is an emerging and credible method of individual identification, based on the fact that the pattern of lines on the red part of lips is unique for each human being.

Tsuchihashi Y. [1] named the wrinkles and grooves on lips as “sulci labiorum rubrorum”. The figure formed by these sulcies called “figura linearum labiorum”, which means “lip prints”. The study of finger print pattern has always been more popular among researchers; however the study of lip prints is gaining more popularity and credibility in forensic medicine and odontology with evolution of technology.

The five basic types of lip prints used by Forensic scientists are:

- Diamond grooves
- Long vertical grooves
- Short vertical grooves
- Reticular grooves
- Branching grooves

Fischer in 1902 was the first anthropologist to describe the furrows on the red part of the human lip. However in 1932 Edmond Locard, renowned French criminologist recommended the use of lip prints in personal identification and criminal investigation.

In 1950, Synder reported in his book ‘Homicide Investigation’ that the characteristics of the lip formed by lip grooves are individually distinctive as the ridge characteristic of finger prints, therefore making it significant in personal identification.

Japanese doctor Suzuki [2] in 1970 examined 107 Japanese female aged 20-36 and simplified the classification of lip prints into five main types:

- **Type 1(a)** – Lip with clear cut grooves running vertically over the lips.
- **Type 1(b)** – Partial length grooves (do not cover entire breadth of lip)
- **Type 2** – Branched grooves.
- **Type 3** – Intersected grooves (like crosses).
- **Type 4** – Reticular pattern (wire mesh).
- **Type 5** – All other pattern (irregular non-classified)

Tsuchihashi [3] studied lips in 1364 persons in 1974 and was convinced that of their

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value in personal identification, and proposed the following classification pattern:

Type I– Clear cut vertical grooves that run across the entire lip

Type I'– Similar to type I, but do not cover entire lip

Type II– Branched grooves (branching Y shaped)

Type III– Criss-cross pattern, reticular grooves

Type IV – Undetermined

Materials and Methods:

The study was conducted in the Department of Anatomy in collaboration with the Department of Forensic Medicine and Toxicology, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha; where the lip prints of 50 male and 50 female MBBS students of 17 to 20 years of age were analysed.

The lip prints of this group were taken in the beginning, and after one year of last print for consecutive 2 years after the commencement of the study. Care was exercised to select individuals having no lesions on the lips. Individuals with known hypersensitivity to lipsticks were not included in study.

The following materials were used for recording the lip prints:

- A dark colour frosted lipstick
- Thin bond paper
- Magnifying lens
- Scale
- A piece of cardboard
- Two clips
- Pen, Pencil
- Tissue paper

A dark colour lipstick was applied with a single stroke evenly on the vermilion border. The subjects were asked to rub both the lips to spread the applied lipstick. After about two minutes a folded white paper inserted between the lips and asked to press on it. Then a paper was taken out and unfolds it to study the print.

Observations and Results:

In present study 100 individuals, comprising 50 males & 50 female students of 1st M.B.B.S. of age group 17 to 20 years were included. The lip prints were recorded and analysed, and it was found out that no two lip prints were identical.

In our study among Males, Intersecting grooves were the commonest in all four quadrants (41.5%), followed by Short Vertical grooves (40%), Long Vertical grooves (34%), and branched groove (29%). Reticular pattern (10.5%) is least commonly seen among males. (Table 1)

Among Females, the commonest pattern observed in all four quadrants was Intersecting grooves (39.5%), followed by Long Vertical grooves (32%), Short Vertical grooves (27.5%), Branched groove (18%) and Reticular pattern (12.5%). (Table 1) This study observed no changes in the lip prints after a year of last print, taken over two consecutive years.

Discussion:

The wrinkles and grooves on labial mucosa, called as sulci labiorum form a characteristic pattern called as lip prints and the study of which is referred as 'cheilioscopy'.

Lip prints are very useful in personal identification as well as forensic identification invaried situations like homicides, suicides, accidents, mass disasters and in establishing criminal responsibility of a suspect.

A study conducted by Tsuchihashi [3] on lip prints of 64 Japanese subjects consisting of 22 males & 42 females aged between 20-30 years concluded that intersecting groove was the commonest in both sexes, followed by long vertical groove, short vertical groove, branched groove, and reticular pattern was the least frequent of all.

Shivapathasundharam B et al [4] observed that the intersecting pattern (resembling type I in Suzuki's classification) was most common (43.33%) while the reticular pattern (resembling type IV in Suzuki's classification) was least commonly seen (10.71%). Some studies establish the importance of gender difference in the observed patterns of lip prints.

According to a study by Sonal-Nayak [5] type I and type II' patterns were dominant in females, while type III and IV pattern were dominant in males. Nagpal Bhuvan et al [6] concluded that type I and type I' patterns are commonest in females, while Verghese AJ et al [7] found type IV predominant among females. There were slight variations observed in males.

In another study conducted by Vahanwala S P, [8] it was observed that all four quadrants having similar type of patterns were predominantly seen in female subjects, whilst different patterns were observed in all quadrants among males.

Conclusion:

In the present study, we used magnifying glass to observe the lip prints and it was found that no two lip prints matches with each other. No changes were observed in consecutive prints taken after one and two years of first lip print at the commencement of the study. So it may be established that lip prints are

different in every individual, and does not change with time so it can be used for personal identification as well as forensic investigation.

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Fig. 1: Diamond Grooves

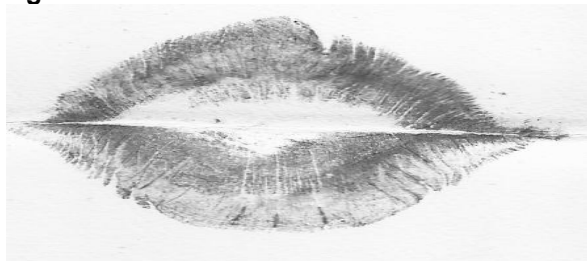


Fig. 2: Long Vertical Grooves

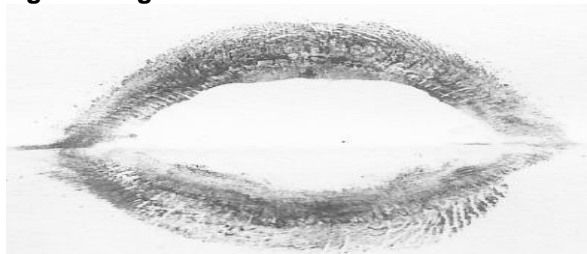


Fig. 3: Short Vertical Grooves

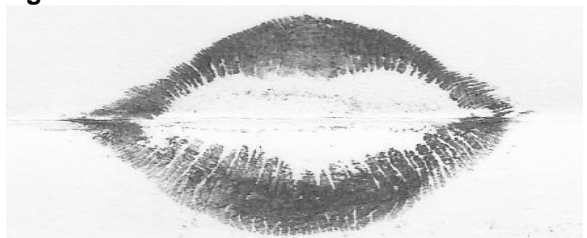


Fig. 4: Reticular Grooves

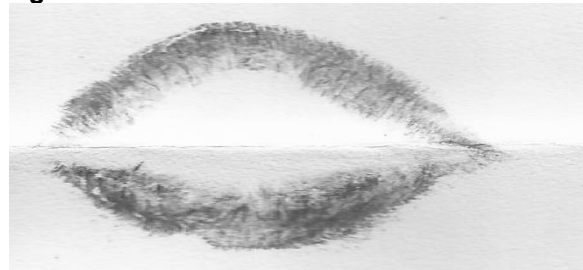


Fig. 5: Branching grooves

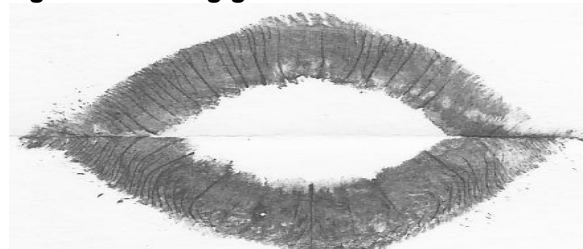


Fig. 6: Intersecting Grooves

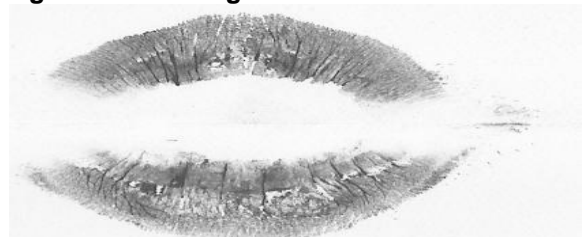


Fig. A: Quadrants and Patterns used for Analysis

(Patterns: I - long vertical groove; II - Short vertical groove; III - Intersecting groove; IV - Branched groove; V - Reticular pattern)

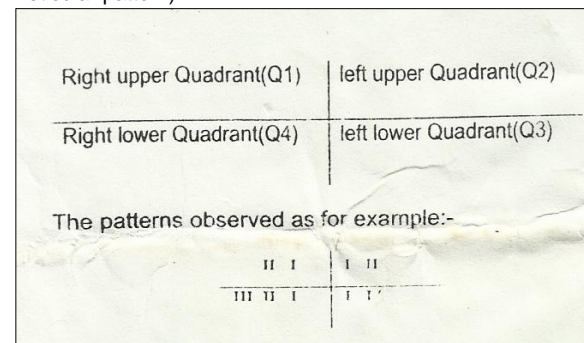


Table 1: Sex wise Distribution of Various Types of Lip Prints

Lip Print Pattern	Male (200 Quad.)	%	Female (200 Quad.)	%	Total (400 Quad.)	%
Long Vertical Grooves	68	34	64	32	132	33
Short Vertical Grooves	80	40	55	27.5	144	36
Intersecting Grooves	83	41.5	79	39.5	162	40.5
Branched Groove	58	29%	36	18	94	23.5
Reticular Pattern	21	10.5	25	12.5	46	11.5

Original Research Paper

Study of Ligature Mark in hanging cases in Bangalore East Region

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Abstract

Hanging is the commonest method of committing suicide and is considered as a painless form of death. In hanging the appreciation of external signs particularly ligature mark plays a vital role. Hence a proper observation and study of ligature mark which the characteristic hallmark of hanging, needs greater emphasis. The ligature mark is a pressure abrasion on the neck at the site of the ligature which appears as a groove. This prospective study was conducted among victims of hanging brought to Dr. B. R. Ambedkar Medical College morgue, Bangalore during the period November 2010 to October 2012. A sum total of 232 cases brought with a history of hanging were selected for this prospective study. Atypical ligature marks with partial hanging outnumbered typical ligature mark with complete hanging. Single ligature mark above the level of thyroid cartilage with a breadth of 1to2cms is observed in the maximum number of cases. Majority of the ligature marks were prominent in their appearance. The colour of ligature mark was dark brown in one third of cases.

Key Words: Hanging; Ligature mark; Suicide; Thyroid cartilage

Introduction:

Death is certain for all living beings, but only humans end their lives prematurely by committing suicide. History of suicides goes back at least to the earliest human records.

Human suicidal behaviour has always been a source of dread and wonder to mankind. There are many methods for committing suicide like poisoning, hanging, self-immolation, drowning etc. Hanging is the commonest method of committing suicide in cities and towns and is considered as a painless form of death.

Sometimes, hanging is adopted as a last resort after other forms of suicide (poisoning, cut throat injury, etc.) have failed to produce the desired effect. The thought to hang one-self may come progressively or on an impulse.

Hanging is a form of violent asphyxial death produced by suspension of the body by a ligature around the neck, the constricting force being the weight of the body (complete hanging), or part of the weight of the body (partial hanging). In hanging the appreciation of external signs particularly ligature mark plays a vital role. Hence a proper observation and study of ligature mark which the characteristic hallmark of hanging needs greater emphasis.

The ligature mark is a pressure abrasion on the neck at the site of the ligature which appears as a groove. In typical hanging, the ligature mark is situated above the level of thyroid cartilage between the larynx and the chin. It is directed obliquely upwards along the line of the mandible and reaches the mastoid processes behind the ears.

It is sometimes absent at the back. However variations in the ligature marks like faint/absent ligature mark, ligature mark artefacts as ant bite marks are encountered in day to day autopsies. Sometimes there may be double ligature marks.

It may be due to slippage of the ligature. Character of the ligature mark depends on various factors like the nature of the ligature, body weight, length of time the body has remained suspended and the number of turns of the ligature round the neck. The course of the ligature mark depends on whether a fixed or running noose has been used.

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Materials and Methods:

This prospective study was conducted among victims of hanging brought to Dr. B. R. Ambedkar Medical College morgue, Bangalore during the period November 2010 to October 2012. Of all the cases brought to the department for medico-legal autopsy, cases in which death had resulted from hanging were identified and selected for this study. A sum total of 232 cases were selected for this prospective study.

We exclude the decomposed bodies in which ligature mark was masked from this study. Detailed information regarding the deceased and the circumstances of death was collected from the police and relatives. In some cases, this information was supplemented by either, visit to scene of occurrence or from the photographs of scene of occurrence.

Results and Discussion:

The hanging deaths are taking different types in their execution as typical/atypical and complete/partial. In this study, typical hangings were seen in 51 cases and atypical hangings in 181 cases. (Table 1) The position of the knot or any intervening object like Clothings, bony projections (angle of the jaw), long plaits in Indian women and also the beard accounted for the majority of the mark being atypical. Similar findings were observed in the studies conducted by other authors'. [1, 2]

In the present study complete hanging was seen in 74 deaths. Partial hanging was taking lives mostly, accounted for 158 deaths. Among these feet touching the ground was seen in 107 deaths, kneeling in 27, sitting and lying down prone in 12 each. The partial type of hanging which was common in our study was also seen in other studies. [1-3] but, in studies conducted by M Ahmad [4] and T. Saisudheer [5] complete hanging outnumbered partial hanging cases.

In our study, it was observed that in 192 cases, the level of ligature mark was above the thyroid cartilage, below the thyroid cartilage in 13 cases and overriding the thyroid cartilage in 27 cases. (Table 2) This was also observed in various other authors' studies. [1, 5-11] In this study, ligature mark was dark brown in 76(32.76%) cases; yellowish brown in 63(27.15%) cases; red colour in 50(21.56%) cases and pale in 43(18.53%) cases. (Fig. 1)

In present study the breadth of the ligature mark was between 1-2cms in 155 cases. (Fig. 2) Similar findings are reported by others. [7, 8, 12-14] The breadth of ligature mark depends on the width of the ligature material and also the multiplicity of the ligature material. The

ligature mark was prominent in 179 cases and faint in 53 cases. (Table 3) Our findings were consistent with the findings observed in other studies. [15-18]

The prominent mark is due to the type of the material being strong and also increased period of suspension. The colour of ligature mark was dark brown in 76 cases (fig. 2) which is consistent with other author findings. [16, 17] The reason being the colour of ligature mark depends on the duration of suspension and the complexion of the person.

Conclusion:

Atypical ligature marks with partial hanging outnumbered typical ligature mark with complete hanging. From the medico-legal point of view, following measures and recommendations in cases of deaths due to hanging are very essential:

- Photograph of the scene of occurrence should include point of suspension.
- In fatal cases not to disturb the ligature material and release only the suspension point or cut the ligature material away from the site of knot.
- To always bring the material along with the body for correlation with the mark.
- Radiograph of the neck plays a vital role to appreciate the fractures of hyoid bone and thyroid cartilage.
- If necessary, to visit the scene of occurrence.

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Table 1: According to the Type of Hanging

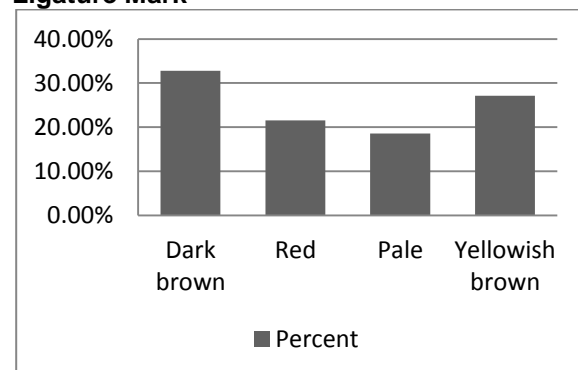
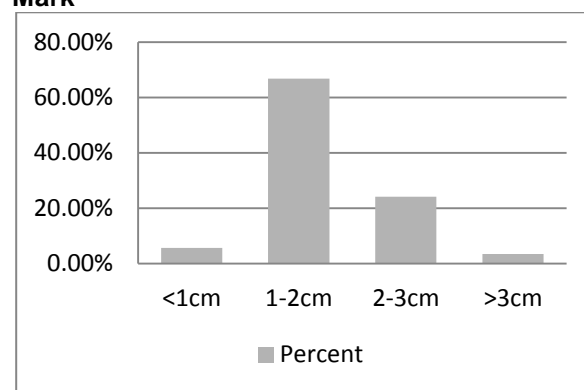
Type of hanging	Cases	Percentage
Complete	74	31.89
Partial	158	68.10
Typical	51	21.98
Atypical	181	78.02
Total	232	100

Table 2: According to the Level of the Ligature Mark

Level of ligature mark	Cases	Percentage
Above the thyroid cartilage	192	82.76
Overriding the thyroid cartilage	27	11.64
Below the thyroid cartilage	13	5.60
Total	232	100

Table 3: According to the Characteristics of Ligature Mark

Characteristic of the ligature mark	Cases	Percentage
Prominent	179	77.16
Faint	53	22.84
Continuous	11	4.74
Interrupted	221	95.26
Total	232	100

Fig. 1: According to the Colour of the Ligature Mark**Fig. 2: According to the Breadth of Ligature Mark**

Original Research Paper

Prevalence of Mental Illness in Inmates of District Jail of Etawah

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Abstract

This paper presents the prevalence rates of mental illness like schizophrenia and major affective disorders by age, substance abuse and nature of offence among male jail detainees. This study was aimed to study socio-demographic profile of prisoners of district jail and to find out the current prevalence of mental illness among prisoners. This study was carried out on total 1200 male prisoners in district jail of Etawah. We included only those prisoners who were clinically diagnosed as suffering from some mental health problem and were under psychiatric treatment for the same. Out of the total 1200 prisoners only 79 were found to be suffering from some sort of mental illness. A large part of mental morbidity was contributed by substance abuse and its related consequences. We have observed that most of the mentally disturbed individuals are involved in commission of violent offences. There could be a significant reduction in crime rates if such individuals were timely diagnosed and treated thus we recommend regular checkup of all prisoners by a psychiatrist for early diagnosis and treatment.

Key Words: Mental Illness, Schizophrenia, Offence, Substance abuse, Prisoners

Introduction:

In today's competitive world mental distress or mental illness has increased significantly, primarily owing to stressful lifestyle.

Personality disorders and behavioral disturbances are seen so commonly among children and young adults, leading to increase in crime rate and severe violence on slight provocation. Talking about the individuals who are imprisoned in jails, mental distress may occur in otherwise normal individuals in response to stress of imprisonment.

Simultaneously there may be exacerbation of preexisting mental illness in vulnerable individuals when they are exposed to stress environment as seen in prisons. In India we do not have a clear understanding of the extent and patterns of mental health problems so frequently encountered in prisons. [1]

Keeping this key issue in mind, we have tried to evaluate the prevalence of common mental health problems encountered in District Jail of Etawah.

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Material and Method:

A descriptive cross sectional study was conducted among the psychiatric inmates in District jail, Etawah, Uttar Pradesh, India. There were a total number of 1200 male prisoners in district jail of Etawah. Among them there were total 79 male prisoners which have been clinically diagnosed with mental illness.

Mental Health problems were defined by two criteria-a recent history or symptoms of a mental health problem. A history of mental health problem included a clinical diagnosis or treatment by a psychiatrist.

Symptoms of a mental health disorder were assessed on criteria specified in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV). [2]

We have not considered the statistics of female prisoners because of insufficient data.

The study subjects comprised of pre diagnosed psychiatric prisoners present in Etawah jail. [3, 4] Permission to conduct the study was obtained from the Director, RIMS &R, Saifai; Jail superintendent of district jail of Etawah, Medical officer in charge of district jail, Etawah, Uttar Pradesh, India. Ethical approval for conducting the study was taken from the psychiatrist who was associated in the treatment of prisoners with mental illness. [5]

The study procedure was systematically carried out for a period of 6 months from the month of July to December 2014. All the psychiatric patients with symptoms of mental

disorder, and who were approved by the psychiatrist based on criteria specified in the DSM fourth edition, were surveyed for presence of mental illness.

An 18 item, predesigned, structured questionnaire was used to obtain information on age, education, marital status, social status, and type of psychiatric disorder, medication used for illness, nature of crime, duration spent in the jail, alcohol and tobacco addiction, drug abuse if any, and frequency of violence or aggression among other inmates.

Observations and Results:

Out of the total 1200 prisoners residing in District jail, Etawah, Uttar Pradesh, India, 79 were diagnosed with having a psychiatric illness. (Fig.1) A large part of mental morbidity is contributed by substance abuse and its consequences.

Total 22.5% of the mentally ill prisoners had alcohol dependence, 13.7% had addiction to tobacco, 23% had ganja addiction and 11.2% had opioid (smack) dependence. (Table 1)

In this study 1.4% of prison population had a diagnosis of primarily schizophrenia.

Prevalence of schizophrenia and bipolar disorder (severe mental illness) was highest in age group of 25-44 years, followed by 18-25 yrs and was lowest in 45-65 yrs. (Table 3)

The prevalence of schizophrenia was 1.4%, bipolar disorder was 1%, anxiety disorder was 1.6%, and substance induced psychosis 0.4%, organic psychosis 0.5%. (Table 2)

A higher rate of incidence of common mental symptoms was noted among under trials and first time offenders. In our study out of 79 prisoners with psychiatric morbidity 1.1% had depression; panic attack in 0.3%, phobia in 0.3% and one had OCD and two inmates had PTSD.

Age and Mental Illness:

The incidence of mental illness among prisoners was found to be highest among young age group of 18-24 years which showed 27 cases with mental disease followed by 25 to 34 years group with 21 cases, followed closely by the 35-44 years age group with 20 cases.

The prevalence of mental illness declined significantly in the higher age group of 45-54 years with only 9 cases of mental disease.

Only 2 cases of mental morbidity were reported in prisoners of more than 55 years of age. We have also tried to study the association of psychiatric illness with the nature of offence.

Out of the 79 prisoners with mental illness, 44 were convicted for committing violent offences. There were six cases of IPC 302, nine cases of IPC 304B, eight cases of sexual

offences (IPC 375, IPC 376), out of which one was charged under POSCO Act. There were seven cases of robbery (IPC 39), 13 cases of physical assault and six cases of 498A. (Fig. 2)

There were total 20 cases of property offences comprising of 13 cases of theft (379 IPC, 27) and 7 cases of fraud, 9 cases of IPC 25, 429, 411). There was only one case of illegal drug trafficking under NDPS Act, eight prisoners were convicted for the offence of kidnapping (IPC 363, 364, 366), seven were charged with public order offence, two were imprisoned for causing riots (IPC 147, 148) and one was punished for trespassing (IPC 352).

Four mentally ill prisoners were charged with abetment to suicide (IPC 306) which seems to be rare offence for a mentally unstable person

Fig. 1: Mentally Ill Prisoners

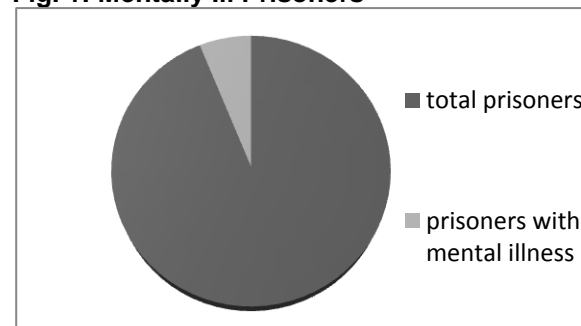


Fig. 2: Type of Offence Committed by Prisoners

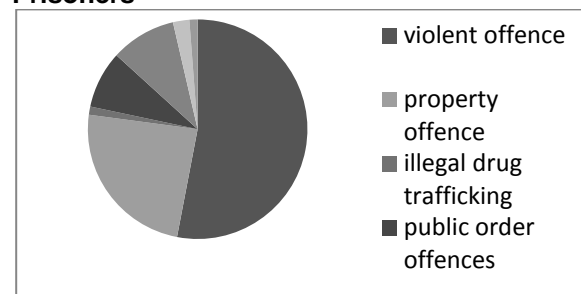


Table 1: Substance Abuse seen in Mentally Ill Prisoners

S.N.	Substance Abuse	Mentally Ill Inmates
1	Alcohol	18
2	Tobacco	11
3	Ganja	18
4	Opioid	9

Table 2: Diagnosis of Psychiatric Illness

S.N.	Psychiatric disorder	Current diagnosis
1	schizophrenia	17
2	Bipolar disorder	12
3	Acute neurosis	19(1.6%)
4	Panic attack	4(0.3%)
5	Phobia	4
6	PTSD	2
7	Depression	14(1.1%)
8	OCD	1
9	Drug induced psychosis	2
10	Organic Psychosis	6(0.5%)

Table 3: Age wise Distribution of Mental Illness

S.N.	Age Group (Yrs)	Mental Illness
1	18-24	27
2	25-34	21
3	35-44	20
4	45-54	9
5	55 and above	2

Discussion:

Our study provides reliable data relating to prevalence of mental disorders among male inmates of district jail in Etawah, Uttar Pradesh.

The observed jail incidence of Schizophrenia, BPD, depression, neurosis was found to be two times higher than normal population. Our results do not help us to determine whether mental illness was the triggering cause of crime commission or it was simply an after effect of the choking living conditions under confinement in the prison.

As we have not done the initial psychiatric assessment of prisoners at the beginning of their entry in jail, we cannot directly comment upon the effect of prison environment in aggravating the mental illness in predisposed individuals. Though we have found a predominance of violent offences among mentally ill prisoners, but it would be unfair to comment on the exact relationship between mental illness and criminal behavior.

In a study by Math et al [14] of 5024 prisoners, 79.6% of individuals were found positive for presence of mental illness or substance abuse in some form. They have also linked majority of mental morbidity with substance abuse and its consequences.

According to the record maintained by prison psychiatrist, 2.2% cases had a diagnosis of psychosis, 1.1% had schizophrenia. [7]

it was found that in our study 6.6% of prisoners were having psychiatric disorders which seems to be consistent with findings of Way et al. [8] According to a study by Herman et al in Australia, the prevalence rate of mental illness among male detainees came to be 6%. [9] Bhojak et al found a very high prevalence rate of 33% among prisoners in Rajasthan. [10]

A similar study by Goyal et al in state of Punjab found a prevalence rate of 23.8%. [11] In our study substance abuse was found among 70.8 % mentally ill prisoners, which is consistent with other studies. [11-13]

We were not able confirm whether the mentally ill patients were addicted to drug abuse before being diagnosed with mental illness or was the drug dependence an after effect of mental illness. A very interesting finding in our study was the inverse relation of mental illness

with increasing age. Maximum cases of psychiatric illness among prisoners were seen in the younger age group 18-24.

According to Bangalore prison study the prevalence rate was highest in 25-44 years followed by age group 18-25 years. [14]

Conclusion:

In our study we have observed that most of the mentally disturbed individuals are involved in commission of violent offences. There could be a significant reduction in crime rates if such individuals were timely diagnosed and treated, thus an early pick up rate by consultation with a psychiatrist is strongly recommended.

Prisoners have a right to get proper treatment just like any other human being. Thus the jail administration should make proper arrangements for psychiatric consultation and treatment of prisoners as per their needs.

Jail administrators should incorporate routine mental health evaluation of prisoners and screening of all incoming detainees by a psychiatrist once or twice in a week for early detection and treatment. This would help the prisoners to stand the complicating procedures of court trials also.

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Original Research Paper

A Study on Alcohol Abuse among Medical Students in A Semi Urban Area of West Bengal

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Abstract

Alcohol consumption has been recognized as one of the prevalent methods of stress-reduction among national and international medical students. The present study is a questionnaire based cross sectional mono-centric one, conducted in 3 batches of medical students of a semi urban teaching institute of West Bengal. The purpose of this study is to find out the prevalence of alcohol abuse including underlying cause of alcohol intake among medical students & its consequences. Data are analyzed by In Stat Graph pad 3.4 version. P values < 0.05 are considered as significant. This study reveals out of total 244 participants, 87 (35.66%) students consumed alcohol at least once in a life time with a male preponderance. Strong relationships exist between alcohol abuse and stress and depression in the students. Family history of alcohol consumption & living in hostel are two other factors accountable for alcohol use. Most of the alcohol users are just occasional drinker. In most cases, there is no deterioration of academic performances or relationship with parents or no adverse behavioral changes. Findings of this study will be of potential interest since today's medical students will become tomorrow's health promoters.

Key Words: Alcoholism, Medical students, Stress, Academic performance

Introduction:

Alcohol is one of the most common substances used for recreation and relief of stress in life among the youth in India. Besides contributing to relaxation and conviviality, alcohol is also associated with dependence, aggressive behaviour, violence, mental and physical illness. Alcohol effects on perceptions, motor skills, emotions, cognitions and psychological, behavioural aspects.

Changing social norms, urbanization, increased availability and marketing and poor level of awareness related to alcohol have contributed to increase abuse of alcohol among the young people. [1] Although a small proportion of drinkers experience direct adverse effects, studies have shown that an increase in per capita consumption of alcohol is positively correlated with an increase in alcohol related health and social problems. [2]

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Medical students are not exempted from this evil effect of substance abuse. Medical students are the cream students of the society and considered to be highly motivated and successful. Alcoholism will affect their academic and professional carrier.

Medical profession is one of the most delicate and responsible job as it deals with healthcare of the society. Alcohol abuse among medical students will decrease the quality of health service in the community.

Alcoholism is more common in medical students of urban setup, where lifestyle, availability of alcohol is easy. But it is also relevant in students of semi urban setup.

Due to lack of entertainment and recreation, study pressure and depression, students of semi urban colleges are more prone to alcohol addiction. This aspect was not studied much till date. The study is focused on to determine incidence of alcohol use among the medical students of this medical college in a semi urban set up and to identify various determinants of consumption of alcohol so that strategies might be formulated to incarcerate the alcohol intake among the would be doctors.

Material and Method: [3, 4]

This is a prospective cross-sectional study and study design is randomized single blind control study. The study is done among the MBBS students of three batches of a medical

college in semi urban area of West Bengal in August-September 2013. Sample size is 244.

Students who have given consent to this study are included as subjects and who give biased answer is excluded from the study.

After getting clearance from the institutional ethics committee, data collection is initiated. Pretested & pre validated questionnaire have been distributed among the students after brief introduction about the work.

Data are collected from all the students of three batches who have given the consent to answer those questions. It is single blind procedure; no identification is recorded to reduce bias. Questionnaire is structured in such a manner, so that biased answers can be eliminated. After screening data are analysed by percentage & tests of significance using statistical software In Stat Graph pad version 3.4. After analysis data are presented by tables.

Observations & Results:

Out of total 244 participants, 87 (35.66%) students consumed alcohol which ranges from the students who have taken alcohol once to frequent users/abusers. 157 (64.34%) participants have never tasted alcohol in life till this study period.

In this study out of total 145 males, 61(42%) are alcohol users, whereas out of 99 females only 26(26%) are alcohol users. P value is 0.017 (Chi square value 5.736, degree of freedom 1) which is statistically significant. But there is no statistically significant difference of male and female participants with alcohol intake in year wise manner. (Table 1)

In our study 150 students have siblings, among them 59(37%) are alcohol users, & among 94 students who have no siblings, 28(30%) are alcohol users. But P value is 0.168 which is statistically insignificant. (Table 2)

Out of total 174 students who belong to nuclear family, 63(36%) are alcohol users & out of total 70 students who belong to joint family, 24(34%) are alcohol users in this study.

P value is 0.892 which is not statistically significant. (Table 3) Present study revealed that total 119 students are under stress, among them 52(44%) use alcohol & out of total 125 students without any stress, 35(28%) are alcohol users.

P value is 0.015, which is statistically significant. (Table 4) In this study out of total 75 students having depression, 38(51%) use alcohol and there are 169 students without any depression, among them 49(29%) are alcohol users. P value is 0.002, which has got strong statistical significance. (Table 5)

Total 150 students have some sorts of extracurricular activities, among them 58(39%) use alcohol & out of total 94 students without any extracurricular activities, 29(31%) are alcohol users. (Table 6)

In our study there are total 65 students who have family history of alcohol consumption, 40(62%) use alcohol themselves, whereas out of total 179 students without any family history, 47(26%) are alcohol users. This is statistically significant. (Table 7)

Present study showed that out of total 184 hostellers, 75(41%) is alcohol users, but among total 60 day scholars, only 12(20%) use alcohol, which is significant. (Table 8)

Among total 87 alcohol users, almost half of them (48%) are occasional drinker i.e. consume alcohol less than once in 2-3 months duration. (Table 9) In this study almost 3/4th of alcohol users show no alteration in academic performances (Table 10) and among total 87 alcohol users, almost half of them (51%) told that their relationship with parents remained unaffected. (Table 11)

Only one fourth participants among alcohol users admitted to have some behavioural change in our study. (Table 12)

Discussion:

In our study, total consented participants were 244. Out of that, only 87 (35.66%) students consumed alcohol which includes the students who took alcohol or tasted once in life or occasional drinker or frequent users/abusers.

The prevalence of alcohol use of present study falls within the broad range (7-86%) of prevalence rate observed in different Indian & Foreign studies. [5-11]

A total of 157 (64.34%) participants have never tasted alcohol in life till this study period. Present study showed male preponderance regarding alcohol use, which is statistically significant. This may be due to social taboo of avoidance of alcohol by females.

Male predominance observed in present study corroborates well with other studies. [8, 10-15] The study reveals alcohol use has no statistically significant relation with the siblings' status or family types of the participants (P value is 0.168 and 0.892 respectively).

As the composition of study population with regard to nuclear or joint family is not uniform there might be a sampling error.

This study described strong association between presence of stress and depression in participants with alcohol consumption.

Here P value is 0.015 and 0.002 respectively both of which are statistically

significant. The reason behind this may be due to the fact that the youth try to get rid of the stressful situation by consuming alcohol.

This finding corroborates well with an Indian study by Kumar P, Basu D. [16]

Association with depression may be attributed to the fact that young students have strong belief that depression can be cured by intake of alcohol. Similar observation is also found in some other studies. [5, 7]

Being engaged with some sorts of extracurricular activities does not provide any protection from alcohol.

Having some family history of alcohol consumption among father, brother or other family members has got a strong impact on alcohol use by the students (P value is 0.000).

The cause behind that may be habit formation of the students from the childhood as they are very well accustomed with the practices of alcohol consumption among family members.

That strong association between alcohol use & family history of alcohol consumption is also observed in works of other researchers. [7, 16, 17] Statistical significant relationship exists between residential status of the participants with their habit of alcohol use (P value is 0.006), but this might be due to the fact that, the proportion of student living in hostel is much higher than day scholars in this institute.

In this study population, almost half of the alcohol users were occasional drinker, there was very few numbers of problem drinker.

That finding does not corroborate well with the finding of other studies [6, 15, 18] reason behind these may be easy accessibility of alcoholic beverages in other places or influence of the climatic conditions. In present study, academic performances of almost 3/4th of the alcohol users remain unaffected.

Reason behind this may be that most of the alcohol users are occasional drinker, & that less amount of alcohol does not have any impact on study pattern. Similar finding is observed in study conducted by Sandra E. File et al.⁽¹⁹⁾ But just the reversed observation i.e. better performance after alcohol use, is seen in the works done by David C. Clark et al. [14]

There is a little impact of alcohol use on bonding with parents, as in 35% cases, they maintain good relation, & in 50% cases, no change in relationship pattern.

This might be due to consumption of alcohol in trivial amount in most of the cases. There is no behavioural change at all in 3/4th of the alcohol users. This can be also attributed to the fact of infrequent use of insignificant amount of alcohol by most of the users.

From this study it is quite obvious that till now alcohol intake, in this Medical College of semi urban area is confined to infrequent and insignificant level. Identification of depression in students and psychological counselling or treatment of those pupil with stress management might be the solution of the budding problem of alcoholism of this newly established Medical college of the eastern India.

Medical colleges need to build up guidelines to modify the students psyche towards the alcoholism which is taken as a way out to alleviate apprehension, worry, and strain produced from academic pressure, workload of curricula.

Shortcomings:

This study accrued data based on a self-reported questionnaire by students which might have some subjective variations. Though Anonymous questionnaire are designed to curtail the problem of underreporting but cannot be overruled due to socio – cultural taboo.

Conclusion:

From the observation obtained from present study, it can be concluded that stress reduction among medical students is must. Emphasis should be given to learn the art of handling the depression or stress of life.

There will be prospects of group therapy and counselling to make them perfect future medicos. A non-punitive, compassionate attitude, with regular counselling for those brilliant but susceptible medical students who were mislaid in the vortex of alcohol abuse might save medical stall worth of the future.

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Table 1: Relationship of Gender of Participants of Three MBBS Batches with Alcohol Use

Alcohol use	1 st MBBS (n=79)		2 nd MBBS (n=98)		3 rd MBBS part I (n=67)		Total (n=244)	
	Male(n=45)	Female (n=34)	Male (n=58)	Female (n=40)	Male (n=42)	Female (n=25)	Male (n=145)	Female (n=99)
Yes	13(28.9%)	8(23.5%)	29(50%)	13(32.5%)	19(45.2%)	5(20%)	61(42%)	26(26%)
No	32(71.1%)	26(76.5%)	29(50%)	27(67.5%)	23(54.8%)	20(80%)	84(58%)	73(74%)

Table 2: Relationship of Sibling Status of Participants with Alcohol Use

Alcohol use	Have siblings n= 150	No siblings n= 94	Statistics
Yes	59 (37%)	28 (30%)	Chi square value 1.898, Degree of freedom 1, P=0.168
No	91 63%	66 (70%)	

Table 3: Relationship of Type of Family of Participants with Alcohol Use

Alcohol use	Nuclear family n=174	Joint family n= 70	Statistics
Yes	63 (36%)	24 (34%)	Chi square value 0.018, Degree of freedom 1, P=0.892
No	111 (64%)	46 (66%)	

Table 4: Relationship of Stress of Participants with Alcohol Use

Alcohol use	Stress present n= 119	No stress n= 125	Statistics
Yes	52 (44%)	35 (28%)	Chi square value 5.881, Degree of freedom 1, P=0.015

Table 5: Relationship of Depression of Participants with Alcohol Use

Alcohol use	Depression present n= 75	No depression n= 169	Statistics
Yes	38 (51%)	49 (29%)	Chi square value 9.711, Degree of freedom 1, P=0.002

Table 6: Relationship of Extracurricular Activities (ECA) of Participants with Alcohol Use

Alcohol use	Have ECA n= 150	No ECA n= 94	Statistics
Yes	58 (39%)	29 (31%)	Chi square value 1.217, Degree of freedom 1, P=0.270

Table 7: Relationship of Family History of Alcohol Consumption of Participants with Alcohol Use

Alcohol use	Positive family history n = 65	Negative family history n= 179	Statistics
Yes	40 (62%)	47 (26%)	Chi square value 24.357, Degree of freedom 1, P=0.000
No	25 (38%)	132 (74%)	

Table 8: Relationship of Residential Status of Participants with Alcohol Use

Alcohol use	Hostellers n=184	Day scholars n= 60	Statistics
Yes	75 (41%)	12 (20%)	Chi square value 7.619, Degree of freedom 1, P=0.006
No	109 (59%)	48 (80%)	

Table 9: Alcohol Users (n=87) According to Frequency of Alcohol Consumption

Daily	Once in week	Once in month	Once in 2-3 month	Occasionally
0	15 (17%)	12 14%	18 (21%)	42 (48%)

Table 10: Alcohol Users (N=87) According to Deterioration of Academic Performances

Deterioration of academic performances present	No deterioration of academic performances
25 (29%)	62 (71%)

Table 11: Alcohol Users (N=87) According to Relationship with Parents

Good Relation	Bad Relation	Deteriorating Relation	Relation Not Effected
30 (35%)	6 (7%)	6 (7%)	45 (51%)

Table 12: Alcohol Users (n=87) According to Behavioral Change

Yes	No
21 (24%)	66 (76%)

Original Research Paper

Trends of Unnatural Deaths in Allahabad, Uttar Pradesh

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Abstract

Pattern of unnatural deaths is a reflection of the prevailing social set up and mental health status of the population. Periodic evaluation of trends of unnatural deaths may provide valuable data to adopt effective preventive measures in this respect. The aim of this study is to find out prevalent pattern of unnatural deaths in the local society throughout the year and how it is affected by age, sex, habitat, marital status and season. This study was conducted during March 2014 to March 2015 in Department of Forensic Medicine and Toxicology, Moti Lal Nehru Medical College, Allahabad. Out of 2958 post-mortem cases, 2690 (90.94%) were unnatural deaths. 1748 (64.98%) victims were male and remaining 942 (35.02%) were female. Married 2372 (88.18%) cases outnumber unmarried 318 (11.82%). Accidental deaths accounted for 1648 (61.26%) cases, suicidal deaths for 457 (16.98%) and alleged homicidal deaths for 275 (10.22%) cases. Maximum deaths 641(23.83%) were observed in age group 25-35 years in both sexes. Highest incidence was observed in rainy season and least (603) in autumn.

Key Words: Unnatural deaths, Accidental deaths, Seasonal trend, Unmarried, Suicidal

Introduction:

Under section 174 of the Code of Criminal Procedure, 1973, the unnatural death defined as that

- (a) A person has committed suicide or
- (b) He has been killed by another or
- (c) He has been killed by an animal or
- (d) By a machinery or
- (e) An accident or
- (f) The person has died under circumstances raising a reasonable suspicion that some other person has committed an offence. [1]

These deaths may be accidental, suicidal and homicidal or remain undetermined. [2, 3] Undetermined deaths is a term used when information pointing to one manner of death is no more compelling than one or more other competing manners of death.

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Unnatural deaths known to claim substantial number of lives & the number are increasing owing to several factors.

Rapidly growing population in cities of India and unchecked urbanization of their periphery exposes more and more population towards hazards of urban lifestyle. Adaptation of stressful life style has become mandatory to live our dreams, if not to survive.

Transportation through rail, road and air has been recording newer heights every year by virtue of expanding rail and road network and enhancing number of vehicles on roads.

Fast moving modern world carries inherent risk of unexpected events results in loss of human lives. Pattern of unnatural deaths is a reflection of the prevailing social set up and mental health status of the population. [4]

The incidence of unnatural deaths is found to be persistently increasing [5] and hence periodic evaluation of trends of unnatural deaths may provide valuable data to adopt effective preventive measures in this respect. Such study was not carried out in Allahabad district in the recent past. So the present study was carried out to determine epidemiological aspects of unnatural deaths.

The unnatural deaths in district were reviewed with reference to age, sex, habitat, marital statues and & manner of death.

Material and Method:

Subjects for present study consists of cases of unnatural deaths among those brought

for autopsy in the mortuary of SRN Hospital associated with MLN Medical College, Allahabad. The data was collected from autopsy report, police inquest report, hospital record and relatives of each individual case.

Data collected was put into the master chart then subjected to computer, analyzed and presented in the form of tables with percentage.

Cases excluded from study were those died due to obvious natural causes such as myocardial infarction, spontaneous brain haemorrhage in absence of any surface trauma, septicemia other than caused by burn and injuries, etc. Postoperative deaths and death from combination of trauma and natural disease or condition were the areas of conflicts and so were excluded from the study.

Results and Discussion:

In the present study the number of unnatural death cases were 2690 (90.93%) out of total 2958 post-mortem done during the study period. (Table 1) This finding is comparable with incidences 92.56% [5], 90.25% [6], 88.13% [7] and 85.14% [8], and 74.69% [9] noted in other studies. 25-35 years (23.83%) was the most common age group affected which is the most dynamic age group.

It is followed by the age group 35 - 45 years (19.67%). The result is in confirmation to those of other studies. [4-8, 10]

Sex wise distribution of unnatural death (Table 2) reveals that 1748 (64.98%) victims were male and 942 were females (35.02%). Similar results were obtained by others with male proportion 62.74% [8] and 53.21%. [6]

In contrast to our result, Hussaini et al [9] reported 18.20% female victims but their study includes only adult female of age group 18 - 60 years among all unnatural deaths.

Most of the victims in both the sex are of age group 25-35 years, followed by age group 35-45 years (12.68%) in male and 15 - 25 years in female (8.88%). (Table 3) Ours is in agreement with the findings of Dere and Rajoo. [11] Understandably extremes of ages are found relatively immune as their activity is less.

Rainy season (27.14%) followed by summers (26.02%) witnessed highest number of unnatural deaths. (Table 5) Kumar [7] observed major cases in summer season (39.14%) followed by rainy (30.88%) and winter season (29.97%). The difference can be due to total four seasons considered for the present study.

In our study majority of victims 2372 (88.17%) were married while 318 (11.82%) died before their marriage (Table 2) which is in consolation with the findings of other studies. [8,

9] Present study also depicts that unnatural death victims residing in rural areas (61.85%) outnumbered those from urban areas (38.14%). (Table 2) Our finding was well supported by Kumar [7] who reported even higher incidence among rural population (86.57%). This difference may be due to more rural population in Varanasi region as compared to the urban.

As per 2011 census, 56.56% (2,079,790) population of Varanasi districts lives in rural areas of villages whereas 75.26% (4,481,518) population of Allahabad districts lives in rural areas of villages. [12]

In spite of rural population of Allahabad district being more than double of the Varanasi district, the higher percentage of unnatural deaths in rural population of Varanasi district may be because of larger number of the study cases by Kumar [7] as compared to the number of cases in our study.

In this study majority of unnatural death occurred in **accidents** of different kind seen in 1648 (61.26%) cases with 1141 (42.41%) males and 507 (18.85%) females. (Table 4) This observation is in agreement with other studies showing accident as a major manner of such deaths. [5-8, 10, 13]

However 87.5% cases reported in the study at Belgaum [13] seems primarily because of small number of cases of unnatural death in a year in comparison to other studies. Age groups involved in accident correlated well with that for unnatural deaths. However, incidence among females remained constant in all four seasons.

Suicidal deaths constitute 16.98% (n = 457) of all unnatural deaths. 281 (10.44%) males and 176 (6.54%) females ended their life by different methods. (Table 4) Similar rate of suicide were observed in other study as well. [8]

The higher incidence of suicide has been reported from Chandigarh (38.5%) [5] and Kolkata (29.8%). [10] The difference may be as a result of exclusion of those cases from present study where circumstances were controversial regarding manner as in poisoning, burns and drowning. The most common age group involved in both the sex was 25 - 35 years afterwards 35 - 45 year in male and 15 - 25 year age group in female found to bear high incidences of suicidal deaths.

Rainy season was particularly venerable with 137 (5.10%) cases of suicide. This may be attributed to various socio-economic factors like lack of employment opportunities, urbanization, break-up in the family support system, economic instability, etc. in this particular age group.

Homicidal deaths counted for 275 (10.22%) cases in which 157 (5.84%) were male

and rest 118 (4.38%) were females. Lower incidences of homicidal death reported from Latur (2.49%) [8] and Kolkata (2.8%) [10] Which reflected higher crime rates involving human body in eastern part of Uttar Pradesh.

The highest incidences of homicidal deaths were found in 25-35 years in male (1.52%) and 15-25 year age group in female (1.48%). Highest incidence seen in summer season in male (1.71%) while lowest (0.89%) in females. In 310 cases manner of death could not be ascertained at the time of study.

India being a poor country with a high unemployment and illiteracy rate, the crime rate should have been very high.

But, the results of the study conducted by Sharma et al [5] showed a negligible percentage of homicidal deaths.

However, in this part of country, lower literacy rate, poverty, low degree of moral values, daring ignorance towards law of the land, challenges in maintaining law and order by the law enforcing agencies due to various reasons and delayed justice and acquittal due to insufficient scientific evidence may be the reasons for higher homicidal deaths.

Conclusions:

It is always fruitful to accumulate data for analysis of unnatural deaths in society as it is a mean to access the socio-economic status and mental health of the society. Accidental deaths are major contributors and young age group is favourable victims although no age group is completely immune.

Suicidal tendencies and suicide are still major preventable causes of such deaths.

Increasing rate of homicidal deaths has been noticed and reflecting disorganized social harmony. All measure must be taken to adopt safe driving practice on the roads and secure industrial operations at any cost.

Even if accidents are not completely preventable, effective and prompt emergency medical services may prove remedial to save the lives of the victims and prevent the loss of youth capital of country.

Crime and frustration in youth should be attended through enhanced employment chances. More number of homicidal and suicidal deaths can be brought down by improving the literacy rate and providing moral education to our youth from beginning.

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Table 1: Incidence of Unnatural Death

Type of Deaths	Cases (%)
Natural death cases	268 (9.06)
Unnatural death cases	2690 (90.93)
Total Post-mortem Cases	2958

Table 2: Cases According to Sex, Residential Status and Marital Status

Sex	Cases (%)
Males	1748 (64.98)
Females	942 (35.02)
Total	2690
Residential Status	Cases (%)
Rural	1664 (61.85)
Urban	1026 (38.14)
Total	2690
Marital Status	Cases (%)
Unmarried	318 (11.82)
Married	2372 (88.17)
Total	2690

Table 3: Age & Sex Wise Distribution

Age Grps (Yrs)	Male (%)	Female (%)	Total (%)
0-5	14 (0.52)	9(0.33)	23(0.85)
5 - 15	77(2.86%)	31(1.15)	108 (4.01)
15 - 25	264(9.40)	228(8.88)	492(18.28)
25 - 35	394(13.53)	247(10.30)	641(23.83)
35 - 45	341 (12.68)	188(6.98)	529(19.67)
45 - 55	229 (7.69)	101(4.57)	330(12.26)
55 - 65	138(4.75)	77(3.23)	215(7.99)
>65 Years	291(10.44)	61(2.63)	352(13.08)

Table 4: Age & Sex Wise Distribution of Different Manner of Death (N = 2690)

Age Group (Yrs.)		Suicide	Homicide	Accident	Undetermined
0-5	M	-	02 (0.07%)	10 (0.37%)	02 (0.07%)
	F	-	03 (0.11%)	05 (0.18%)	01 (0.03%)
5-15	M	04 (0.14%)	08 (0.29%)	53 (1.97%)	12 (0.44%)
	F	07 (0.26%)	08 (0.29%)	13 (0.48%)	03 (0.11%)
15-25	M	48 (1.78%)	23 (0.85%)	172 (6.39%)	21 (0.78%)
	F	47 (1.74%)	40 (1.48%)	101 (3.75%)	40 (1.48%)
25-35	M	81 (3.01%)	41 (1.52%)	242 (8.99%)	30 (1.11%)
	F	56 (2.08%)	28 (1.04%)	130 (4.83%)	33 (1.22%)
35-45	M	64 (2.37%)	34 (1.26%)	225 (8.36%)	18 (0.66%)
	F	31 (1.15%)	16 (0.59%)	112 (4.16%)	29 (1.07%)
45-55	M	40 (1.48%)	26 (0.96%)	137 (5.09%)	26 (0.96%)
	F	16 (0.59%)	09 (0.33%)	64 (2.37%)	12 (0.44%)
55-65	M	21 (0.78%)	11 (0.40%)	91 (3.38%)	15 (0.55%)
	F	13 (0.48%)	08 (0.29%)	44 (1.63%)	12 (0.44%)
>65	M	23 (0.85%)	12 (0.44%)	211 (7.84%)	45 (1.67%)
	F	06 (0.22%)	06 (0.22%)	38 (1.41%)	11 (0.40%)
Total	M	281(10.44%)	157 (5.83%)	1141(42.41%)	169 (6.28%)
	F	176 (6.54%)	118 (4.38%)	507 (18.84%)	141 (5.24%)

Table 5: Seasonal Variation in Different Manners of Unnatural Deaths

Season		Suicide	Homicide	Accident	Undetermined	Total Cases
Summer (March-May)	M	79 (2.94%)	46 (1.71%)	302 (11.23%)	45 (1.67%)	700 (26.02%)
	F	36 (1.34%)	24 (0.89%)	127 (4.72%)	41 (1.51%)	
Rainy (July-August)	M	79 (2.94%)	41 (1.52%)	315 (11.71%)	49 (1.82%)	730 (27.14%)
	F	58 (2.16%)	34 (1.26%)	128 (4.75%)	26 (0.97%)	
Autumn (Sept-Nov.)	M	60 (2.23%)	41 (1.52%)	236 (8.77%)	34 (1.26%)	603 (22.42%)
	F	42 (1.54%)	30 (1.12%)	126 (4.69%)	34 (1.26%)	
Winter (Dec.-Feb.)	M	63 (2.34%)	29 (1.07%)	288 (10.71%)	41 (1.51%)	657 (24.42%)
	F	40 (1.48%)	30 (1.12%)	126 (4.69%)	40 (1.48%)	
Total	M	281(10.44%)	157 (5.83%)	1141 (42.41%)	169 (6.28%)	N = 2690 (100%)
	F	176 (6.54%)	118 (4.38%)	507 (18.84%)	141 (5.24%)	

Original Research Paper

Epidemiological Study of Two Wheeler Accident Victims In Rural South India

¹Ananda Reddy, ²Balaraman R

Abstract

Vehicular accidents are steadily mounting up on the Indian roads, so critical analysis of causative factors is pivotal to prevent them in future. This study was designed to assess the epidemiological factors constrained in two wheeler accident victims. It's a cross-sectional study of two wheeler related deaths autopsied at the IGGGH & PGI in Pudducherry. Data gathered by interviews, autopsy and results were analysed. Two wheeler crashes were accountable for 10.85% of all 1318 autopsies. Most vulnerable are males (81%) and individuals between 16-29 years (35%). Most victims were from rural area (47%), Hindus (79%), married (49%) and middle income (62%) group. These fatal events frequent on national highways (36%), evening rush traffic hours (42%) and involves motorcycle occupants (64%) and pedestrians (24%). Prime RTA contributors like human errors; vehicle and road factors were evaluated. Importing awareness and education among vulnerable population alleviate the frequency of accidents and dreaded outcomes.

Key Words: Two wheeler accidents, Fatalities, Motorcycles, Human errors

Introduction:

Worldwide, every day about 3400 people die due to road traffic accidents (RTA) and predicted to result in death of around 1.9 million people annually by 2020. [1]

Nearly 90% of world's RTA fatalities are occurring in low and middle-income countries, whereas highly motorised countries contribute very little though they accommodate over 60% of world's vehicles. [2] RTAs are the sixth leading cause of death in India (over 1, 30, 000 deaths / year) and responsible for huge share of emergency hospitalization, socio-economic burden, disabilities and deaths of young and middle aged population. [3]

Currently two wheelers are major component of road traffic, preferred family vehicle and they have taken mega share of road accidents. Motorcycle users, pedestrians and pedal cyclists are vulnerable road users. [1]

They are directly exposed to impacting vehicle or hard objects during collision and likely to get injured severely. Even though two-wheeler related RTA deaths are very familiar on Puducherry roads and seemed to have been overlooked. Hence this study is aimed at interpreting epidemiological factors in two-wheeler accidental deaths.

Materials and Methods:

This study was conducted at the Indira Gandhi Government General Hospital and Postgraduate Institute, Puducherry (Union territory in South India) from 1st January to 31st December 2013.

Among the medico-legal autopsies conducted in the study centre, all two wheeler (motorized and non-motorized) related accidental deaths were included in this observational, cross section study.

Data of demographic characteristics and epidemiological factors behind every subject died in two wheeler accident were collected by personal interview with the concerned police authorities, relatives of the deceased, eye witnesses and survivors in the same accident.

This was further evaluated to understand the human, vehicle and road factors in causing accidents. All body findings including injuries were personally examined at autopsy and correlated with the history.

RTA deaths involving other than two wheeler vehicles, non-vehicular accidents & injuries, and non-confirmed cases are excluded

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from this study. The collected data was analyzed manually as well as using the Microsoft excel package (2010). Statistical analysis was done for frequencies, percentages, proportions & ratios and results were interpreted.

Observations and Results:

Overall, 1318 medico-legal autopsies were conducted in the study centre during calendar year 2013, among them 312 are RTA cases and 143 cases are purely two wheeler related RTA deaths. Accordingly, two wheeler mishaps are accountable for 45.8% of RTA deaths and 10.85% of all autopsies.

Two wheeler fatalities were significantly higher in males (81%) than females (19%) with a gender ratio of 4.3:1. More victims were in the age group of 16-49 years (68%), but young adults between 16-29 years (35%) are vulnerable to accidents. (Table 1)

The majority of the victims belong to rural population (47%), Illiterates and Low education (70%), Hindu religion (79%), Employed & students (48%) and middle income (64%) group. (Table 2)

Majority of the fatal two wheeler accidents occurred in rainy season, weekends (40%), daytime (62%), and nearly half of them reported during evening rush traffic hours. (Table 3) Fatal accidents happened more on national highways (36%) and less on village roads (13%). Two wheeler riders (46%) & pillion riders (18%) were affected maximum than pedestrians (24%), and pedal cyclists (09%) were least affected in this study.

The geared motorcycles (78%) are often involved in fatal accident than mopeds (13%) and pedal cycles (06%).

Maximum victims were brought to hospital within an hour of accident and rest were found dead at the scene of accident. Nearly three-fourth of victims was died within first 24 hours of accidents and only four cases have been survived more than a week. (Table 4)

The human errors were found to be the commonest causative factor for fatal accidents compared to vehicle and road contributors.

The most important causative factors are motorcycle occupants not-wearing of helmets (84%), riders doesn't have driving license (33%), driving under intoxication (27%), over-speeding (15%), bad & narrow roads (28%), and over- taking (10%). (Table 5)

Discussions:

Many social factors like unemployment, poverty & education forced rural people to migrate into urban / suburban areas, and to adapt urbanization and motorization.

Two wheelers are preferred transportation vehicles for vast Indian families as they are cheaper, gives better mileage, carry at least 2 to 3 passengers, easy to park & ride in traffic congestion. Two wheeler accidents are contributed for nearly half of total RTA deaths, two wheeler users and pedestrians have the highest rates of fatal injuries. [4, 5]

The several factors blameworthy for high two wheeler accident are more vehicles on Indian traffic, Vehicle vulnerability, poor road status, coupled with non-adherence of riders to road safety rules & traffic laws.

Males spend lots of their time in travelling and various outdoor activities, so they are prone to accidents and having unfavourable gender ratio. [6] Individuals between 16 to 49 years of age are regularly tangled in fatal RTA and more so by the young adults.

Earlier studies also reported that most victims were males in the age group of 20-49 years, [7, 8] 18-37 years [9] and 18-44 years. [10] These people are more likely to expose, travel lot, take risks and involve in fatal accident, and may lead to huge financial burden to the families and disabled permanently.

Contrast to earlier studies, the most victims are rural and semi-urban inhabitants in the present study as it was conducted in rural population.¹¹ Greater proportion of victims in two wheeler RTA are illiterates and low education personals and it may be correlated with poor road sense / Ignorance of road safety rules and traffic sense. [7, 12]

High incidence of accidents during summer and rainy seasons are closely related to travelling activity of people, deterioration of roads and environmental factors. [7]

Road accidents are occurring more during weekends, daytime and at evening hours and these findings are closely resembles other research studies. [7, 8]

The crest of accidents during these hours coexist with soaring traffic density, traffic congestion, urge to reach destination in time, high people movements to office, schools, factories, business place & house) and failure to follow traffic rules. Agriculturists here use two wheelers (pedal cycle or motorcycles) a lot for travelling, but they have little or no knowledge on road safety rules & laws.

Indian motorcyclists and pedestrians are vulnerable to fatal accidents, whereas pedestrians & pedal cyclists, Pedestrians & car occupants are vulnerable to accidents according to studies conducted abroad. [13]

Narrow roads, Lack of footpaths & subways, low traffic sense and road safety

knowledge among rider and pedestrians makes them vulnerable for road traffic accidents on Indian roads. [14] The reasons for high incidence of accidents on the highways (National & State) and city roads might be these roads are busiest, very narrow, too much traffic during peak hours, no traffic signals at junctions and no strict enforcement of road safety rules.

It is noteworthy that majority of victims were brought alive to hospital in two wheeler accidents and excess of them were died in first 24 hours. Multifactorial involvement in accident outcome are such as the severity of accident, transportation problems, lack of medical emergency services, insufficient & untrained staff and facilities in the hospitals.

Hence the timely availability of quality emergency medical services to the injured will play a crucial role in preventing mortalities and disabilities. Too many factors (human, vehicular and roadways) contribute for causation of two wheeler accidents, and human errors are responsible for many fatalities.

Though certainly know the fact that helmets reduce head, facial and brain injuries significantly, still most of the motorcycle occupants were found not-worn helmet at the time of accident. Driving a vehicle under intoxication is a crime, because alcohol intoxication impairs driving ability of a person and level of impairment is directly related to blood alcohol concentration. [15]

Use of mobile phones while driving a vehicle is associated with a high chance of accidents and hence traffic laws prohibit the use of these gadgets by the rider while driving.

Many countries have imposed restrictions on the high speeding, legal age for driving license, graduate driver licensing, increase in fine & withdrawal of Driver's license and speed control interventions have led to significant reduction in traffic accidents. [16]

Conclusions and Suggestions:

Fatalities are remarkably high in motorized two wheeler accidents and most victims are males and young adults.

Enhanced awareness and education to the general public and vulnerable road users on obeying traffic rules, use of road safety and protective measures while driving will mitigate accidents. Fatal accidents were frequently occurs in daytimes, peak hours of traffic and maximum victims are died within first 24 hours.

Availability of excellent emergency trauma care centres & ambulance services during the early hours of trauma in rural India will dramatically reduce mortalities and disabilities.

Though multiple factors interacted in causation of RTA, they can be prevented to certain extent by implementing and enforcing traffic laws strictly such as drunken driving, crash helmets, mobile usage, and speed limit.

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Table 1: Age and Gender-wise Distribution of Fatal Two-wheeler Accident Cases

Age grps (Yrs)	Male (%)	Female (%)	Total (%)
0 - 9	03 (02)	01 (01)	04 (03)
10 -19	14 (10)	03 (02)	17 (12)
20 -29	30 (21)	06 (04)	36 (25)
30 -39	23 (16)	05 (03)	28 (20)
40 -49	13 (09)	06 (04)	19 (13)
50 -59	18 (13)	02 (01)	20 (14)
60 -69	09 (06)	03 (02)	12 (08)
> 70 years	06 (04)	01 (01)	07 (05)
Total	116 (81)	27 (19)	143 (100)

Table 2: Demographic Characteristics of Deceased in Fatal Two-Wheeler Accidents

Demographic Characteristics	Cases (%)
Native area or Domicile	
Rural	67 (47%)
Semi-urban	50 (35%)
Urban	21 (15%)
Unknown	05 (03%)
Total	143(100%)
Educational Status	
Uneducated	36 (25%)
Primary School	23 (16%)
Secondary & Intermediate	42 (29%)
Graduation & above	33 (23%)
Unknown	09 (06%)
Total	143(100 %)
Socioeconomic Status	
Lower	31 (22%)
Lower Middle	39 (27%)
Upper Middle	50 (35%)
Higher	17 (12%)
Unknown	06 (04%)
Total	143 (100%)
Marital Status	
Single	61(43%)
Married	70 (49%)
Divorced/ Separated	04 (03%)
Widow	01 (01%)
Unknown	07 (05%)
Total	143 (100%)
Occupational Status	
Unemployed	26 (18%)
Employed & Business	36 (25%)
Students	33 (23%)
Housewives	11(08%)
Agriculturist & Laborer	37 (26%)
Total	143 (100%)

Table 4: Epidemiological Factors in Fatal Two Wheeler Accidents

Epidemiological Factors	Cases (%)
Types of Road	
National Highway	52 (36%)
State Highway	25 (17%)
City Roads	33(23%)
Village Roads	18(13%)
Approach Road	12 (08%)
Unknown	03(02%)
Total	143(100%)
Two Wheeler Involved	
Geared Motorcycle	112 (78%)
Scooter	05(03%)
Moped	18(13%)
Pedal Cycle	08(06%)
Unknown	02 (01%)
Total	143(100 %)
Road User Status	
Pedestrian	34 (24%)
Rider	65 (46%)
Pillion Rider	26 (18%)
Pedal cyclist	13 (09%)
Others	02 (01%)
Unknown	03 (02%)
Total	143 (100%)
Time to Hospitalization	
Non- hospitalized	37 (26%)
Within an hour	79 (55%)
2-4 hours	21 (15%)
5-12hours	04 (03%)
12-24hours	01 (01%)
2 days onwards	01 (01%)
Total	143 (100%)
Survival Period	
Spot death	41 (29%)
Transpiration / <1hr hospital	45 (31%)
2-6 hours	21 (15%)
7-24 hours	15 (11%)
2- 6days	17 (12%)
7 days or more	04 (02%)
Total	143 (100%)

Table 3: Distribution of Fatal Cases According to Days and Time

Days & Time (24hr)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total (%)
06:01-09:00	3	3	2	2	2	3	4	19 (13)
09:01-12:00	3	2	3	2	4	6	5	25 (17)
12:01-15:00	2	1	4	0	1	4	2	14 (10)
15:01-18:00	5	3	3	3	3	9	6	32 (22)
18:01-21:00	3	5	4	4	4	4	5	29 (20)
21:01-24:00	1	2	2	2	2	3	2	14 (10)
00:01-06:00	2	1	2	0	1	2	2	10 (07)
Total	19 (13%)	17(12%)	20(14%)	13(09%)	17(12%)	31(22%)	26(18%)	143(100)

Table 5: Contributing Factors for Causation of Fatal Accidents*

Human Errors	Cases (%)	Vehicle Factors	Cases (%)	Road Factors	Cases (%)
Drunken driving	39 (27)	Over speeding	22 (15)	Congested & Narrow road	25 (17)
Mobile usage	16 (11)	over crowding	06 (04)	Speed breakers	04 (03)
No- helmet	121 (84)	Over taking	15 (10)	Bad road	13 (09)
No driving license	47 (33)	Engine fault	03 (02)	Poor lighting	05 (04)
Negligent or Rash driving	22 (15)	Brake failure	02 (01)	Improper Crossing	03 (02)
Abiding traffic rules	17 (12)	Poor light	03 (02)	Improper/No traffic signals	07 (05)
Total	262		51		58

*Multiple responses

Original Research Paper

Demographic Profile and Pattern of Death of Foetus and Infants: An Autopsy Based Study in Indore District (MP)

¹Ashok K. Rastogi, ²Bajrang K. Singh, ³Sanjay K. Dadu

Abstract

It is a post-mortem based study, in this study infant and foetus included. Total 32 cases included out of which 29 cases foetus and 03 cases were infants. Out of which 53.13% cases were female, 25% cases were male and 21.88% cases sex could not determine. Most of the foetus died in 2nd & 3rd trimester contributing 75% cases, most commonly in 2nd trimester 43.75% cases followed by 3rd trimester 31.25% cases. Least number of cases had seen in first trimester 15.63%. Maximum numbers of cases was still birth 59.38%. After autopsy examination we found there were 50% cases in advance stage of decomposition and 50% (16) cases were in early stage of decomposition or decomposition not started. Even after implementation of strong act pre conceptional & prenatal diagnostic technique act (PC & PNDT Act), it is not so effective to control female feticide and infanticide. Premarital affairs are increasing the cases day by day resulting increasing illegal abortion day by day.

Key Words: Infant, Foetus, Still birth, Decomposition, Autopsy examination, Trimester

Introduction:

The reproductive mortality was classified into four components; stillbirth (28-40 weeks of foetus-hood), early neonatal death (day 0-6), late neonatal (day 7-30) and post neonatal death (day 31-364). [1]

The term infanticide comes from the Latin word **in-fans** meaning unable to speak. Infanticide means the unlawful destruction of a newly born child within one year of life; **Neonaticide** is the killing of a baby within 28 day of its birth. It is the most common crime and the perpetrator is usually the mother.

Filicide is the deliberate act of a parent killing his or her own son or daughter. [2]

Infanticide was common in all well-studied ancient cultures, including those of ancient Greece, Rome, India, China, and Japan.

The Jews and Christians were clearly against the taking of human life and generally forbid the killing of any newborn infant.

Maimonides, the renowned Jewish philosopher and physician, pointed out that a single man was first created in Genesis "to teach us that if any man destroys a single life in the world, scriptures imputes it to him as though he has destroyed the whole world." [3]

The end of the practice of infanticide in the ancient world coincided with the rise of Christianity as a major religion. The practice was never completely eradicated, and even continues today in areas of extremely high poverty and overpopulation. [4, 5] Sexism was particularly prominent in Arabia before the time of Prophet Mohammed (570-632 AD).

The Holy Koran introduced reforms that told us the occurrence of this bad practice of female infanticide before Islam he asked with censure for example how would a father account for his actions, "When the female child that had been buried alive shall be asked for what crime she was put to death?" [3]

Other reforms included the prohibition of infanticide due to economic causes.

The phenomenon of female infanticide is as old as many cultures and has likely accounted for millions of gender-selective deaths throughout history. It remains a critical concern in a number of "Third World" countries today, notably the two most populous countries on earth, China and India. [3, 6]

Studies in India have indicated three factors of female de-selection in India, which are the economic utility, socio- cultural utility, and religious functions.

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In China where large number of infanticide occur, the cause is differ as it is due to one child policy which used by the governorate, in which any family prevented to has more than one child, this leads to increase of female infanticide due to male over referral. [7]

Filicide is also practiced in developed countries. In the United States during 1992 parents committed 290 murders of their children.

Large-scale studies of filicide have revealed that younger children are at most risk, especially those children less than six months of age. After that point, the risk lowers steadily, only to rise again in adulthood. [8]

Aims and Objectives:

- To know the demographic profile, the predisposing factors, methods of infliction and
- The role of the Forensic Pathologist in the diagnosis of suspected infanticide cases

Material and Method:

This study was done in Department Forensic Medicine, Mahatma Gandhi Memorial Medical College Indore (MP).

Post-mortem examination of all cases mentioned in this study conducted in mortuary of this department in year 2012 -2013. Cases included in this study were all intra-uterine death and infant below one year of age.

Observation and Discussion:

During study period total 32 infants and foetal post-mortem was conducted in our department. In our study 53.13% (17) cases were female, 25% (08) cases were male and 21.88% (07) cases sex could not be determined. (Table 1) A study done at Assiut Medico-legal Department during the period of 2003-2005 showed that Females represented 53.13% that is equal percent found in our study. [9]

In 75% (24) cases foetus died in 2nd & 3rd trimester, most commonly in 2nd trimester 43.75% followed by 3rd trimester 31.25% cases, least number of cases seen in first trimester 15.63%. Our findings were totally different to Rajashree Pradhan et al study which showed maximum abortion rate 60.70% in second half of 1st trimester and lowest incidence in first half of 1st trimester abortion 1.56%. [10]

Our study also differ to the Shiva Kumar BC et al and Roy Chowdhury et al study in which they also observed that majority of women 84.7% and 95% were aborted in 1st trimester of their gestation period. [11, 12] This difference was due to the post-mortem study and in first trimester foetus were so small and it easy to dispose and destroy.

Infants contributed 09.38% cases. No case reported of male foetus within 1st trimester in our study and also no case reported in male infants. Most commonly male foetus died in 2nd trimester 18.75% (06) cases followed by 3rd trimester 06.25(02) cases. Most commonly female foetus died in 3rd trimester 21.88% (07) cases slightly less in 2nd trimester 18.75% (06) cases, least number of cases reported in 1st trimester 03.13% (01) case.

In 07 cases sex could not be determined as foetus was so small, less than 04 month intra uterine life or advance stage of decomposition.

Foetus belongs to less than 04 month intrauterine life sex determination not possible by physical examination or by the autopsy examination. [13]

Sex could not be determined in 12.50% (04) cases in 1st trimester, 3.13% (01) cases in 2nd trimester and 6.25%(02) cases in 3rd trimester. Maximum numbers of case 59.38% were still birth in this study. (Table 2)

Similar findings were seen in Naidu S et al and Rajashree Pradhan et al study where among all perinatal deaths, two thirds (66.66%) were still births and (88.57%) were still born babies respectively. [14, 10]

The live birth and dead born foetus contribute 12.50% (04) separately, 15.63% (05) cases by the autopsy examination longevity could not be determined due dead body was in advance stage of decomposition (Table 2).

Study done by Sawsan A et al they reported that the cause of death couldn't be identified in about 46.88 % of cases due to advanced putrefaction. [9]

In this study duration of death calculated with the help of post-mortem changes seen over the dead bodies during autopsy. Death within 24hours and more than 02 days contribute similarly 40.63% (13) cases separately. Duration of death between 24hours to 48 hours was 18.75% (06) cases. (Table 3)

In present study during autopsy examination some dead bodies were known hospital death and in some cases finding present over the dead body suggest that foetus or infant died in the hospital i.e. hospital tag present around the wrist or ankle joint and written as B/O mothers name W/O father name or hospital dressing or other tag or intravenous cannula or other hospital interventions present over the body.

Total hospital death were 34.38% and non-hospital were 59.38%, while in 6.25% cases it was not decided by the autopsy examination whether hospital death or non-hospital death. (Table 4) Identification of dead bodies

established by autopsy examination and some cases were known identity. The known cases were 37.50% and unknown identity cases were 62.50% in our study. (Fig.1)

In this study we observed that in 50% cases advance stage of decomposition was seen during autopsy examination and in 50% cases there was either early stage of decomposition or decomposition not started. (Fig. 2)

Conclusion:

During this period total 32 infant and foetal post-mortem were conducted. In our study 53.13% (17) cases were female, 25% (08) cases were male and 21.88% (07) cases sex could not determined. Most of the foetus died in 2nd & 3rd trimester was 75% (24) cases, most commonly in 2nd trimester 43.75% (14) cases.

Maximum number of cases was still birth 59.38% (19); the live birth and dead born foetus contribute 12.50% (04) separately.

Death within 24hours and more than 02 days contribute similarly 40.63% (13) cases separately. Duration of death between 24hours to 48 hours was 18.75% cases.

Identification of dead bodies was established by autopsy examination and cases of known identity were 37.50% and unknown identity cases were 62.50%. During autopsy examination we found 50% cases were in advance stage of decomposition and 50% cases were in early stage of decomposition or decomposition not started.

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Table 1: Age and Sex wise Distribution

Age grps (month)	Male (%)	Female (%)	Undetermined (%)	Total (%)
<04 IUL	00(0.00)	01(3.13)	04(12.5)	05(15.63)
>04-07IUL	06(18.75)	06(18.75)	01(3.13)	14(43.75)
>07-10 IUL	02(6.25)	07(21.88)	02(6.25)	10(31.25)
Infants	00(0.00)	03(9.38)	00(0.00)	03(9.38)
Total	08(25.00)	17(53.13)	07(21.88)	32(100.0)

Table 2: Cases According to Longevity

Longevity	Cases	%
Still birth	19	59.38
Live birth	04	12.50
Dead born	04	12.50
Undetermined	05	15.63
Total	32	100.0

Table 3: According to Time since Death

Time since Death	Cases	%
< 24 hours	13	40.63
>24-48 hours	06	18.75
> 2days	13	40.63
Total	32	100.0

Table 4: According to Place of Death

Place of Death	Cases	%
Non hospital death	19	59.38
Hospital death	11	34.38
Unknown	02	06.25
Total	32	100.0

Fig. 1: According to Identity

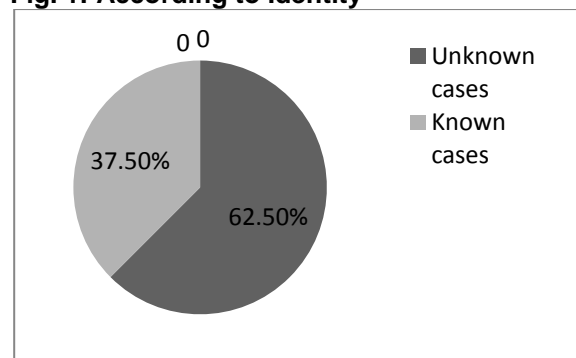
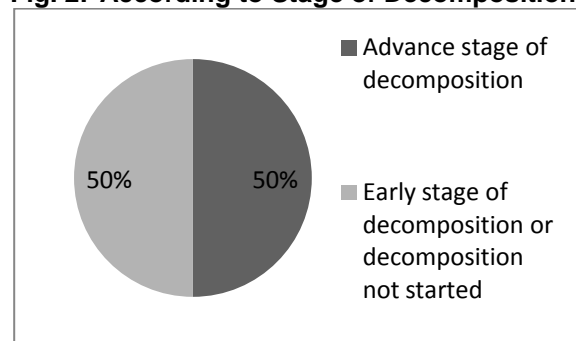


Fig. 2: According to Stage of Decomposition



Original Research Paper

A Study on Various Methods Adopted For Masquerading Murders

¹Hema Sundar Pydi, ²P. Umamaheswara Rao

Abstract

Homicide is killing of a person by another. With ever increasing knowledge availability to people, fear of conviction and evolving technologies, people are trying to showcase the crime in other way. Here we studied the various methods employed by the accused, to showcase the murdered person in a way other than the actual method of murder. A total of eight such cases were found during the study period. 1) wife was stabbed to death, body dismembered at joints and disposed at various garbage bins, 2) thief was throttled to death and thrown over road to showcase as RTA, 3) Member of a robbery gang was hanged, cuts were made over is wrist to showcase as suicide, 4) old woman was throttled to death and thrown into big drainage to show as accidental drowning, 5) worker was throttled to death and left long in an isolated place till decomposition, 6) a person was beaten to death over neck and thrown over road to show as an RTA, 7) A person was beaten to death over head and thrown in shallow drain to show as accidental drowning, 8) a woman was smothered to death and burnt to show as suicidal burns.

Key Words: Murder cases, Post-mortem examination, Crime scene visit, Methods of masquerading

Introduction:

Homicide means causing death of a person by another person. This homicide may be lawful or unlawful. Lawful homicide includes justifiable and excusable homicides. Unlawful homicide includes murder (S.300.IPC), culpable homicide (S.299IPC), culpable homicide amounting to murder (S.304 A.IPC), rash or negligent homicide (S.304A.IPC). [1, 3, 4]

There may be several reasons for committing a murder, like jealousy, rivalry, infidelity, want of money (burglary), unsoundness of mind, war, so on. The method chosen to commit a homicide is equally varied, like shooting, stabbing, poisoning, fire, asphyxia, shaken baby syndrome, vehicular accidents, etc.

As per survey by Canadian Centre for Justice Statistics, stabbing, shooting & beating were the common methods of homicide during 2008-2012. [2] With ever increasing knowledge, availability to people, fear of conviction and evolving technologies, people are trying to showcase the crime in other way.

This is done to mislead the investigation and escape conviction. Here we studied the various methods employed by the accused, to showcase the murdered person in a way other than the actual method of murder.

Materials and Methods:

The Study period was from June 2012 to May 2014. An average of 1100 cases is being brought to this department for autopsy per year.

The information was gathered from Inquest report, Post-mortem examination, Crime scene visit, Police investigative information and Histo-pathological reports.

The case reports in which masquerading of murders were done, are described in this paper briefly:

Case One:

A tailor found his wife to be in an unacceptable position with some other man.

Fig. 1: Stab Wound on front of the Chest



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Out of anger, he stabbed her to death with scissors, dismembered her at joints, boiled them in turmeric water and disposed the parts at different garbage bins.

Post-mortem examination showed stab in front of chest on lower side. Multiple Scalds in burnt areas. Anatomical disarticulation was attributed to his prior profession as chicken meat vendor. (Fig. 1, 2)

Fig. 2: Dismembered Lower Limbs



Case Two:

A thief went for stealing petrol in a petrol shop. Accidentally he caught fire, which drew the owner's attention. Owner throttled the thief to death and threw him over road to show as RTA. Autopsy showed contusions over neck, hyoid bone fracture and burns over limbs.

Case Three:

An old woman was throttled to death. He was thrown in a big drainage to show as an accidental drowning. Autopsy revealed fracture of hyoid bone and no significant water in lungs and stomach. Diatom test was also negative.

Case Four:

A building owner throttled a worker, kicked and squeezed the testicles over sexual jealousy. Then he left the body in the under construction building for 3 days so that decomposition masks the cause of death. Autopsy showed contusions of neck, abrasion over scrotum and contusion of testicles.

Case Five:

A RTC bus driver was beaten over neck with wooden log. He was then thrown over road to showcase as a Road Traffic Accident. Post-mortem examination showed contusion of back of neck and C4-C5 vertebrae fracture with cord contusion.

Case Six:

Three members robbed an ATM. They met in a private apartment and had alcohol. Due to some clash, two members killed the third one

by hanging. Cuts were made over left wrist and neck to showcase as suicidal hanging. Chili powder was sprayed over the body.

Post-mortem examination showed congestion of face, ligature mark and cuts over his left wrist, front of neck. (Fig. 3, 4)

Fig. 3: Death by Hanging



Fig. 4: Cut marks on Left Wrist



Case Seven:

Dispute occurred between a man and his three other friends.

Fig. 5: Body found in Shallow Water Drain



They invited him to a party, gave him alcohol and beaten him to death with iron pipe. Later they disposed the body in a far-away shallow water drain to show as accidental drowning. (Fig. 5)

Autopsy showed several lacerations over head and linear contusion over trunk. There was intracranial hemorrhage. Chemical analysis was positive for alcohol.

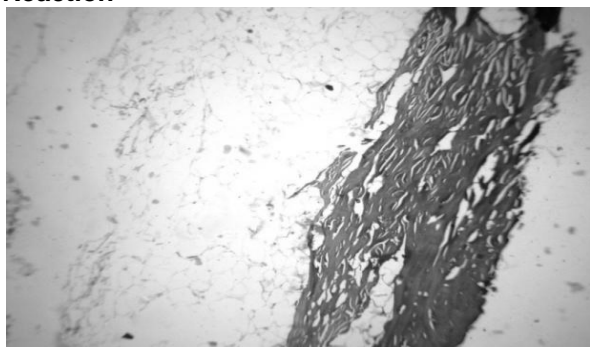
Case Eight:

A woman was smothered to death by her in-laws. Then kerosene was poured over her and burnt to show as a suicide. (Fig. 6) Post-mortem showed contusions over the mucosal side of both lips. No soot is seen in trachea. Histopathology of burnt edge showed no vital reaction. (Fig.7) [5-7]

Fig. 6: Body burnt after Smothering



Fig. 7: Histopathology showed no Vital Reaction



Discussion:

A murder may be done out of several reasons and by several methods. This study focused on not just the method of murder, but on the methods employed after murder to mislead the investigation. We have found that there are various methods of masquerading the case, being tried by the accused in different cases. The motive is predominantly to escape conviction. The methods may be scientifically oriented like putting suicidal cut over wrist by the ATM robbers. And can be of ordinary improper thought like putting the victim in shallow drain. They depend upon the profession, knowledge, state of mind and motive of the culprit.

Conclusion:

Meticulous autopsy reveals the true cause of death and provides valuable information for investigation. Post mortem examination, police investigation, Forensic evidences, confessions of the accused, police investigation, when all go together, can never miss the culprit. Proper knowledge on the possible methods of alterations can make the doctor more accurate in his post-mortem examination.

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Original Research Paper

Radiological Study of Union of Lower End of Humerus and Femur for Estimation of 16 and 18 Years Age in Agra Region

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Abstract

The bony age is determined from the study of growing ends of long bones i.e. the appearance and fusion of epiphysis with the diaphysis. The bony age is considered nearest to accuracy in estimating the clinical age. The actual bony age can't be determined in living, therefore the law enforcing agencies has to rely upon radiological estimation of bony age that too with many limitations and conditions. The present series of work was conducted at Forensic Medicine and Radiology Department of Sarojini Naidu Medical College, Agra. The study was based on 200 cases of males and females 10-20 years of different school and colleges running in the Agra city. In male all epiphysis of lower end of humerus are fused except medial epicondyle at age of 16 years. Lower end of femur not fused in both males and females at age of 16 years. In both males and females lower end of femur fused at age of 16 years.

Key Words: Skeletal age, Radiological examination, union, Femur, Humerus

Introduction:

While most researches determine union visually, some scholars advocate the use of radiographs to determine the degree of union. [1] Skeletal age, dental age, morphological age, secondary sex character age are other method in use for asserting age of individual. In medico-legal practice a combined view is taken and opinion is expressed after considering all methods. However radiological examination is a must and the court of law did not believe any conclusion without it. [2]

The complexity of overall ossification problem may be gleaned by the estimation that at the 11th prenatal week in humans there are some 806 centers of bone growth, at birth about 450, while the adult skeleton has only 206 bones. [3]

It is an established fact that the sequence of appearance and ultimate ossification of epiphysis varies in both sexes in different part of the world to the extent that there are wide variation even in the population of the different states of a country.

In case of alleged rape when the sexual intercourse has taken place with the consent of the girl, to made it a cognizable criminal offence it has to be proved that the girl was < 16 years of age. The medical experts are not in a position to certify the age of the girl due to the lack of relevant data with the result that the accused get the benefit of doubt and is set free. [4]

Material and Methods:

The present study was carried out in the Forensic Medicine and Radiology Department of Sarojini Naidu Medical College, Agra. A total of 200 (100 males, 100 females) in the age group of 10-20 years were selected randomly from various schools of Agra Region.

Criteria for Selecting Subjects:

- They should be living in Agra for more than 5 years.
- They should be free from any physical disability or endocrine anomaly.
- Only those cases were taken for the study whose date of birth is verified by their school or college authorities by birth certificate.
- Informed expressed verbal consent of the subject was taken before proceeding to their, physical, dental and radiological examinations.

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The persons selected for study were grouped as per their stated age, 10-11 years, 11-12 years, 12-13 years, 13-14 years, 14-15 years, 15-16 years, 16-17 years, 17-18 years, 18-19 years, and 19-20 years.

The age group 10-11 years is considered as those of who have completed 10 years of age but yet to complete 11 years of age and similarly other age groups. Age as stated by them is further confirmed by birth certificate or entry in their school record.

After obtaining informed expressed verbal consent for their radiological and clinical examination each person is x-rayed for Right side elbow and knee joint. AP and Lateral view is taken and the skiagrams are studied in detail in reference to fusion of epiphysis at lower end of humerus and lower end of femur.

Radiologically the union is taken as complete when:

- Diphysio-epiphyseal space is completely obliterated and become bony in architecture and density. [5]
- There is continuity of the periosteum between epiphysis and diaphysis with no notching at the periphery of epiphyseal line.
- Presence or absence of epiphyseal scar

For generalization fusion in more than 75% cases is relied upon as complete fusion. For the study X-ray films were divided into two groups for each epiphysis:-

- Those showing complete union.
- Those showing non-union.

Observations and Results:

In present work 100 females and 100 males of various authentically known age groups were selected. These cases were distributed between 10 to 20 years of age. (Table 1) In (Fig. 2) there is a male of 11 years showing appearance of ossification centre of trochlea, capitulum and medial epicondyle.

Lateral epicondyle with capitulum is fused in 100% cases in both males and females at the age of 16 years. Trochlea with capitulum & conjoint epiphysis with diaphysis of Humerus is fused in all cases of females & most cases of males (83.33%) and (75%) respectively at age of 16 years. Lower end of femur is fused 3 times more in females as compared to male. (Table 2)

Lateral epicondyle with capitulum, trochlea with capitulum and conjoint epiphysis is fused in all cases in females and male at the age of 18 years. (Fig. 4)

Medial epicondyle with diaphysis of humerus is fused in all cases in females and in most cases (91.67%) in case of males. (Fig. 3)

Lower end of femur is fused in all cases in females and it is not fused in 17.67% cases in males. (Table 3, Fig.1) In all the epiphysis mean age of fusion is higher in males as compared to females. Difference in age of fusion between males and females is statistically significant. (Table 4)

Discussion:

The epiphyseal union in females occurs earlier than males by few months to 2 years. This is in consonance with various observations, which in long bones females show fusion earlier than male. [6-8]

Considering 75% as age of fusion all the epiphysis of lower end of humerus are fused in females at age of 16 years. These findings were similar with the finding of other workers. [9]

In males all epiphysis of lower end of humerus are fused except medial epicondyle at age of 16 years. This is in consonance with various observations. [10]

Lower end of femur not fused in both males and females at age of 16 years. [11] In both males and females lower end of femur fused at the age of 18 years. These findings are similar with finding of other workers. [11]

Religion, diet, socio-economic status had no effect on epiphyseal union. In assessing the age of candidates, radiological examination is of adequate help but with limitations. We recommend further study of larger geographical area and statistic tests for near scientific opinion in age assessment cases.

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Fig. 1: Rt. Knee Showing Fusion of lower end of Femur (Female 18 Yrs, 2Months)



Fig. 2: Rt. Elbow Joint showing centre for medial epicondyle, capitulum & Trochlea appeared but not fused. Centre for lateral epicondyle not appeared (Male 11yrs, 1 month)



Fig. 3: Rt. Elbow Joint Showing Partial Fusion of Medial Epicondyle. Lateral Epicondyle with Capitulum & Capitulum with Trochlea Fused (Male 16 Yrs, 4 Months)



Fig. 4: Rt. Elbow Showing Complete Fusion of All Epiphysis around Lower End of Humerus (Female 18 Yrs, 2Months)



Table 1: Distribution of Study Subjects According to Sex

Age Grp (Yrs)	Males	Females	Total
10 – 11	5	4	9
11 – 12	5	4	9
12 – 13	6	5	11
13 – 14	8	10	18
14 – 15	18	15	33
15 – 16	12	20	32
16 – 17	12	10	22
17 – 18	12	12	24
18 – 19	10	12	22
19 – 20	12	8	20
Total	100	100	200

Table 2: Epiphyseal Union at Age of 16 Years

EPIPHYSIS	Males (%)	Females (%)
Lateral epicondyle with capitulum	100	100
Trochlea with Capitulum	83.33	100
Conjoint epiphysis with diaphysis of Hur	75	100
Medial epicondyle, with diaphysis of Hur	50	85
Lower end of femur	16.67	50

Table 3: Epiphyseal Union at Age of 18 Years

EPIPHYSIS	Males (%)	Females (%)
Lateral epicondyle with capitulum	100	100
Trochlea with Capitulum	100	100
Conjoint epiphysis with diaphysis of Hur	100	100
Medial epicondyle, with diaphysis of Hur	91.67	100
Lower end of femur	83.33	100

Table 4: Comparison of Mean Age of Fusion between Males and Females

Epiphysis	Mean Age		Mean S.D.		t value	p value
	Male	Female	Male	Female		
Lateral epicondyle with capitulum	16.51	15.87	1.966	2.215	2.024	<0.05
Trochlea with Capitulum	16.83	15.97	1.810	2.118	2.754	<0.05
Conjoint epiphysis with diaphysis of Humerus	17.28	16.17	1.658	1.976	3.554	<0.05
Medial epicondyle with diaphysis of Humerus	17.23	16.54	1.837	1.810	2.160	<0.05
Lower end of femur with shaft	18.01	17.16	1.309	1.618	2.770	< 0.05

Original Research Paper

Study of Railway Fatalities in Moradabad District

¹Afzal Haroon, ²Ravi Gangal

Abstract

Accidental deaths and injuries are inevitable in this modern way of living. Railways are safe and efficient mode of travelling in India but deaths due to railways are not negligible as compared to road traffic deaths. Moradabad division of northern railway has total route 1402 km over which 107 pair of mail/express and 53 pair of passenger trains run daily. The present study is done to find out the epidemiological factors and pattern of injuries in railway related fatalities. Total 268 cases were brought for post-mortem examination during 3 year period from 2010 to 2012 in Moradabad. Males were predominantly involved with M: F ratio of 14.7:1. Maximum no. of victims 95 (35.45%) were in the age group 21-30 years. Seasonal distribution was uniform and majority of victims died on the spot 239 (89.18%) cases. Maximum no. of fatalities was accidental in nature 211(78.74%) cases and injuries to vital organs seen in 173 (64.56%) cases were the most common cause of death.

Key Words: Accidental falling, Railway fatality, Overcrowding, Carelessly, Multiple injuries

Introduction:

Railways are safe and efficient mode of travelling as compared to road travel because train runs on the rails but the injuries and deaths caused due to accidents is inevitable.

There are many studies on the fatalities caused by the RTAs as in India most of the places can be only accessed by the roads but the death due to railway accidents is not negligible especially in the areas where railway lines are crossing the busy places inside the cities and towns.

Many settlements are located very close to the tracks and the persons cross these tracks carelessly to take shortcuts and thus are exposed to the risks of accidents. Deaths due to railway injuries are of different types and can occur during the boarding and deboarding of moving trains, collisions and derailments.

It is also the commonest method of suicide and masking the cases of homicides also as dead bodies are left on the railway tracks to conceal the identity and to mislead the investigations.

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Moradabad Division [1] of Northern Railway has its Divisional Headquarter at Moradabad. It is an old city, established by the Mughal prince 'MURAD' and is famous for its Brass Industry. Brass Wares, stainless steel utensils, electro-plated nickel, silver and lacquer-plated brass wares are well known specialties of this city. The Division serves a population of about 3 crores spread over 26 civil districts in the western part of Uttar Pradesh and in the newly created state Uttarakhand.

It has a total route of 1402.15 kms and track kilometre of 2701.72 over which 107 pairs of Mail/Express and 53 pairs of Passenger trains run daily. There are 204 Stations on the Division.

Approximately 2.72 lakhs passengers are booked daily. The Division caters to the transport requirements of a number of industries including fertilizers, sponsored food grains, sugar, Iron & steel units & BHEL.

Moradabad Division provides crucial connectivity by trains between Delhi and the states of Uttar Pradesh and Uttarakhand. It also connects the northern states of Punjab, Haryana and J & K with Uttar Pradesh.

This study was done to properly understand the epidemiological profile of victims, pattern of injuries produced leading to the death of victims and to suggest the measures for the prevention of railway related deaths.

Material and Method:

The present retrospective study on the pattern of fatal injury by train accident was done by Department of Forensic Medicine, T.M.M.C & R.C Moradabad during the period of 3 years

from 1st January 2010 to 31st December 2012. All the cases of fatalities related to railways and handled by police including GRP Moradabad were included in the study and the data regarding the age, sex, manner of death, injuries produced and cause of death was obtained from the records of GRP and from the post mortem report done in the district hospital. Death due to collision, derailment of trains, natural death in the train, platforms and decomposed bodies are excluded from the study.

Observations and Results:

During this study period total 3656 post-mortem examination were done in district mortuary during 3 year period from 1st January 2010 to 31st December 2012, out of which 268 cases were due to railway related deaths brought by police and GRP Moradabad. Thus incidence of railway death is 7.33%.

In our study the age varies from 10 years to 60 years and peak incidence of fatalities 95 (35.45%) was observed in age group of 21-30 year followed by 31-40 year which has 62(23.14%) cases. Out of total 268 cases, 251(93.65%) were male while 17(6.35%) were female. Thus male: female ratio of 14.7:1 was observed. (Table 1)

Summer season (March to June) recorded 95(35.44%) cases, rainy season (July to October) 84(31.35%) cases and winter season (November to February) recorded 89(33.21%) cases in this study. Thus the seasonal distribution was almost uniform throughout the year. (Table 2)

Majority of cases 239(89.18%) were brought from the spot. This showed that victims died on the spot because of extensive injuries caused and inability to reach the hospital because there is no means of transport available. (Table 3)

Our study showed that in 174(64.92%) cases was not transected and multiple abrasions, abraded contusions, lacerations were present on the body. Along with the external injuries multiple fractures of the upper limb bones, lower limb bones, ribs, fracture of the skull bones with missing brain were present.

Regarding the internal organs laceration of liver, lungs, kidney and spleen was common feature in accidental fall from moving train.

Transection at the level of neck region was commonest in 41(15.29%) cases and was found mostly in suicidal cases followed by at the level of lower limb in 23(8.59%) cases. (Table 4)

In this study accidental deaths was commonest, seen in 211(78.74%) cases followed by suicidal 46 (17.17%) and least was

homicidal seen in 8(2.99%) cases. (Table 5)

We observed in present study that injury to vital organs accounted for maximum 173(64.56%) cases as a cause of death followed by haemorrhagic shock 59(22.02%) cases. Head injury was cause of death in 28(10.45%) cases. (Table 6)

Discussion:

Moradabad district has a population of 889,810 according to 2011 census report. It is also a divisional head quarter of northern railway and is important connecting link to Uttar Pradesh capital Lucknow and Uttarakhand State with Delhi by the railways and thus many people commute to Delhi by trains on daily basis.

The present study was conducted by Department of Forensic Medicine T.M.M.C & R.C Moradabad for the period of 3 years from 1st January 2010 to 31st December 2012 and the incidence of railway fatalities was 7.26% which is similar to the study done by Satish NT et al [4] (9.82%) and Wasnik RN et al (5.99%). [5]

However the incidence of fatalities was 25.79% and 4.5% in Sheikh MI et al [8] and Hussaini SN et al [2] studies respectively. In present study the age of the victims varied from 11-60 years. The peak incidence was observed in the age group 21-30 years comprising 95(35.45%) of the cases.

More than half 58.59% of cases comprised of age group of 21-40 years in the study. Individuals in the age group less than 10 years and more than 60 years were not involved in the fatal accidents. This is in accordance with other studies done previously. [4, 8, 11, 12]

Individuals in the first and seventh decade were not affected in present study. The reason for the above is that young adults are the prime bread earners of the family and they travel between the cities for the purpose of job and business opportunities.

The children are in the protection of adult members of the family while the old persons are experienced and careful during the journeys by trains.

Males 251(93.65%) outnumbered the females 17(6.35%) in the present study with the male: female ratio of 14.7:1. Our findings were in accordance to the study done by others. [9, 10]

But it was in contrast with the study done by Roop Kumar KM et al [3] who reported male to female ratio as 2.87:1. The reason for the male majority is that men everywhere are more exposed to outdoor activities, traveling between home and place of work, take the risk of boarding and deboarding from moving trains, hanging on the doors, standing on footboards

and travelling on the roofs of trains because of overcrowding while females mostly keep themselves indoor mostly due to cultural background, lack of industries and low potential for employment rate owing to poor literacy, along with the tendency that some male members mostly accompany females and extra precautions are taken while travelling in trains.

There is no effect of seasonal variation in our study and the cases were uniformly distributed throughout the year. Wasnik RN et al [5] also has similar observation of uniform distribution. This study is in contradiction with the study done by Roop Kumar KM et al [3] who observed maximum fatalities in first four months of year and Sahoo and Kar [9] observed in middle four month.

Our study clearly shows that majority of the victims died on the spot because of extensive injuries caused and was in accordance to RN et al. [5] This is due to the reason that victims are usually alone and cannot ask for help and also the lack of transport facility from the spot of accident.

In the present study commonest manner of the railway fatalities 211(78.74%) cases were accidental in nature followed by suicidal 46(17.17%) cases and least was the homicidal seen in only 8(2.99%) cases.

This was consistent with the various studies done by authors. [5-11] who observed that manner of death was mainly accidental followed by suicidal, homicidal and other unknown methods. Accidental railway fatalities are due to the falling from the moving trains while boarding and deboarding, crossing the railway tracks carelessly to take short cuts, hanging on the doors and travelling on the roofs of trains and is more common in males.

Suicide is next common manner of death and was found in males as well as females. Our study shows that involvement of female is very much less as compared to male because females rarely do the suicide by violent methods. [11]

In the present study maximum fatalities are due to accidental falling from the moving train. Injuries caused to the victim showed that multiple abrasions, abraded contusions were most commonly found over the body followed by laceration and multiple fractures of the ribs and limbs and similar finding was observed by others. [4-6, 11]

In most of the cases extensive injury to head with fracture of skull bones were present and brain was missing from the head. The reason is that the victims when falls from moving train are severely injured by stones lying near

the railway tracks. Decapitation was next common finding and was mostly found in suicidal cases. The victims lay themselves along the track with neck over the rails and then subsequent decapitation with or without the transection of the lower limbs.

Crush laceration at the level of thorax and abdomen level was mostly found in the cases who were trying to cross the railway line carelessly. Injuries to thorax were observed in accidental and suicidal cases. Multiple fractures of ribs were commonest finding followed by laceration of lungs. Abdominal visceral injuries were commonest with laceration of the liver found in majority of the cases followed by laceration of kidneys.

The next common was laceration of spleen and injury to the intestines was least common. The reason is that the liver is not protected in the bony cage and is superficial and when moving body is suddenly comes to the rest as in cases of fall serious injuries are produced. It is in accordance with Satish NT et al and Wasnik RN et al findings. [4, 5]

Maximum mortality in 173(64.56%) cases was due to injury to the vital organs followed by haemorrhage and shock in 59(22.02%) cases. This is due to the reason that multiple organs were involved simultaneously due to accidental injuries.

Haemorrhagic shock was due to crush amputation of the lower limbs and in the extensive injuries to the thorax and abdomen. Similar observations were made by Wasnik RN et al [5], Sheikh MI et al [8] and is in contrast with the study done by Hussaini SN et al [2], Pathak A et al [7] who have the opinion of shock due to haemorrhage is common cause of death.

Conclusion:

Death due to trains is important cause of morbidity and mortality in India. With increasing population and overcrowding in trains railway fatalities are mostly accidental in nature.

Railways are cheap, safe and efficient mode of travelling and are preferred by people for travelling and accidental death can be prevented by implementing simple measures both by public and railway authorities.

People should be made aware by posters, banners about the hazards of boarding and deboarding from moving trains and travelling on foot boards. Over bridges and underpasses should be constructed by railway authorities where the railway lines are crossing the busy areas inside the cities. Slum around the tracks should be relocated elsewhere. Fencing should be done along the tracks in the busy

areas to prevent the people from crossing the tracks as shortcuts and unnecessary walking over the tracks. Coach of the trains should have centralized system of opening the doors when the train is completely stopped and the train should move only when the doors are completely closed and it is not possible to open it in mid journey.

Helpline numbers should be printed inside the coaches to inform the authorities in case of emergency. Railway should strictly implement the laws of railway acts and the people should be penalized for breaking the rules for the safety of passengers.

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Table 1: Age & Sex wise Distribution

Age grps (Yrs)	Male	Female	Total (%)
0-10	0	0	0 (0)
11-20	42	3	45 (16.79)
21-30	89	6	95 (35.45)
31-40	57	5	62 (23.14)
41-50	39	2	41 (15.29)
51-60	24	1	25 (9.33)
Total	251	17	268(100)

Table 2: Seasonal Distribution

Season	Cases (%)
Summer (March to June)	95 (35.44%)
Rainy (July to October)	84 (31.35%)
Winter (Nov. to Feb.)	89 (33.21%)

Table 3: Cases brought from

Victims	Cases	%
Spot	239	89.18
Casualty	29	10.82
Total	268	100

Table 4: Level of Transection

Level	Cases	%
Neck	41	15.29
Thoracic	19	7.09
Abdomen	11	4.11
Lower Limb	23	8.59
No Transection	174	64.92
Total	268	100

Table 5: Manner of Death

Manner of Death	Cases	%
Accident	211	78.74
Suicide	46	17.17
Homicide	8	2.99
Unknown	3	1.10
Total	268	100

Table 6: Cause of Death

Cause of Death	Cases	%
Injury to vital organs	173	64.56
Head Injury	28	10.45
Shock and Haemorrhage	59	22.02
Septicaemia	8	2.97
Total	268	100

Original Research Paper

Correlation of Stature and Foot Length among Medical Students from Southern Parts of India

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Abstract

Stature is one of the primary characteristics of identification of human beings. The main concern of the Forensic investigations in mass disasters is to establish personal identity of unknown and dismembered human remains. Like other body parts, the foot of a person exhibits biological correlation with height. The present study is a cross sectional study undertaken with aim to find out the correlation of percutaneous measurement of foot length with the height of a person and to estimate the stature from foot length among a group of medical students. The sample of the study included 305 (142 males and 163 females) medical under graduate students of age group between 18 to 22 years who were born and brought up in Southern Parts of India (Puducherry, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh). Maximum foot length and height were measured by Vernier calliper and stadiometer respectively. Predictive equations using linear regression were derived. The correlation between stature and foot length was found to be statistically significant. Regression equation derived was $\text{Stature} = 58.145 + 4.421 \times \text{Foot Length}$. The accuracy of stature determination by this method is reported to be 71%.

Key Words: Foot length, Stature, Regression equation, Identification

Introduction:

In Forensic anthropology, identification of unknown and dismembered human remains is achieved under two different contexts. One is by "estimation," where an identification profile is prepared from unidentified remains in the hope of eventually identifying the said remains.

The second one is called "evidentiary", where a stature derived from long bones or body parts is shown to be consistent with the "known" stature of a particular missing person with the likelihood of a correct identification.

In certain cases, where stature is the biological characteristic of interest, both of these contexts can occur. [1] "Height" is a generally accepted descriptor of an individual that forensics, public and law enforcement authorities recognize and understand. [2]

German anthropologist Breiteringer conducted the most comprehensive study including 2428 male athletes where he measured their stature and limb proportions to estimate the height from corresponding long bone measurements.

This is so far the largest study of measurements on living individuals used for estimates of stature from the skeleton. [3] Anthropologist Trotter and the statistician Gleser developed regression equations based on measurements of long bones from World War II casualties, where identity of each individual was known, as well as their stature while living.

Thus, both the actual stature and the skeletal measurements were known. They concluded that stature is in "a state of flux" and stressed not to use a regression equation for a different population than the one for which it had been developed. [3]

Foot size and hence the foot length bears a biological correlation with height and it suggests that the stature might be estimated from foot length. The foot is useful in the context of identification of dismembered remains, as in most of the cases it is protected by the shoe.

In such situations, different methods developed over the time by different researchers worldwide help us to estimate the stature and thereby the identity of the deceased.

Earlier studies by Robbins, Topinard and Martin put forth many foot length/stature

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percentages for various populations ranging from 14.9 to 18.1.

Among those, the most popular was the finding given by Topinard i.e. maximum foot length divided by 0.15 reveals the stature of a person. Few authors suggested multiplication factors calculated by dividing the stature by foot length. [4, 5] But these methods have very high estimation error. Later on, many researchers developed regression methods, which impose a simple relationship between the size of a specific body part and stature. [6-13]

All these methods to determine stature make assumptions about proportions of the human body. However, people come in a variety of body shapes with lot of individual variation based on age, sex, race, geography, ethnicity and ancestry and to account for this, separate formulae are needed for different groups and populations. Even in our country, people from different regions of India bear different morphological features depending on the geographical location, racial distribution and ethnic characteristics hence single data cannot be applied to the entire nation. [2]

With this viewpoint current study was undertaken to develop the standards for south Indian population.

Materials and Methods:

The present study is a cross sectional descriptive study conducted including 305 medical undergraduate students (142 males and 163 females) who were born and brought up in Tamil Nadu, Pondicherry, Karnataka, Kerala and Andhra Pradesh (Southern part of India) and between the age group of 18 to 22 years.

Students with congenital or acquired skeletal deformities and those who did not belong to southern parts of India were excluded from the study. Informed consent was obtained from all the participants.

Height (stature) was measured by making the subject stand barefoot on the board of a standard stadiometer with both feet in close contact with each other, trunk braced along the vertical board, and head oriented in ear-eye plane. The measurement was taken in centimeters by bringing the horizontal sliding bar to the vertex. For the foot length, measurements were collected from the left foot as per recommendation of International agreement for paired measurements at Geneva (1912). [14]

The foot length was measured as a straight distance between the posterior most projecting point of heel and the anterior most projecting point (the end of great toe or second toe) when placed on flat surface.

This measurement excluded any nail extending over the end of the toe.

Measurements were taken at fixed time of the day (i.e. between 2 pm to 4 pm) to avoid diurnal variation and were collected by a single person to eliminate the observer bias. The observations were tabulated and analyzed using MS Excel 2010 and regression equation was derived by linear regression analysis.

Observations and Results:

The mean, standard deviation, range of stature of the study population distributed sex wise. In males, stature ranges from 154.7 cm to 188.0 cm with a mean value of 172.42 and standard deviation was 6.25. The stature in females ranges from 146.0 cm to 175.0 cm with mean value of 158.83 and standard deviation was 6.19. (Table 1)

Present study shows that in the males, left foot length varied from 22.2 cm to 29.0 cm with mean value of 25.57 cm and standard deviation was 1.31. Whereas, in case of females, length of left foot varied from 20.4 cm to 26.0 cm with mean value of 23.05 cm and standard deviation was 1.18. (Table 2)

The mean ratio index for the total study population was 14.662. For males, it was observed to be 14.834 and for females, it was 14.514 with standard deviation 0.555 and 0.528 respectively. (Table 3) The regression equations were derived separately for male and female subjects as well as for the combined data. (Table 4) The coefficient of co-relation (r) was 0.842 for combined data. The values of coefficient of determination (r^2) were 0.472, 0.453 and 0.71 respectively for male, female and combined data. Hence, the accuracy of estimation of stature was 47% and 45% for male and female data respectively.

Whereas the regression equation developed for the combined data could determine the stature of any subject irrespective of sex with 71% accuracy.

Discussion:

Stature is one of the characteristics that may be used to identify an individual. From birth to adulthood, stature increases until a maximum is reached. However, even during growth, stature is not a fixed measurement for any individual. It increases rapidly during puberty and reaches maximum at adulthood. It is known to decrease slightly during the day, and with age, especially after about the age of 30 years.

To overrule this variation, the present study subjects were selected between the age group of 18-22 years. There are many studies [6-13] in which researchers attempted to

establish correlation between stature and foot dimensions. The present study extends the findings of previous studies by exploring data i.e. foot lengths (left) and height using linear regression models.

In our study, stature in males was in the range of 154.7 cms to 188 cms with the mean of 172.42 cms. Similarly, stature in females was in the range of 146 cms to 175 cms with the mean of 158.83 cms. It was observed that males have taller stature compared to females.

The fact that males are constitutionally taller than females as the age of puberty being 2-3 years later in them as compared to females gives them the additional time for growth.

This explains that formula for one sex cannot be applied for other sex.

Agnihotri et al [6] studied 250 medical students from a medical college in Mauritius concluded that there is a highly significant difference between sexes with average foot length of males being significantly greater than females. It is evident that, our study is in correlation with these findings.

Stature ratio index in the present study was 14.662 for combined data while it was 14.834 and 14.514 for male and female subjects respectively. This observation is consistent with study by Phillip TA [7] (Male-14.250 and female-14.280) and Robbins [4] (Combined data-14.976, Male-15.199 and female-14.750) where the authors measured the foot outline length.

Krishan K [8] studied only male Gujar population from North India and developed a division factor of 0.1512, which is slightly more than our findings.

Correlation coefficient of foot length and stature suggests a linear and significant relationship in present study. Similar results were observed in studies by others. [8-13]

Conclusion:

The present research exhibits a significant correlation between foot length of a person and his/her stature.

The regression thus equation developed, could determine the stature of any subject irrespective of sex with 71% accuracy.

This study was done including the subjects residing particularly in South Indian region hence the observations can be applied with fair accuracy to South Indian population.

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Table 1: Sex Wise Distribution of Stature

Stature (in cm)	Male(n=142)	Female (n=163)	Total
Mean	172.42	158.83	165.62
SD	6.25	6.19	9.2
Minimum	154.7	146	146
Maximum	188	175	188

Table 2: Sex Wise Distribution of Left Foot Length

Foot length (in cm)	Male(n=142)	Female (n=163)	Total
Mean	25.57	23.05	24.31
SD	1.31	1.18	1.77
Minimum	22.2	20.4	20.4
Maximum	29	26	29

Table 3: Foot Length to Stature Ratio Index

	Mean Ratio Index	SD
Male	14.834	0.555
Female	14.514	0.528
Combined population	14.662	0.563

Table 4: Regression Equation for Estimation of Stature from Foot Length

	Regression equation	S.E.E.	r	r ²
Male	Stature = 88.611 + 3.277 x FL	4.553	0.687	0.472
Female	Stature = 72.239 + 3.765 x FL	4.947	0.673	0.453
Combined population	Stature = 58.145 + 4.421 x FL	5.02	0.842	0.71

FL- foot length, r - coefficient of co-relation, r²-coefficient of determination

Original Research Paper

Fatal Road Traffic Accidents: Causes and Factors Responsible

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Abstract

Road traffic accidents are one of the leading causes of morbidity and mortality in the world. The etiological factors may be classified into human and environmental out of which human factor account for 90% of the accidents. The present study was conducted to know the causes and factors responsible for the accidents. Human error is responsible for accidents in 77% of cases in which drivers were at fault in 56.2% of cases followed by pedestrians and passengers of vehicles responsible for 17.8 and 3.0% cases respectively. Defects in vehicles, poor weather accounted for accidents in 8.4% cases respectively and bad roads were responsible for accidents in 4% cases only. None of the driver or passenger of the vehicles was wearing helmets or seatbelts, a very disturbing trend. The important human factors responsible for accidents were, over speeding, rash driving, not following traffic rules, carelessness while crossing roads, playing on road, alcohol intake, fatigue and sleepiness.

Key Words: Road traffic accidents, Causes, Risk factors, Drivers, Human error

Introduction:

Road Traffic Accidents (RTAs) are one of the leading causes of morbidity and mortality in the World. WHO data show that in 2002 nearly 1.2 million people worldwide died as a result of road traffic injuries. In addition to these deaths; between 20 million and 50 million people globally are estimated to be injured or disabled.

RTAs are the eighth leading cause of death in the World and are expected to rise to the fifth position by year 2030, if adequate measures are not taken. [1]

Road traffic injuries accounts for 38 million disability adjusted life years (DALYs) lost or 2.6% of global burden of disease.

Low and middle income countries accounts for 91.8% of the DALYs lost to road accident injuries worldwide. [2] In India 1, 37, 423 fatalities occurred as a result of RTA in 2013 which accounted for 36.4% of all accidental deaths in the same period. [3] There is steep rise in vehicular accidents in the present era due to urbanization and tremendous growth in the road transport sector.

Accidents constitute a complex phenomenon of multiple causation. The etiological factors may be classified into two broad categories- human and environmental. [4]

Road accidents continue to be a growing problem worldwide. Up to 90% of the factors responsible for causation and prevention of accidents are attributed to human factors. [5] The present study was conducted to find out various causes and factors responsible for RTAs so as to evolve strategies to prevent and better manage road traffic accidents.

Material and Methods:

The present study was conducted in the Department of Forensic Medicine at Pt. B. D. Sharma PGIMS Rohtak in year 2001. All the cases of death due to RTAs were included in the present study. During the period of study, a total of 450 road accidents deaths were subjected to medico-legal autopsy.

Necessary information for the study was gathered from police, inquest report and interview of relatives and friends of victims and eye-witnesses present at the time of accidents.

In few cases adequate information was not obtained and such cases were put under unknown group. A detailed Performa was prepared for filling the observations on the present study. The information thus collected was statistically analyzed.

Observation and Results:

A total of 1510 bodies were brought for post-mortem examination out of which 450

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cases (29.8%) were due to road accidents. The causes of accidents were analyzed in detail.

In our study Human error was responsible for accidents in 77% cases out of these drivers were at fault in 56.2% cases followed by pedestrians and passengers responsible for 17.8 and 3% deaths respectively.

Present study showed that Vehicle and weather were responsible in 8.4% cases each. Poor and defective roads lead to 4% of fatal accidents and in 2.2% cases the cause was unknown. (Table 1)

In this study the common faults of drivers responsible for fatal accidents were due to over speeding (49.4%), rash driving (31.6%), loss of control (6.8%), violation of traffic rules (5.5%), alcohol intoxication (4.3%) fatigue and sleepiness (2.4%). (Table 2)

In present study out of 80 pedestrians responsible for accidents, 58.8% were careless in crossing roads, 20% were crossing from wrong sides, and 16.2% of children were playing on roads and 5 % were vulnerable due to old age and diseases. (Table 3)

Out of 13 Passengers responsible for fatal accidents, 46.2% were catching or getting down of running buses, 38.4% were travelling on foot board of buses, 7.7% were catching the buses from wrong side of the road and 7.7 of passengers were projecting outside the body of the vehicle when they fell out. (Table 4)

In this study out of total 38 cases of accidents attributed to faults of vehicles, 28.9% of vehicles were overloaded or overcrowded, 28.9% of passengers ejected out of open jeeps during collision. These open jeeps are used to ferry passengers illegally. Wrongly parked vehicle on roads leading to accidents at night accounts for 15.8% cases.

In this study 13.2% of vehicle has failure of brakes or steering, 7.9% had a tyre burst at high speed leading to accidents due to overturning or collision with vehicles or trees. In 5.3% cases, projecting loads from rear of trucks accounted for the accidents. (Table 5)

Regarding the effect of poor weather, 44.7% cases occurred at night due to poor vision and due to fog or mist respectively and 10.6% of due to heavy rain or storms in this study. (Table 6) Our study showed that out of 18 cases of accidents due to poor road condition, 33.3% each occurred due to stray animals on road and potholes and damaged roads respectively. In 22.2% cases merging of rural roads directly to a highway with high speed traffic were responsible for accidents. 5.6% cases each occurred due to diversions or construction material on the roads and illegal speed breaker, respectively. (Table 7)

Table 1: Causes of Fatal Road Accidents

Causes	Cases	Percentage
Human Error	346	77.0
1. Fault of Drivers	253	(56.2)
2. Fault of Pedestrians	80	(17.8)
3. Fault of Passengers	13	(3.0)
Role of Vehicles	38	8.4
Role of Weather	38	8.4
Role of Roads	18	4.0
Unknown	10	2.2
Total (n=450)	450	100

Table 2: Faults of Drivers

Faults	Cases	Percentage
Over speeding	125	49.4
Rash Driving	80	31.6
Loss of Control	17	6.8
Violation of Rules	14	5.5
Alcohol intoxication	11	4.3
Fatigue/ Sleepiness	06	2.4
Total (n=253)	253	100

Table 3: Faults of Pedestrians

Faults	Cases	Percentage
Carelessness	47	58.8
Wrong Crossing	16	20.0
Playing of Roads	13	16.2
Disease	04	05.0
Total (n =80)	80	100

Table 4: Faults of Passengers

Faults	Cases	Percentage
Catching / alighting Running Bus	6	46.2
Travelling on Foot Boards	5	38.4
Catching / alighting from wrong side	1	7.7
Projecting outside the Vehicle	1	7.7
Total (n=13)	13	100

Table 5: Faults in Vehicles

Faults	Cases	Percentage
Overcrowding / over loading	11	28.9
Ejected out of open jeeps	11	28.9
Wrongly Parked on Road	06	15.8
Failure of Brakes / Steering	05	13.2
Tyre Burst	03	7.9
Projecting loads	02	5.3
Total (n=38)	38	100

Table 6: Factors related to Weather

Faults	Cases	Percentage
Night / Poor vision	17	44.7
Fog / Mist	17	44.7
Heavy rain/ Storm	4	10.6
Total (n=38)	38	100

Table 7: Factors related to Roads

Faults	Cases	Percentage
Stray Animals on road	6	33.3
Potholes / Damaged Road	6	33.3
Merging of Rural Road with Highway	4	22.2
Diversions / Material on Road	1	05.6
Illegal Speed Breakers	1	05.6
Total (n=18)	18	100

Discussion:

India accounts for about 10% of road accidents fatalities worldwide and 85% of all road accidents occurred in the developing countries. [2] In the present study road accidents

accounted for 29.8% of all medico-legal post-mortem in one year period.

The factor of human error is found to be most significant (77%) as compared to defects in vehicles, roads or weather conditions similar to previous studies [6-9] The drivers were at fault in 56.2% of cases and were responsible for over speeding in 49.5% cases, rash driving in 31.6% cases. Violation of traffic rules, alcohol intake, a fatigue and sleepiness were other causes. [7, 8]

Pedestrian comprising of elderly and children are most commonly affected group of road accident victims. Majority of them are themselves responsible for accidents due to carelessness, not following traffic signs, old age and diseases and children usually playing on roads. [8, 9] The common faults of passengers were catching or getting out of buses from wrong side or running buses, travelling on foot boards or projecting out of the vehicles. [7, 8]

The most disturbing finding in the present study was that none of the drivers and passengers of motor bikes or four wheelers were wearing helmets or seat belts leading to fatal injuries. [10-12] In the cases of accidents attributed to faults of vehicles, 28.9% of vehicles were overcrowd/overloaded and in 28.9% of cases victims ejected out of crowded open jeeps at time of collision. A small number of vehicles had mechanical failure in form of steering/ brake failure or tyre burst at high speed. [6, 7]

Poor weather conditions like night or poor visibility, fog, mist and heavy rain/storm and defective roads are other factors responsible for accidents. Findings of our study are consistent with others. [7, 13]

But the increased number of accidents at night or early morning hours is due to alcohol intoxication, rash driving, fatigue and sleepiness of drivers. The problem of accidents in darkness is not a matter of visibility but a consequence of the way drivers use roads at night. [13]

On a larger scale, the main cause of accidents on Indian roads is a chaos created by mixing of slow and fast moving traffic on the same roads. This is due to infrastructure shortage and lack of effective public transport system to keep pace with rapid and substantial increase in demand so the passengers are turned to personalized mode of transport or intermediate public transport as autos, taxis and jeeps which further add to traffic congestion. [2, 14]

Conclusions:

The problem of road traffic crashes and injuries is growing both in absolute number and relative term. Human error is the most common

cause of road accidents out of which drivers are at fault in more than three-fourth of cases followed by faults of pedestrians and passengers. The defects in vehicles, poor road infrastructure and poor weather accounts for a smaller number of cases. Road safety is a multispectral and multidimensional issue requiring a multipronged approach at various levels. The important steps required to improve road safety for road uses are:

1. Training and Education of Road Users:

- Promote the road safety at school.
 - Training of drivers and driving instructor.
 - Training of engineers on road safety.
 - Training in first Aid- drivers of buses and trucks should be trained in basic first aid.
 - Training of the traffic police for better traffic management.
2. Strengthen the system of driving license to improve competence of drivers.
 3. Strict implementation of traffic rules and Safer road infrastructure.
 4. Fitment of safety features in vehicles at the stage of designing, manufacturing, usage, operation and maintenance.
 5. Ensure safety of vulnerable road user by segregating slow and fast moving traffic.
 6. Ensure emergency medical attention for road accident victims.

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Original Research Paper

Determination of Stature by Palm Length in Central India

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Abstract

Different parameters like Age, Sex, Race, Stature etc are used for identification from fragmented remains. Identification of an individual from mutilated or distorted or fragmented remains is a difficult task. Almost every body part bears more or less constant relationship with stature. Similarly palm length also has a definite correlation with stature of an individual. Considering this fact the present study is based on measurement of palm length of boys and girls in the age group of 19-25 years belonging to the same geographical area. Measurements were analyzed statistically. Linear regression equations were derived and multiplication factors (16.94 for males & 17.51 for females) were calculated. The study shows that palm length bears a significant relation to stature and can be an important tool for stature estimation in medico-legal cases & anthropology. Also it can be shown that the measurement and formulae for males and females are different. That is formula which is obtained for one sex cannot be applied to the other sex for getting the desired results.

Key Words: Identification, Palm length, Stature, Multiplication factor, Linear regression

Introduction:

Anthropometry is being widely used in medical sciences for identification. Establishing identity of an individual from mutilated, decomposed & amputated body fragment is important now a days due to natural disasters like earthquakes, tsunamis, cyclones, floods and man-made disasters like terror attacks, bomb blasts, mass accidents, wars, plane crashes, mutilation to conceal identity etc. [1]

The use of anthropometry in the field of forensic science dates back to 1882 when Alphonse Bertillon, a French police expert invented a system of criminal identification based on anthropometric measurements. [2] Different parameters like Age, Sex, Race, Stature etc. are used for identification. Different studies have shown that stature can be estimated from length of long bones, fragmentary remains, spine, metacarpals, metatarsals, skull, scapula etc. [3]

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Stature is used for constructing a biological profile that assists with the identification of an individual. So far, little attention has been paid to the fact that stature can be estimated from hand impressions left at scene of crime. [4] Every body part bears more or less constant relationship with stature. The relationship between specific body dimensions/proportions can be used to help solve crimes in the absence of complete evidence. [5]

Sometimes even intact hand might be available for examination, where the need arises to derive formula for stature using a portion of hand or at least intact palm. [6]

Also when stature cannot be measured directly due to deformity like kyphosis, lordosis and scoliosis, contractures or missing legs, the original stature of these people can be estimated by multiplying the dimension of hand lengths of these sexes or ethnic groups with respective multiplication factor. [2]

Palm length also has a definite correlation with stature of an individual. Also India is a country with variable geography, race, environment and climatic conditions, which influences the stature. The dominance of hand does not have a significant role to play while estimating stature from palm length or hand length. [7] Considering these facts the present study is based on measurement of palm length of boys and girls belonging to the same geographical area.

Here we have also determined multiplication factor & regression equation for

estimating stature from palm length. Although some studies say multiplication factor are less reliable than regression equations. [8]

This study may prove useful to doctors/ forensic experts to establish stature in mutilated bodies especially when forearm & hand is intact or if forearm and palm is intact and most of the other parts are damaged or in conditions where only a part of the hand is brought for examination.

Materials and Methods:

This was an observational cross sectional study conducted in the department of Forensic Medicine, JNMC, Sawangi (Meghe), Wardha over a period of 2 years. The study group included 230 normal adult (110 males and 120 females) medical students admitted to JNMC, Wardha in the age group of 19-25 years who were born and brought up in central India.

Non-resident Indians, students from other regions, students with bony deformities, students with poorly defined distal flexion crease of forearm and proximal flexion crease of middle finger and left handed persons were excluded from the study. After obtaining informed written consent, physical parameters were recorded.

Stature was measured by stadiometer (vertical metallic height measuring instrument) graduated in centimeters. The subject was in standing posture with bare foot with head in eye-ear-eye (Frank fort) plane. Palm length was measured using Vernier caliper (0-300mm, Photo 1) from midpoint of distal transverse crease of forearm to mid-point of proximal flexion crease of middle finger. (Photo 2)

Photo 1: Vernier Caliper

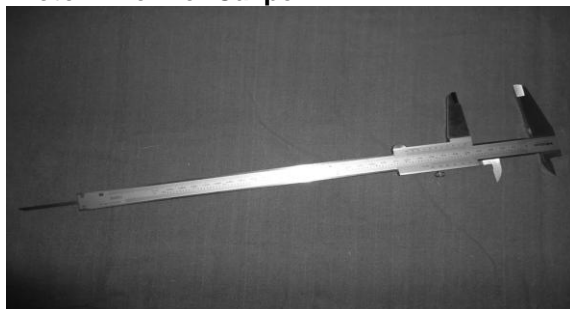
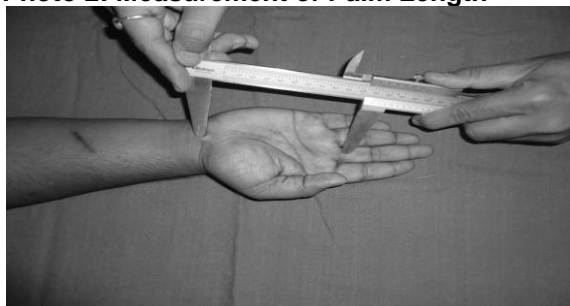


Photo 2: Measurement of Palm Length



The measurements were taken after the supinated hand & forearm were placed on flat, hard & horizontal surface with fingers extended & adducted. [6] Analysis was done using SPSS (statistical programme for social sciences) computer programme version 17.0 to calculate linear regression equations and multiplication factors. All the measurements were taken between 2 to 4 pm and by the same observer to avoid any diurnal & subjective variations.

The significance of results was tested using Z-test. P-value of less than 0.05 was considered as significant. Regression equation, correlation coefficient, range, mean, standard deviation and multiplication factors were calculated.

Observation & Results:

In our study Stature in males varied from 154.10 to 185.00 and stature in females varied from 146.30 to 180.50 cm. Mean height for male was 171.12 ± 6.26 and for female it was 159.43 ± 5.87 . By using z-test statistically significant difference was found in height between male and female. (Table 1, Graph 1)

Present study showed that Palm length in males varied from 8.80 to 11.70 and in females varied from 7.80 to 11.10 cm. Mean palm length for male was 10.10 ± 0.54 and for female it was 9.10 ± 0.53 .

By using z-test statistically significant difference was found in palm length between male and female. (Table 2, Graph 1)

In this study Significant positive correlation was found between palm length and height in males and in females also, which means that as palm length increases height also increases proportionately. Palm length showed higher degree of correlation with stature in males than in females.

The Correlation coefficient was 0.69 in central Indian males and 0.49 in central Indian females (Table 3, Graph 2, Table 4, and Graph 3). This suggests formula for one sex cannot be applied to estimate stature for the other sex.

Linear regression equations are derived for the estimation of stature for the study group for both the sexes. (Table 3 & Table 4) Estimated height can be calculated by using above line of regression 1 for males and line of regression 2 for females when we know the palm length of the respective person (male/female). Coefficient of determination ($R^2 = 0.49$ for males and 0.24 for females) were determined. Standard error of estimate was 0.41 for males and 0.46 for females.

Multiplication factors are also derived for the estimation of stature for the study group for

both the sexes. Multiplication factor for males is 16.94 and for females are 17.51. (Table 5)

Discussion and Conclusion:

The reviewed literature shows that stature is influenced by many factors like genetics, nutrition, environment, climatic conditions, races, gender, age etc. The acceptance of relationship between stature and other body dimensions has led to many investigations between stature and length or width of particular components.

Such relationships have proved to be extremely useful to forensic scientists, anatomists and anthropologists. In the present study also an attempt was made to find out stature from palm length in the central Indian population. In our study, stature in males varied from 154.10 to 185.00 and stature in females varied from 146.30 to 180.50 cm.

Mean height for male was 171.12 ± 6.26 and for female it was 159.43 ± 5.87 . In the present study males had significantly higher values of stature than females. Similar findings were also shown in other studies. [3, 6-13]

Palm length in males varied from 8.80 to 11.70 and palm length in females varied from 7.80 to 11.10 cm. Mean palm length for male was 10.10 ± 0.54 and for female it was 9.10 ± 0.53 . In the present study males had significantly higher values of palm length than females.

Similar observations were noted by Rastogi et al. [6] This suggests that there is genetic difference between male and female. This also suggests the fact that males are constitutionally taller than females which explains this difference. There by it is also suggested that the formula for one sex cannot be applied to estimate stature for the other sex. [6, 7, 13] This correlates with our study.

In our study we found statistically significant correlation between palm length and stature in males and in females also. In study by Chikhalkar et al, forearm length showed highest degree of correlation with stature. [1] Other studies also showed that hand length is more useful in estimating the stature than hand breadth, foot length or foot breadth. [3, 7]

Study by Sanli et al also showed significant relationship between hand length and stature. [5] Jasuja OP et al has shown that statistically significant correlation exists between hand length or palm print and stature. The prints if available at the scene or actual measurements can be used for stature estimation. [10] In other studies significant correlation was found between hand length & stature. [14]

In our study correlation coefficient was 0.69 in central Indian males and 0.49 in central Indian females. Higher correlation was found between stature & palm length in males than in females. The correlation coefficients between stature and palm length were found to be statistically highly significant.

Same were the findings in the study by Srinivasa Reddy P et al. [15] Study by Rastogi et al showed correlation coefficient ranging from 0.59 to 0.62 in males and 0.63 to 0.68 in females, showing higher degree of correlation between stature and palm length in females. Study by Sanli et al showed higher coefficient of correlation between hand length and stature in males than in females. [5]

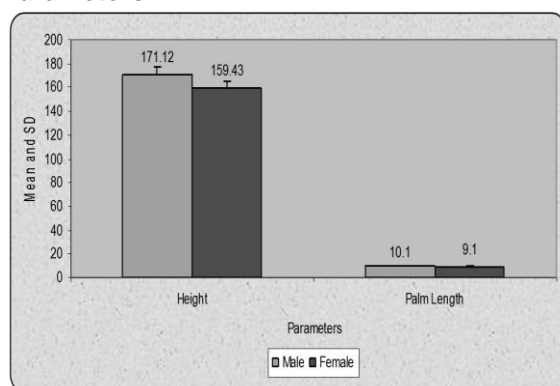
Similar findings were noted by other studies, where they found that when the hand lengths were compared to height, the relationship was stronger in males than in the females. [3, 11, 14] In our study, the multiplication factor for estimation of stature from palm length for females is 17.51 and for males is 16.94. The study conducted by Rastogi et al shows the multiplication factor 16.42 to 16.49 for females and 15.75 to 15.92 for males. Thus multiplication factors are slightly more in our study.

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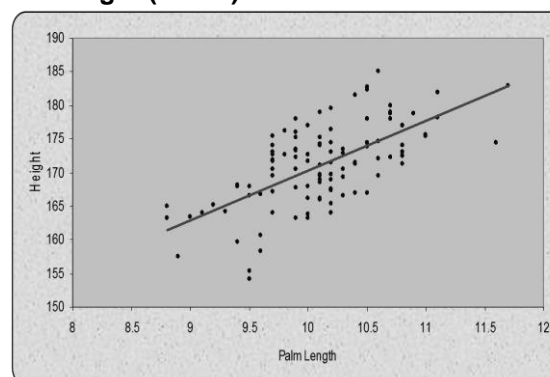
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Graph 1: Gender Wise Comparison of Parameters



Graph 2: Correlation between Palm Length and Height (Males)



Graph 3: Correlation between Palm Length and Height (Females)

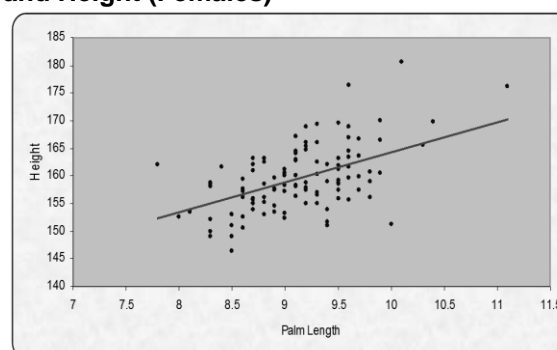


Table 1: Stature in Central Indian Population

Gender	N	Mean	Std. Deviation	Minimum	Maximum	p-value
Male	110	171.12	6.26	154.10	185.00	0.000, S
Female	120	159.43	5.87	146.30	180.50	

Table 2: Palm length in Central Indian Population

Gender	N	Mean	Std. Deviation	Minimum	Maximum	p-value
Male	110	10.10	0.54	8.80	11.70	0.000, S

Table 3: Correlation between Palm Length and Height (Males)

Variable	Mean	Std. Deviation	N	Correlation 'r'	p-value
Palm Length	10.10	0.54	110	-	-
Height	171.12	6.26	110	0.69	0.000 S, p<0.05

- Regression Equation is : Height = 96.34 + 7.39* Palm Length —(1)

Table 4: Correlation between Palm Length and Height (Females)

Variable	Mean	Std. Deviation	N	Correlation 'r'	p-value
Palm Length	9.10	0.53	120	-	-
Height	159.43	5.87	120	0.49	0.000S, p<0.05

- Regression Equation is : Height = 110.05 + 5.42* Palm Length—(2)

Table 5: Multiplication Factor for Palm Length in Central Indian Population

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

Original Research Paper

Hepatic Injury in Poisoning Cases: An Autopsy Study

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Abstract

Poisons act on various organs in the body that may result in fatality. In the present study, the liver pathology in various poisoning cases was studied in autopsied bodies that were conducted in a tertiary care hospital in Mangalore. The incidence of poisoning was equal in third, fourth and fifth decades with male to female ratio 7:3. The predominant poison responsible for fatality was Organophosphorus compound followed by Pyrethroid, zinc sulphide and Carbamates. Majority of the victims survived for less than 6 hours. Serum bilirubin level was raised in organophosphate, Pyrethroid and zinc phosphide poisoning. Serum liver enzyme levels were raised in zinc phosphide, copper sulphate, Pyrethroid and organophosphate poisoning. Congestion was the predominant gross finding seen in all the poisoning cases. Yellowish discoloration of liver was mainly seen in paraquat, zinc phosphide and organophosphate poisoning. The predominant microscopic finding was congestion, steatosis, periportal lymphocytic infiltration, intrahepatic haemorrhage, centrilobular necrosis and intrahepatic cholestasis.

Key Words: Poisoning, Hepatotoxicity, Liver Pathology, Liver function test

Introduction:

Poisoning is one of the major social problems worldwide. The morbidity and mortality due to poisoning varies in different parts of the world due to variation in consumption of toxic substances. The commonly used compounds include pesticides, opioids, benzodiazepines, alcohol, antidepressants, etc. [1-6]

Since majority of the drugs and toxic compounds are metabolized in the liver, it is more prone for injury caused by these agents.

The relative importance of hepatic injury due to various types of toxins has changed considerably over the years. Poisoning by phosphorus has almost disappeared from the USA, but remains a problem in other parts of the world due to suicidal or accidental ingestion of rodenticides.

A cause of hepatotoxicity outstripping all others in the UK and of growing importance elsewhere is the suicidal ingestion of Paracetamol. [7] The hepatic toxicity induced by pharmaceuticals, toxins, recreational drugs and pesticides can range from steatosis to massive necrosis.

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The present investigation is undertaken to study the liver cell changes in autopsy samples of various poisoning deaths.

Material and Methods:

Forty cases of deaths due to poisoning were subjected to postmortem examination in the Department of Forensic Medicine, Father Muller Medical College, Mangalore, Karnataka from January 2009 to December 2011.

The gross findings were noted at autopsy and liver tissue was subjected to histopathological examination in the Department of Pathology, Father Muller Medical College, Mangalore, Karnataka.

The routine viscera and blood samples were collected at autopsy and sent to Forensic Science Laboratory for chemical analysis and confirmation of the poison consumed.

Observations and Results:

Majority of the cases were in the age group of 21-50 years. Incidence was more common in males (27 cases) compared to females (13 cases) with male to female ratio was 7:3. (Fig. 1) The predominant poison responsible for fatality was Organophosphorus compound (OPC), followed by Pyrethroid, zinc sulphide and Carbamates. (Fig. 2)

Majority of the victims survived for less than 6 hours followed by 6-24 hours. (Fig. 3) Clinical investigations were done in only 25 cases. Serum bilirubin level was raised only in organophosphate, Pyrethroid and zinc phosphide poisoning. Out of 11 organophosphate cases, total bilirubin was

raised in 2 cases, but there was no rise in conjugated or unconjugated bilirubin level. Out of six Pyrethroid cases, total bilirubin was raised in two cases and conjugated as well as unconjugated bilirubin was raised in only one case. Total bilirubin was raised in all five cases of zinc phosphide, but conjugated as well as unconjugated bilirubin was raised in only one case. Serum protein level was raised only in 20% of zinc phosphide poisoning with raised Albumin-Globulin ratio.

Other poisoning cases did not show any rise in these levels. Serum liver enzyme levels were mainly raised in zinc phosphide and copper sulphate poisoning followed by Pyrethroid and Organophosphate poisoning. (Table 1) During autopsy, predominant gross finding of the liver was congestion in all the cases of poisoning. However, in paraquat and zinc phosphide cases, congestion was seen only in 50% of cases.

Cut surface of liver showed yellowish discoloration in 50% of paraquat and zinc phosphide cases and 9% of organophosphate poisoning. Blackish discoloration of liver surface adjacent to stomach was observed in both sulphuric and formic acid cases.

Multiple petechial haemorrhages over the surface and in the cut sections were observed in 80% and 9% of zinc phosphide and organophosphate cases respectively. Cirrhotic changes were visible in 18% of organophosphate cases. The viscera and blood were sent for chemical analysis, which showed positive results for poisoning in only 32 cases.

On histopathological examination the predominant microscopic findings were congestion and steatosis in most of the poisoning cases in the present study. (Table 2)

Steatosis was microvesicular and macrovesicular in the organophosphate, Pyrethroid, Carbamates, zinc phosphide, and sulphuric acid poisoning; while it was mainly microvesicular in alcohol, copper sulphate, benzodiazepine and Organochlorine poisoning.

Congestion was seen in all cases except alcohol, sulphuric acid, formic acid and Organochlorine poisoning.

Periportal lymphocytic infiltration was observed in organophosphate, Pyrethroid, zinc phosphide, benzodiazepine and turpentine poisonings. Intrahepatic haemorrhage was seen in 2 cases of zinc phosphide and one case of organophosphate poisoning.

In two cases each of Pyrethroid and zinc phosphide poisoning centrilobular necrosis was seen, while periportal fibrosis was seen in one case, each of combined organophosphate

with Pyrethroid consumption and Organochlorine poisoning. Intrahepatic cholestasis was seen in three cases of zinc phosphide poisoning.

Discussion:

Poisoning is one of the global health problems. Earlier studies have shown that the incidence of poisoning was more common in the age group of 21-30 years. [1, 8, 9] However, in the present study, the incidence of poisoning fatalities were equal in third, fourth and fifth decades. This could be due to the fact that the causes for poisoning fatalities (i.e., social, economic and psychological reasons) vary in different places as well as individuals.

The incidence of poisoning fatalities was more common in males (67.5%) in the present study and is consistent with those of earlier reports [1, 9, 10] Men are the predominant gender in developing countries involved in jobs to take care of the family and they are more prone for psychological stress.

Hence, suicidal tendencies are more in men. In the present study, the commonest agent responsible for the fatality was Organophosphate, and is consistent with earlier studies. [1, 8-10] Common use of the Organophosphates as pesticides/ insecticides in agricultural fields and domestic areas is prone for accidental poisoning while easy accessibility accounts for its use for suicidal purpose.

In the present study, the second commonest compound responsible for fatality was Pyrethroid followed by aluminum and zinc phosphides. However, aluminum and zinc phosphides stand second in other studies. [1, 8, 9] The pyrethroids are commonly used in agriculture, and aluminum and zinc phosphides are used as rodenticides in houses and agriculture fields crops, which are easily available for suicidal purpose.

In the present study, majority of the victims survived for less than 6 hours followed by 6-24 hours. This is consistent with other studies. [11, 12] In most of the poisoning cases, the initial few hours is very critical. Most of the fatalities result in this period because the victims are not able to reach the hospital in time for treatment. Hepatotoxicity is indicated by decreased level of serum albumin and increased levels of AST, ALT, INR, serum bilirubin and blood ammonia levels.

In the present study, serum bilirubin and liver enzyme levels were raised mainly in organophosphate, Pyrethroid, zinc phosphide and copper sulphate poisoning.

Co-poisoning with Organophosphorus and Pyrethroid pesticides causes inhibition of glutathione S-transferase, superoxide dismutase, catalase, transaminases and phosphatases leading to reduced glutathione content, increased activity of lactate dehydrogenase and thiobarbituric acid levels. [13] Elevated transaminase and alkaline phosphatase can persist for 3 to 6 days in survivors of organophosphate intoxication. [14]

In our study, congestion was the predominant gross finding followed by yellowish discoloration and multiple petechial haemorrhages especially in zinc phosphide, organophosphate and Pyrethroid poisoning. This is consistent with earlier studies. [15, 16]

Sulphuric acid caused blackish discoloration over the surface where the stomach was in contact with liver.

In this study, microvesicular and macrovesicular steatosis was the predominant histopathological finding in most of the cases.

Pesticides and ethanol causes oxidative stress in the liver mainly by an induction of microsomal cytochrome P-450 that may lead to modification of lipids, proteins and nucleic acids in the liver. [17, 18] Also, ethanol-modified epigenetic parameters such as DNA methylation, different site-specific modifications in histone proteins and microRNAs lead to fatty liver. [19] In this study, centrilobular hepatic necrosis was mainly observed in Pyrethroid and zinc phosphide poisoning, which is consistent with earlier studies. [20, 21]

Pyrethroids metabolize in the liver by the action of cytochrome P450 microsomal enzyme system via esoteric and oxidative pathways which results in oxidative stress causing hepatic necrosis. [22]

Phosphide ingestion leads to a high superoxide dismutase activity and low catalase levels that causes increased free radicals and accelerates lipid peroxidation, which results in cellular death. [23]

Centrilobular necrosis followed by rapid disappearance of necrotic cells was observed in Paracetamol overdose. [24]

In the present study, serum alkaline phosphatase was raised in 4 cases of zinc phosphide, 2 cases of organophosphate and one case of Pyrethroid poisoning, which indicates bile duct pathology.

However, histological evidence of intrahepatic cholestasis was demonstrated in only 3 cases of zinc phosphide poisoning. It has been reported that surrogate alcohol mixtures containing guanidine derivatives cause

irreversible disturbance of bile transport in hepatocytes and biliary capillaries. [25]

Summary and Conclusion:

In the present study, liver injury was due to direct cytotoxicity of the consumed poisons. Liver cell injury was invariably present in all the cases and the severity of injury ranged from congestion, haemorrhage, periportal inflammation, steatosis, cholesterol granuloma to zonal necrosis and massive necrosis.

The predominant poison consumed in majority of the deaths was Organophosphorus compounds and phosphides. Middle aged men formed the largest group of poisoning deaths.

Liver, being the main organ of metabolism, is the target of injury in poisoning. The nature of the poison and the type of cell injury caused in other organs including liver determine the course of poisoning.

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Fig. 1: Age wise Distribution of Cases

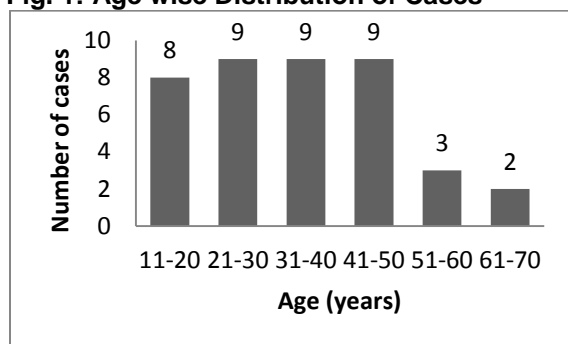


Fig. 2: Distribution of Poisoning Cases

Table 1: Liver Enzyme Levels in Different Cases of Poisoning

Poisonous compounds	AST (SGOT)	ALT (SGPT)	ALP
	No. (%)	No. (%)	No. (%)
Organophosphate (n=11)	3 (27)	3 (27)	2 (18)
Pyrethroids (n=6)	5 (83)	3 (50)	1 (17)
Organophosphates + Pyrethroids (n=2)	1 (50)	1 (50)	-
Zinc phosphide (n=5)	5 (100)	5 (100)	4 (80)
Copper sulphate (n=1)	1 (100)	1 (100)	-

AST – Aspartate aminotransferase, SGOT – Serum glutamic oxaloacetic transaminase, ALT – Alanine transaminase, SGPT – Serum glutamic pyruvic transaminase, ALP – Alkaline phosphatase. # The above investigations were not done in remaining cases.

Table 2: Liver Histopathology Findings in Different Cases of Poisoning

Poisonous compounds	Congestion	Steatosis	PLI	Haemorrhage	Necrosis	Fibrosis	
		Microvesicular	Macrovesicular				
Organophosphate (n=11)	5 (45%)	7 (64%)	3 (27%)	4 (36%)	1 (9%)	-	-
Pyrethroids (n=6)	2 (33%)	3 (50%)	2 (33%)	2 (33%)	-	2 (33%)	-
Organophosphate + Pyrethroids (n=2)	2 (100%)	2 (100%)	1 (50%)	1 (50%)	-	-	1 (50%)
Carbamates (n=5)	2 (40%)	2 (40%)	1 (20%)	-	-	-	-
Zinc phosphide (n=5)	2 (40%)	4 (80%)	2 (40%)	2 (40%)	2 (40%)	2 (40%)	-
Alcohol (n=1)	-	1 (100%)	-	-	-	-	-
Sulphuric acid (n=1)	-	1 (100%)	1 (100%)	-	-	-	-
Formic acid (n=1)	-	1 (100%)	-	-	-	-	-
Copper sulphate (n=1)	1 (100%)	1 (100%)	-	-	-	-	-
Benzodiazepine (n=2)	1 (50%)	1 (50%)	-	2 (100%)	-	-	-
Organochlorine (n=2)	-	1 (50%)	-	-	-	-	-
Turpentine (n=1)	1 (100%)	-	-	1 (100%)	-	-	-
Unknown (n=2)	2 (100%)	-	-	-	-	-	-

PLI – Periportal lymphocytic infiltration

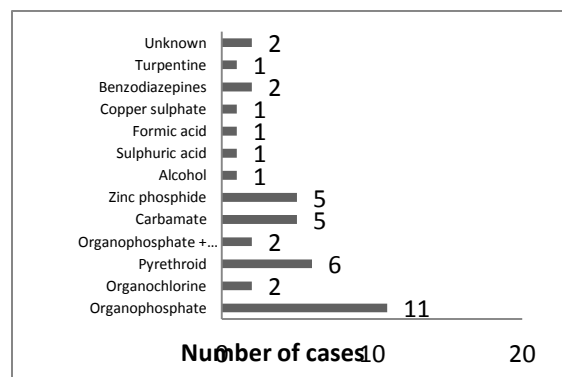
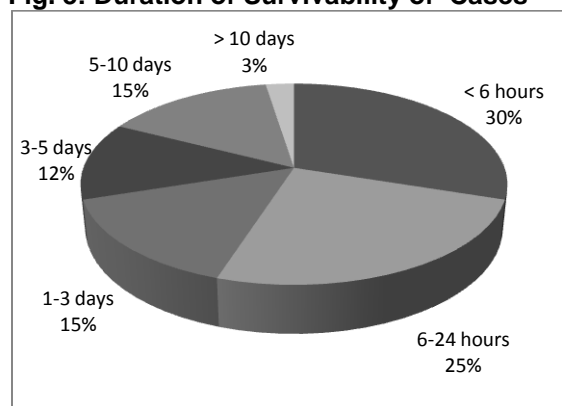


Fig. 3: Duration of Survivability of Cases



Original Research Paper

Causes of Suicide in Acute Poisoning Cases in different age Groups: A Study

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Abstract

As suicidal poisoning is a significant contributor to mortality and morbidity throughout the world, it is imperative to find out causes of suicide in particular age groups involving acute poisoning, as it will immensely help the health policy makers to reduce the mortality and morbidity due to suicidal poisoning. So this study was carried out over a period of two years at Rural Medical College, Loni to study causes of suicide according to age group in acute poisoning cases. Data about the age, manner of poisoning and cause of suicide pertaining to the incident of poisoning was collected and statistically analyzed.

In maximum number of suicidal cases, cause for suicide was family conflicts 59 (28.55%). Financial problem was cause of suicide in maximum number of cases in the age group of 41-50 and 51-60 years. Unemployment was the causes of suicide only in the age group of 31- 40 years. Failure in examination was cause of suicide only in the age group of 11-20 years. The present study helps to interpret the causes of suicidal poisoning.

Key Words: Causes of Suicide, Poisoning, Age Group, Poisoning

Introduction:

The era of poisoners for hire may have long ago reached its pinnacle, but environmental poisons confront all of us with no end of this poisoning menace in sight. [1] Primitive man must very early have discovered that certain substances, both mineral and vegetable, are poisonous. He, no doubt, made use of this knowledge in avoiding these deleterious substances and in employing them against his enemies. [2-4] In ancient times homicidal poisoning was common, but now a days accidental and suicidal poisoning is increasing which is a big problem today.

Accidental and suicidal poisoning is a significant contributor to mortality and morbidity throughout the world and varies from place to place and changes over a period of time. The incidence of poisoning is rising in India. More than 50,000 individuals die of poisoning every year. [5] As per the Registrar General of India, more than one lakh persons (1,22,637) in the country lost their lives by committing suicide during the year 2007 and the commonest means adopted for suicide was poisoning in 34.8% cases. [6] So it is imperative to find out causes of suicide in particular age groups involving acute poisoning, as it will immensely help the health policy makers to reduce the mortality and morbidity due to suicidal poisoning.

The present study is carried out at Pravara Rural Hospital and Rural Medical College of Pravara Institute of Medical Science, Loni to study causes of suicide according to age group in acute poisoning cases.

Materials and Methods:

This hospital based prospective cross sectional study was carried out over a period of two years duration from 01/09/2008 to 31/08/2010 after approval by Institutional Ethics and Research committee at Rural Medical College, Loni and Pravara Rural

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Hospital, of Pravara Institute of Medical Sciences, Loni.

All admitted and brought dead cases of acute poisoning, cases of known and unknown bites and stings from all age were included in the study. All cases of chronic poisoning, poisoning cases admitted and referred to other hospitals, absconded cases, brought dead cases without history of acute poisoning, cases admitted without history of poisoning, bites and stings were excluded from the study.

Comprehensive proforma for the study was designed which containing age, manner of poisoning and cause of suicide. Information about the relevant facts pertaining to the incident of poisoning was gathered by directly interviewing the patient (wherever possible) or the relatives, friends or those accompanying the patient after obtaining the written, informed consent and also from the investigating police authority. Relevant data of the individual poisoning cases was collected from medico-legal cases register of casualty, case papers from concerned department, inquest, post-mortem reports, chemical analysis report after taking informed consent from patient or relatives.

The manner of poisoning was decided depending upon the information given by the patient and /or relatives of the patient, police and postmortem report in case of death. If there was difference of opinion regarding the manner of poisoning, manner was considered as undetermined. In suicidal poisoning cases, information about cause of suicide was gathered by directly interviewing the patient (wherever possible) or the relatives, friends or those accompanying the patient after obtaining the written, informed consent and also from the investigating police authority. If there was difference of opinion regarding the cause of suicide, cause of suicide was considered as unknown.

Data was statistically analyzed using statistical software SPSS Statistic 17 and Microsoft Office Excel 2003. Data was analyzed in the form of percentage (%) and proportion.

Observations and Results:

During the period of 24 months from September 2008 to August 2010 total 557 cases of acute poisoning were reported. In maximum number of suicidal cases, cause for suicide was family conflicts [159 (28.5%)] followed by unknown causes [47 (8.4%)] and dowry [18 (3.2%)] while in a single case cause

of suicide was crop failure. Failure in examination was the cause of suicide in 5 (0.9%) cases, unemployment in 6 (1.1%) cases, failure of love in 7 (1.3%) cases, financial problem in 12 (2.2%) cases and psychiatric & chronic diseases in 14 (2.5%) cases. Financial problem (poverty, burden of loan repayment) was cause of suicide in maximum number of cases in the age group of 41-50 and 51-60 years with 4 (0.7%) cases each. Unemployment and crop failure were the causes of suicide only in the age group of 31- 40 years with 6 (1.1%) cases and 1 (0.2%) case respectively. Failure in examination was cause of suicide only in the age group of 11-20 years with 5 (0.9%) cases. Dowry was cause of suicide in maximum number of cases [12 (2.2%)] in the age group of 21-30 years followed by in 11-20 years of age group [5 (0.9%)]. Family conflicts was cause of suicide in maximum number of cases in the age group of 21-30 years with 79 (14.2%) cases followed by 11-20 years of age group [48 (8.6%)] and 31-40 years of age group [22 (4%)].

Psychiatric & chronic illness was cause of suicide in maximum number of cases in the age group of 31-40, 41-50 and 71-80 years with 3 (0.5%) cases each. Marital disharmony was cause of suicide in maximum number of cases in the age group of 31-40 years with 8 (1.4%) cases. Failure in love was cause of suicide only in the age group of 21-30 and 11-20 years with [5 (0.9%)] cases and [2 (0.4%)] cases respectively.

Cause of suicide was unknown in maximum number of cases in the age group of 21-30 years with 27 (4.9%) cases followed by 31-40 years in 8 (1.4%) cases. Cause of suicide was not applicable in 274 (49.2%) cases as manner of poisoning in these cases was either accidental or undetermined.

Discussion:

Finding of the present study, that in maximum number of cases, cause of suicide was family conflicts was in accordance with the study done by Chavan KD et al [7] who reported it to be in 60.67% cases. Reason for higher number of suicide due to family conflicts may be due to fact that maximum cases in the present study were in the age group of 11-30 years in which most of the individuals were immature and short tempered due to more stress, various responsibilities, bad habits, addictions, so minor cause may be sufficient in them to cause suicidal impulse. Other reasons for suicides in the present study including failure in examination, financial

problem, failure in love, unemployment and others correlate with the reasons for suicide mentioned in the study conducted by Chavan KD et al.[7].

Finding in the present study was in contrast with the study done by Gannur DG[8] who reported that in maximum number of poisoning cases, the cause of suicide to be financial problem (76.3%) followed by domestic problems in 19.2% cases. In spite of extensive search we could not compare variations in cause of suicide according to age due to non availability of such findings in the studies done by other workers.

Financial problem (poverty, burden of loan repayment) was cause of suicide in maximum number of cases in the age group of 41-50 and 51-60 years. This may be due to fact that this age group is suffering from all types of stress and strain i.e. domestic, economic and inability to fulfill responsibilities of the family like marriages of their daughters, which might have produced suicidal impulse in them. Unemployment and crop failure were causes of suicide only in the age group of 31-40 years and may be due to economic instability. Failure in examination was cause of suicide only in the age group of 11-20 years as most of the exams like 10th and 12th standard examination which decides the future, are usually appeared for in the same age group and tremendous pressure from parents to do good in exams may have lead to impulse for suicide.

Dowry was cause of suicide in maximum number of cases in the age group of 21-30 years. This may be due to fact that most of the marriages do occur in the same age group. Economical dependence of women and dowry demands are common in rural area so higher incidence of violence against women by husband and her in laws may have lead to suicidal impulse. Family conflicts were cause of suicide in maximum number of cases in the age group of 21-30 years and in 11-20 years of age group and may be due to immaturity and short temperedness in this age group.

Failure in love was cause of suicide only in the age group of 21-30 and 11-20 years. This may be due to fact that these individuals in this age group are young and not matured. Cause of suicide was unknown in maximum number of cases in the age group of 21-30 years. This may be due to the fact that individuals in this age group might do something which is not acceptable in the family and socially like unacceptable sexual

relationships, addictions and gambling and so they didn't reveal cause of suicide.

Conclusion:

The present study helps to interpret the causes of suicidal poisoning. It is imperative to identify these trends in causes of suicidal poisoning, as it will immensely help the health policy makers to reduce the mortality and morbidity due to suicidal poisoning. To prevent suicidal poisonings psychologists and psychiatrists should work in cooperation to provide support even within the smallest health care units. The vulnerable age group for committing suicide should be identified and proper psychological support should be provided.

The high incidence of suicide in the young age group and in young married couples can be checked by developing satisfactory interpersonal relationship and tackling effectively social and psychological problems between the young and the elders in the society. To reduce suicidal dowry deaths due to poisoning it is necessary to spread awareness about the anti-dowry laws and to provide proper and sincere help for the victims. Female adolescents in the rural areas should be well educated and sensitized about the advantages of being economically independent. The root cause of suicidal tendencies among specific age groups must be diagnosed and treated by qualified psychiatrists. Treating the problems leading to suicidal behaviors, changing attitudes, stress management, general and marriage counseling are recommended to tackle social and psychological problems. Health education program for prevention suicidal poisoning should be designed and implemented for the benefit of the public at large.

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Table 1: Distribution of Causes of Suicide According to Age Group in Acute Poisoning Cases

Causes of suicide	Age in years								Total
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Financial problem (poverty, burden of loan repayment)	0	0	1(0.18)	3(0.54)	4(0.72)	4(0.72)	0	0	12(2.15)
Unemployment	0	0	0	6(1.08)	0	0	0	0	6(1.08)
Crop failure	0	0	0	1(0.18)	0	0	0	0	1(0.18)
Failure in examination	0	5(0.89)	0	0	0	0	0	0	5(0.89)
Dowry	0	5(0.89)	12(2.15)	1(0.18)	0	0	0	0	18(3.23)
Family conflicts	1(0.18)	48(8.61)	79(14.18)	22(3.95)	7(1.26)	1(0.18)	0	1(0.18)	159(28.55)
Psychiatric, Chronic Illness	0	1(0.18)	1(0.18)	3(0.54)	3(0.54)	2(0.36)	1(0.18)	3(0.54)	14(2.51)
Marital disharmony	0	0	4(0.72)	8(1.44)	2(0.36)	0	0	0	14(2.51)
Failure in love	0	2(0.36)	5(0.89)	0	0	0	0	0	7(1.26)
Unknown	0	6(1.08)	27(4.85)	8(1.44)	4(0.72)	1(0.18)	1(0.18)	0	47(8.44)
Not applicable*	100 (17.45)	33(5.92)	66(11.85)	28(5.03)	22(3.95)	13(2.33)	9(1.62)	3(0.54)	274(49.18)
Total	101(18.1)	100(17.9)	195(35.0)	80(14.3)	42(7.5)	21(3.7)	11(1.9)	7(1.2)	557(100)

Obituary

Dr Abhininder Singh Thind was born on 23.04. 1955. He did his MBBS from GMC Amritsar in 1973-78, making his father proud and indeed an achievement in itself for a simple village boy to become a learned doctor. He then joined PCMS and later joined MD Forensic Medicine GMC Patiala in 1991. In journey through his career he worked at Guru Gobind Singh Medical College, Faridkot, GMC, Amritsar, GMC Patiala and this culminated in his becoming the Director Research Medical Education, Punjab and Medico Legal Advisor to Govt of Punjab. He was a man who helped anyone within his reach. A firm believer of God and most of all a good human being. May his soul rest in peace.



Dr. A.S. Thind
(23-04-1955 to 26-10-2015)

Original Research Paper

Profile and Pattern of Hanging Cases at a Tertiary Care Hospital, Khammam; Telangana

Bharath Kumar Guntheti¹, Sheik Khaja², Uday Pal Singh³

Abstract

Out of 824 medico legal cases presenting to Dept. of Forensic Medicine, MGH, Khammam, TS during one year (November 2014 to October 2015), 32 (n=32) hanging cases were reported and all of them were taken into the present study. It was observed that the most vulnerable age group was 21 to 30 years [75.00%] in both sexes, with male to female ratio being 3:1. Males, Married, Hindu by religion, from rural area accounted for 71.87 %. 24[75.00%] belonged to low income group. Preferred place of hanging was indoor setting in 31[96.81%] cases. Financial problem was the main cause of committing suicidal hanging. Marital unhappiness, chronic non-curable illness, domestic violence were the other main causative factors of hanging. Hanging was complete in 24[75.00%] and was atypical in 22 [68.75%] cases. Ligature material was present in 31 cases, it was above the level of thyroid cartilage in 28[87.50%], the ligature mark was oblique in 31[96.87%], deep in 26[81.25%]. Rope was used as ligature material by 24[75.00%]. Salivary discharge was observed in 14[43.75%] cases. Protrusion of tongue was seen in 12[37.50%]. Asphyxial signs and congestion of organs, soft tissue petechial hemorrhage was seen in 2 [6.25%], intimal tears of carotid artery in 4[12.50%]cases , fracture of hyoid bone in 7[21.87%] cases and no thyroid cartilage fracture were seen. The study objective was to find out the epidemiological findings, pattern of hanging and identifying appropriate reasons

Key Words: Hanging, Incidence, Ligature material, place, Income, Education

Introduction:

The high incidences of suicidal hanging among young adults impose an enormous socio economic burden on the society and are very sparingly reported from rural parts of India [1]. Hanging is a form of mechanical asphyxia caused by suspension of the body by ligature which encircles the neck, the constricting force being the weight of the body[2]. Depending on method adopted for hanging, body is either completely suspended without any part touching the ground as in Complete hanging or as in Partial hanging, some part of the body touches ground. A slight force produced by Weight of the head [5-6 kg] acts as a constricting force and can kill a person.

In India, killing a victim and suspending the body from a tree or a rafter to avert suspicion is very common practice, such postmortem hangings simulate suicidal hanging and it is necessary to find out if hanging is the cause of death in a suspended body [2]. Thorough external and internal examination helps in arriving at an opinion on the cause of death and to forward the same to Investigating officer. The forensic pathologist has to distinguish between hanging and other forms of strangulation and between suicidal, homicidal and accidental hangings. A study on common methods of suicide, risk factors, sociodemographic factors, cultural aspects and other established etiologies in an area serve as road map not only for a forensic expert but also for local governing bodies to take appropriate control measures. This study is meant to conclude the above perspective.

Aims & objective:

1. To study of profile and analysis of risk factors and pattern of hanging
2. To study the prevalence of hanging fatalities and determine the reasons

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Material and Methods:

The present study was carried out at Mamata General Hospital, Khammam between November of 2014 and October of 2015 after obtaining prior permission from Institutional Ethics Committee and proper consent from either attendant or victim. Detailed history from victims, relatives, hospital records, inquest, and autopsy reports etc., were filed in a specially designed Pro forma. All the data was analyzed compared statistically and the results are tabulated

Observation and Discussion:

Incidence It is observed that, out of 824 medico legal cases presented to the Dept. of Forensic Medicine, 32 were cases of hanging. Incidence was 3.88%. Similar observation was reported by author [3].

Age & Sex: The maximum numbers of hanging 18[56.25%] cases were observed between age group of 21-30 years. 28[87.50%] victims aged less than 40 years. The most vulnerable age group for hanging was observed as 21-40 years. 4 [12.5%] each in young (up to 20 years) and elderly (above 40 years) aged group chose hanging. In age below 10 years only one accidental hanging case was seen and in extreme age above 60 years no cases were found. These were consistent with authors [3, 4]. This particular age group is most active period in one's life. Frustration due to various reasons such as financial problems, the burden of livelihood, unemployment, and poverty contributed to their death. Among 32 hanging cases, 24 were males and 8 females, which suggests male predominance. The male to female ratio is 3:1. These were consistent with authors [3-7]. [Table no.1]

Religion: Religion wise, most of victims 25[78.12%] were Hindu, which is similar to author [8]. [Fig 1]

Marital status: 21 [65.62%] victims were married which outnumbered the unmarried. Similar observations are noted by author [5-10]. This shows that the marital disharmony, personal, financial responsibilities stimulated them to commit suicidal hanging. [Fig 2]

Domicile pattern: Highest numbers of 23 [71.81%] victims were from rural. Similar to authors [6,7]. High incidence in rural area due to rural population migration, crops loss either droughts or rains, lack of work. [Fig 3]

Place for Hanging: 23[71.81%] cases were rural in origin which was similar to author [6, 7]. Population migration, crop loss either by droughts or floods, lack of work, loss in other

traditional occupations contributed to their high incidence.

Income group: We observed that incidence of hanging was more in low income groups 24[75.00%]. These are consistent with authors [6-10]. This showed that low income served as a motive for dissatisfaction among individuals and commit suicide by hanging which indicated that hanging was more of psychological in origin. [Fig 4]

Educational status: Out of 26[81.25%] victims who went to school, 12[37.50%] received primary education, 8 [12.5%] received secondary education. Same results are made by author [10]. [Fig 5]

Occupation: More number of cases of suicide by hanging was found in farmers 24[75.00%]. These findings were consistent with authors [10-13, 15]. Committing suicide by hanging was observed in farmers with financial problems due to failure of crops either by floods or droughts. Presence of poverty, lack of crop insurance schemes also contributed. [Fig 6]

Site of Hanging: Usually victim of suicide prefers any secluded place which will suit his purpose of committing suicide. We observed that the home was the place of choice by 22[68.75%] victims. Among total number of hanging cases outside home, 10[31.25%] were male. Similar findings were found in study done by authors [10-16]. This suggests that females chose home for hanging more than male [Table no.2]

Time of Hanging: Most of the victims [81.25%] committed hanging in day time. These are consistent with Indian authors. It suggests that victim of suicide prefers any particular time which will suit his purpose of committing suicide also other family members engaged with their daily activities during day time.

Season of Hanging: Highest incidences of hanging [37.50%] cases were reported in rainy season. Similar findings are observed by authors [11, 13]. Loss of crops either due to droughts or floods badly resulted financial crisis.

Reason for Hanging: Reasons for committing suicide by hanging was observed maximum in persons with financial problems [43.75%] followed by marital disharmony [15.62%], psychiatric 4[12.50%], chronic non-curable illness [9.37%], domestic violence [9.37%], academic failure [6.25%] and love failure [3.12%]. These are consistent with authors [6,7,11,13]. While in most active phase of one's life (21-40 years), exposure to anxiety, stress, financial problems, unemployment, failure in studies, love endings, alcohol addiction, and emotional instability were the alleged reasons for committing hanging. [Fig 7]

Type of Hanging: Complete hanging was observed in 24 [75.00%] cases. These are consistent with other studies [7, 15, and 18]. Typical hanging was observed in 10 [31.25%] cases while atypical hanging was reported in 22 [68.75%]. These are similar to authors [15-19].

Position of Ligature: In our study, position of the ligature was fixed around neck in 25 [78.12%] cases. Same findings are made by authors [18-19]. [Table no 3]

Type of ligature loop: We observed single ligature loop in 19 [59.37%] cases. These are consistent with authors [19-20].

Manner of Hanging: Regarding the manner, in our analysis, it showed that 30 [93.75%] cases were suicidal in nature. 1 [3.12%] case was homicidal in nature, where female was found to be victim due to family disputes and 1 [3.125] accidental hanging occurred while a male child was playing with rope. These are consistent with authors [7, 20]. [Fig 8]

Cause of death: Cause of death in maximum [50.00%] cases was due to the combination of both asphyxia as well as venous congestion. Similar results were observed by authors [7, 14, and 20]. [Fig 9]

Ligature findings: According to the ligature findings, in majority of hanging cases, the ligature mark was oblique 31 [96.87%], above the thyroid cartilage in 29 [90.62%], incompletely encircling the neck in 24 [75.00%], single turn in 19 [59.37%], with a width of 0—2 cms. in 23 [71.87%] cases, and rope was used as a ligature material in 18 [56.25%] cases. Similar results were noted by authors [15-20]. Ligature mark around the neck, presence of abrasions, ecchymoses and redness about the ligature mark, trickling of saliva from mouth, ecchymoses of larynx or epiglottis, rupture of intima of the carotid and post mortem signs of asphyxia served as tool for diagnosis of hanging. [Table no. 4]

Other postmortem findings: Postmortem findings, asphyxial signs, congestion of organs were observed in all cases. Petechial hemorrhages were seen in the eyes. Body showed lividity in the legs, forearms and hands. Similar results were noted by authors [17-22]. Asphyxia in hanging is usually related to the compression of the carotid arteries, rather than blockage of the airways. Their absence helped to distinguish hanging from other strangulations. [Table no. 5]

The ligature mark was reddish brown in 18 cases, it was pale in 2 [6.25%] and parchmentized in 12 [37.50%]. Similar observations are reported by authors [14, 15]. The color of the ligature mark depends mostly

on the duration of suspension of the body and nature of the ligature materials used and also the time elapsed between death and autopsy.

Protrusion of tongue was seen in 12 [37.12%] cases. Similar findings were made by authors [20-22]. The probable reason for this phenomenon could be that the constricting force of the ligature caused upward pressure on the neck structure causing elevation of the tongue.

Salivary stain was present in 14 [43.73%] cases of hanging. These are consistent with authors [17, 19, and 22]. Saliva is often found dribbling from angle of the mouth down the chin. This is supposed to be sure sign of ante mortem hanging as secretion of saliva being a vital function, cannot occur after death.

Hyoid bone fracture was noted in 7 [21.87%] cases of hanging and that age was above 40 years. This may be due to calcification and fragility of bony structures. These results were also observed by authors [17-20]. In our study, majority of victims were of young age below 40 years, and the fracture frequency of hyoid bone increased with age as it got ossified.

Conclusion:

Incidence of hanging was 3.88%. Most vulnerable age group was 21 to 30 years with male to female ratio being 3:1. Married Hindu males, from rural areas, working as farmers with low educational and financial background committed suicidal hanging in rainy season during day time at their homes. Ligature material was soft in majority of the cases. 90.62% were suicides, one case of accidental and one homicidal hanging was observed. Financial problem was the most common reason in male. Marital disharmony is utmost reason in female. Asphyxial signs and congestion of the organs, cardinal signs dribbling of saliva, presence of redness of ligature mark, and evidence of fracture of hyoid bone helped in arriving at a conclusion in most cases. Combination of asphyxia and congestion remained as cause of death.

Preventive measures: Appropriate education, farmer's crop insurance, proper psychotherapy, and careful monitoring of children while they are playing control hangings in most of the cases

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Table No.1. Age and Sex wise distribution

Age in yrs	Male	Female	Total
0-9	1[3.12%]	0	1[3.12%]
10-20	2[6.25%]	1[3.12%]	3[9.37%]
21-30	14[43.75%]	4[12.50%]	18[56.25%]
31-40	4[12.50%]	2[6.25%]	6[18.75%]
41-50	2[6.25%]	1[3.12%]	3[9.37%]
51 -60	1[3.12%]	0	1[3.12%]
61 above	0	0	0
Total	24[75.00%]	8[25.00%]	32

Fig 2. Marital status distribution

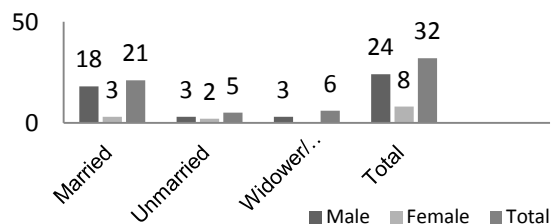


Fig 4. Socioeconomic Status

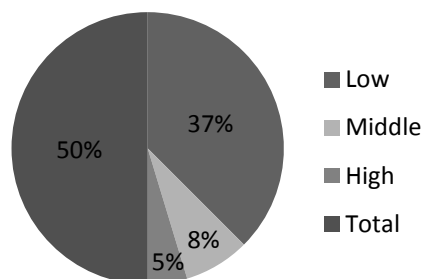


Fig 1.Community wise distribution

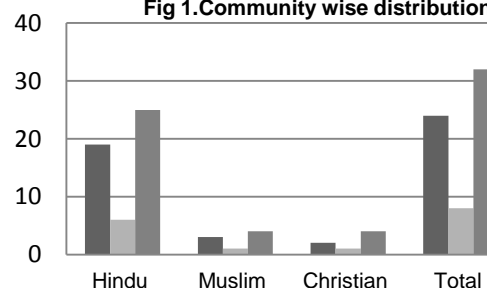


Fig 3. Showing Domicile Pattern

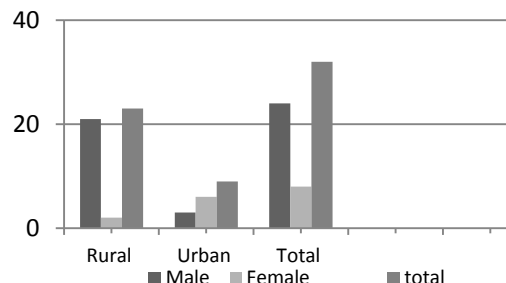
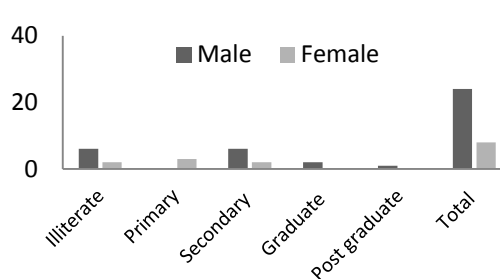


Fig 5 . Showing Educational status



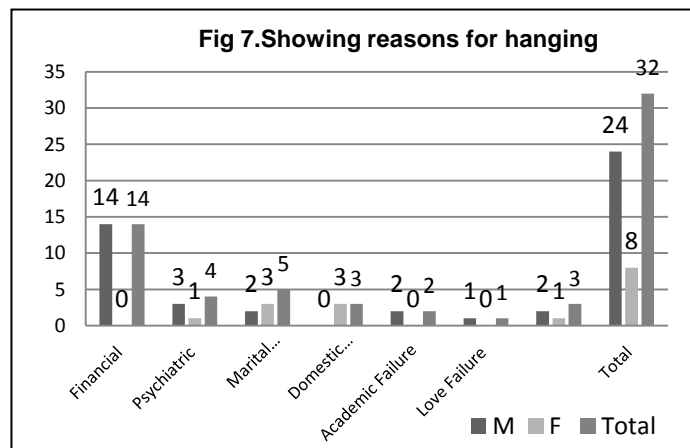
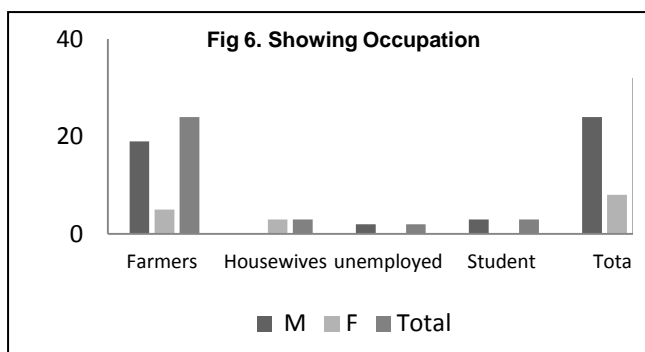


Table 2 Showing Site of hanging

Indoor	Place of hanging	Male	Female	Total
	Residence	14[43.75%]	8[25.00%]	22[68.75%]
	Lodging	5[15.62%]	0	5[15.62%]
	Office	2[6.25%]	0	2[6.25%]
	Hospital	1[3.12%]	0	1[3.12%]
	Jail	1[3.12%]	0	00
Outdoor	Park	1[3.12%]	0	1[3.12%]
	Total	24	8	32

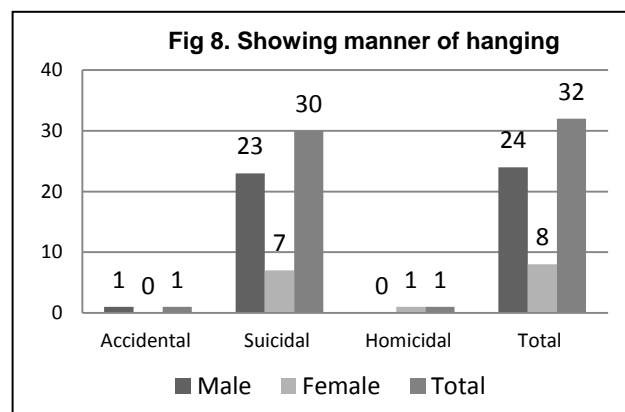


Table 3. Showing position of ligature knot

Position of ligature knot	Male	Female	Total
Fixed knot	20[62.50%]	5[15.62%]	25[[78.12%]
Running noose	3[9.37%]	2[6.25%]	5[15.62%]
Slip knot	1[3.12%]	1[3.12%]	2[6.25%]
Total	24	8	32

Table 4. Showing ligature findings

Patho-anatomic finding	Present	Absent
Ligature material	32[100%]	-
Ligature mark	32[100%]	-
Above the level of thyroid cartilage	29[90.62%]	2[6.25%]
Below the level of thyroid cartilage	2[6.25%]	30[93.75%]
At the level of thyroid cartilage	1[3.12%]	31[96.87%]
Protrusion of tongue	12[37.50%]	20[62.5%]
Salivary discharge	14[43.75%]	18[56.25%]
Hyoid bone fracture	7[21.87%]	25[78.12%]
Fracture of Thyroid cartilage	00	00
Fracture of Cricoid cartilage	00	00
Soft tissue hemorrhage	2[6.25%]	30[93.75%]
Carotid artery intimal tears	4[12.50%]	28[87.50%]
Other discharges	2[6.25%]	30[93.75%]

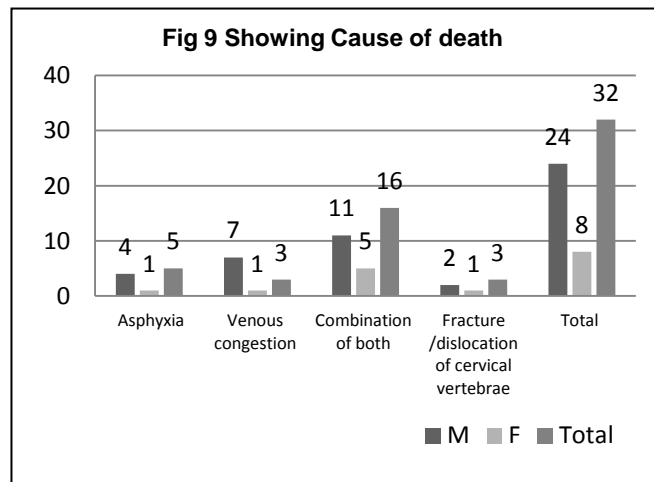


Table 5 Showing other Postmortem findings

Post mortem	Cases	%
External findings		
Rigor mortis	21	65.62
Pm staining	12	37.50
Blood in natural orifices	6	18.75
Protrusion of tongue	12	37.50
Struggle marks	1	3.12
Salivary stains	12	37.50
Asphyxial signs	32	100
Internal findings		
Hyoid bone fracture	7	21.87
Thyroid cartilage fracture	0	-
Cricoid cartilage fracture	0	-
Congestion of organs	32	100

Review Research Paper

Photography in Forensic Medicine: Guidelines and Recommendations in the Indian Perspective

¹Puneet Setia, ²Raghvendra Singh Shekhawat

Abstract

Photography has been an integral part of Forensic Medicine since time immemorial. Since these photographs are predominantly used for legal purposes, they should be as accurate and informative as possible. Photographs are not only important to document injuries, but also to document absence of injuries (*negative photographs*). The major factor with photography in Forensic Medicine is that the photographs are not repeatable and also that one copy has to be submitted to the courts. Therefore utmost care is required when the photographs are taken and preserved. A good photograph not only gives detailed information of the incident but also assists the court in administration of justice. The present paper not only addresses common problems faced by the Forensic Medicine experts while taking photographs, but also provides guidelines and technical suggestions for better photography. Along with that new concepts in medical photography are also discussed.

Key Words: Forensic Photography, Documentation, Court, Justice

Introduction:

In the Forensic Medicine Post-graduate curriculum, neither the speciality of Forensic photography is included, nor is any such training given. At many places, the photographs are taken by police personnel, who are neither trained in medicine nor in photography.

The end results are well known and don't need any description here. The same goes for the photographs taken in emergencies and mortuaries. This is quite expected that the photographs taken in the emergency rooms and mortuaries are often grossly non-descriptive and not up to the requisite standards.

The importance of photography in medico-legal cases has been advised in many documents of International repute like by The National Association of Medical Examiners, USA and in The Istanbul Protocol. [1-3] The National Human Rights Commission also makes video filming of post-mortem examinations in cases of custodial deaths mandatory. The growing trend among medical professionals is to use the mobile phones for taking pictures, as they are readily available. [4, 5]

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Although, many of the commonly available present day mobiles come with many features relevant for us, they also have their own inherent problems, which we will discuss later.

Additionally, there are problems with data protection and it also creates a bad impression regarding lack of professionalism.

There are some mistakes that are commonly committed by the person taking the photograph. While most of them are due to faulty technique, some are due to inexperience.

Some of the common mistakes are:

1. **What to photograph?** : It is commonly seen that the photographer doesn't even know what should be photographed. The injuries or lesions which need to be documented descriptively go unnoticed many times.
2. Poor choice of the Camera
3. Poorly Focussed Images
4. The camera shakes
5. Over-exposed and under exposed images
6. Poor colour reproduction
7. The glistening or glaring of wet surfaces
8. The image noise: Image noise is random (not present in the object imaged) variation of brightness or colour information in images, and is usually an aspect of electronic noise.

The Common Problems and their Remedies:

1. Consent:

For medico-legal documentation no guidelines are there to take the consent of the

person in India. As per the international guidelines specific consent of the live victim should be obtained before taking any photographs. The consent must be valid. [6]

Even if consent is not required for medico-legal cases, the patient needs to know that the pictures may be used for teaching purposes or for publication in medical journals. [3, 7] In author's opinion, whenever photographs are taken for academic purposes, consent should be taken from the patient him/herself or his/her relatives (in autopsies).

2. Following the "as is" Strategy:

It is always recommended to take the "as is" photographs of the subject, whether it is the emergency department or the mortuary.

If any changes need to be made, like removing the clothes, wiping the blood stains or mud stains etc. that should be done after taking the first photograph.

This not only helps in documenting the fresh injuries but also takes a record of the clothing, marks of identification, evidences of any prior medical interventions and the person/persons accompanying the subject.

3. The Logical Sequence:

Generally, it is best to start with overall photographs and then takes closer, more detailed pictures. The first photo should always be a colour cover sheet. These cover sheets have known colour values that make colour correction easier and more accurate.

The colour scale can also be used as reference. The logical sequence should be followed. First, the overall photographs should be taken. These should be followed with mid-range photographs. [8]

Mid-range photographs are important as they provide information of the relative location of injuries on the particular anatomical part of the body. This is often useful to avoid distorting the size or shape of the injury, and to prevent misinterpretation. [9] Close-up photos are next.

Close-up photos should be just that taken so that the injury nearly fills the frame. It is always a good practice to obtain an identification picture ("ID Shot") of the patient. This should be a frontal view of the victim and should clearly show the victim's face. [10]

4. Medically Important versus Forensically Important Images:

It should be borne in mind that many injuries which are seen in the Emergency Department or other wards might seem to be trivial and "too small" to be documented but they may have a tremendous Forensic importance. In a case of sexual assault, a simple tear of the

fraenum (at the base of tongue) may be overlooked by the treating physician but a forensic person can't afford to miss such a finding. It has been well said that in case of confusion, take as many relevant pictures as much you can, rather than having none! If you want to err, err on the side of safety.

5. Proper Use of Scales:

In Forensic photo-documentation one should always use a scale. For this, angled rulers, standard rulers and inch-tapes can be used. At times readily available standard objects like coin or matchstick can also be used. For injuries like bite-marks L-shaped rulers should be used. It is strongly advisable that the structure to be measured and measuring tape are both in the same plane and both of them are perpendicular to the optical axis.

6. The Identity of the Picture:

Non-identifiable pictures are useless for the court procedures. These can be used only for teaching purposes. Therefore date scales and the case number should be included along with the scales in every picture.

7. Simplicity:

A photograph should have only one primary subject e.g., an autopsy specimen, a gunshot wound, or a grazed abrasion. The value of a photograph with numerous visual centrepieces is often diminished by the resulting clutter and confusion it creates.

Therefore, when the photograph is planned, one should keep in mind what he/she wants to depict and click accordingly, so that it depicts only those aspects that are relevant.

8. The Choice of the Camera:

Although, the conventional 35mm cameras are said to be the gold standard for documenting forensic findings, they are rarely used now days. Any digital camera with four mega pixel capacity or more should be quite enough for documentation purposes.

Digital single lens reflex cameras should be preferred over digital compact cameras as they have better sensors.

Many digital cameras record metadata in their digital images, in formats like exchangeable image file format (EXIF) or JPEG. Some cameras can automatically include extended metadata such as the location at which the picture was taken (e.g., from a GPS).

As a simple rule to check for the suitability of the camera for

Forensic use, you can take a trial picture of a printed text with eight point font size from 20 cm distance. If the text on the picture can be

read then it is a good camera for documentation purposes. [7]

9. The Out of Focus Images:

It is not unusual that while taking photograph of a lesion or an injury, the nearby surface is inadvertently focused. If this nearby surface is in a different plane than that of the desired target, the picture will be blurred.

The same blurring and poor picture quality can also be due to unsteady shaking of the hand which is holding the camera. [11] Using a tripod or a stand can prevent shaking to a large extent.

10. Light and Background:

The photographs should be preferably taken in daylight or with background lightened. The presence of bright lights or reflective surfaces can produce a wash out of the detail (overexposure) and the injury will become less visible on the photograph.

Remember: lighting can be critical to the appearance of some injuries. The background shouldn't be crowded or full of bright colours.

Distracters like autopsy instrument, discarded clothing etc. should not be included in the photographs. During autopsies the organ can be put on a widely-spread gauze piece for taking a photograph. [9]

11. Understanding the "Proximity Effect":

The focal length of the lens together with the distance of the camera to the subject determines what is shown in the picture. Being very close to the subject will cause three-dimensional objects such as faces, for example: to appear out of focus.

This is called the proximity effect. Current photographic literature also uses the word "**wide angle effect**". [12, 13] For Forensic examination, macro photography (extreme close-up photography) is important.

Most cameras can only achieve this very small distance to the subject by using a very short focal length (maximum wide angle). This can cause considerable distortion of the image.

12. Controlling the Exposure:

The most important factors which decide the exposure of a picture are aperture, time and sensitivity of the sensors. The present cameras either automatically adjust the exposure or give you an option for the situation. [14]

If the photographer is not an expert or a trained professional, it is advisable to use the default or auto setting of the camera for best effects.

13. Pictures from Mobile Phones:

As already stated, pictures taken from the mobile phones are not really sufficient for the legal purposes. If it is required to print bigger images of the photographs, the mobile phones often fail as they have low resolutions.

Even with higher mega pixels, the mobile does not give same quality as the camera as the aperture of the mobile phone is small, which causes less clarity in the photograph as compared to a camera. [15] Also, as the mobile phone lens has a wide angle, therefore the pictures are either distorted or blurred at the peripheries.

14. Photographing the Glistening "Wet" Surfaces:

Many of us have faced the situation where while conducting the autopsy, we find an interesting finding and we land up into agony as the photograph which was taken is "*not so informative*" due to the wet and glistening surface of the specimen.

Cross polarization is a technique used to capture back-scattered light from a subject while dramatically reducing or eliminating direct planar light that is reflecting from a subject, and is primarily used in nature photography. [16, 17]

This technique allows a photographer to reduce or eliminate glare caused by flash, commonly observed on oily, waxy, wet, or otherwise shiny surfaces. Cross polarization is particularly suited for autopsy photos.

This technique does not require a great deal of equipment. Aside from the camera and flash unit, a circular polarizer (attached to the camera lens) and a linear polarizing filter (attached over the flash) are required. [17]

15. Using the Flash Correctly:

To avoid the effects of camera shakes, a flash should be used. However, if a flash is used in an already bright environment it can lead to over exposure. Therefore, it is advisable to use the auto setting of the camera so that the flash is used only when required.

With digital cameras, using a built-in flash or a flash which has been specifically made for the camera offers the advantage that the white balance will be easy to do.

16. Dealing with Bloody Specimens:

In cases of road traffic accidents and homicides, often the bodies are stained with excess of blood. After taking the initial photographs, it is advisable to remove the excess blood. A photograph of an injury without pooled or smeared blood is more likely to be admitted into evidence and shown to the Magistrate than an excessively bloody one.

17. The “Special Cases”:

In certain circumstances it becomes indispensable to meticulously document the injuries as in the cases of sexual assaults.

Gross visualization of the genital area post-sexual assault identifies some but not all injuries. To assist further in the identification and documentation of micro injuries, the use of toluidine blue dye and colposcopy are often employed. [18, 19]

18. Photo-editing:

Now-a-days the digital photographs can be easily edited with the help of innumerable soft-wares available on the internet. Things like genuine cropping of the pictures can be done.

Pictures can also be edited in retrospect and many sophisticated photo-editing software tools are available which allow a variety of changes to be made. However, with the advent of these smart techniques images can be drastically manipulated. A yellowish bruise can be converted into a blue one and vice-versa.

For forensic pictures, it is mandatory that the picture information produced by the camera is left in its original state. Changes made by picture-editing software should be avoided and if the correction of technical mistakes is unavoidable, it should only be done on copies of the original data. [20]

19. Storage and Backup:

- a. **Conventional Photographs:** Obviously, the negatives of the photographs should be protected from heat and light. They should better be locked in a cupboard with limited access to outsiders. It is desirable if a catalogue is there for the stored photographs. There should be a chart which mentions the name of the person who gains an access to the pictures, along with the date and time when that person accessed it.
- b. **Digital Photographs:** Whenever the photographs are transferred to the computer, at least two copies should be made in CDs. These CDs, after proper labelling, should be kept in a locked cupboard. Special precautions need to be followed for the pictures saved in the personal computers. It is all a matter of personal preferences that how the data is stored.

It also depends on the computer literacy of the forensic expert as to what secure level he can store his data. The folders can be password protected. It would be advisable not to share the data on the “virtual drives” which are readily available on

the internet as the possibility of hacking cannot be ruled out.

Hospitals may differ on their policy and practice of whether the photographs stay with the medical records or are archived separately. You should be familiar with the policy at the institution in which you practice.

Discussion and Conclusion:

Written descriptions, even in the best hands, are often inadequate to describe injuries.

Additionally, when the medical evidence expert is called in the court to appear as an expert witness, photographs serve as an aid to memory. [10] Much physical evidence is short lived and if not recorded early may be lost permanently. Injuries heal faster than the legal system operates.

The importance of good photographic skills in documenting the findings of the Medico-legal cases is undisputed.

Many technologies like **Google Glass and High-speed photography** are already into the market and are becoming the preferred choice of Medical photographers. [21]

Alternative Light Photography is a tool to help see damage even before it is visible on the skin. A camera such as the Omni chrome uses blue light and orange filters to clearly show bruising below the skin's surface. [22]

Infrared photography not only provides a new arena for the documentation of abrasions, bruises and laceration, but is equally important for bite mark analysis. [23]

In Indian context, where we often lag in resources and research work, an initiative is required from the Forensic community. It is desirable that Mandatory short-term (7 days) workshops should be frequently organised for training in Forensic Photography.

The workshops should include people both from the Medical as well as the technical fields. Along with this the interested experts can approach the online resources which are readily available. [4] In the end we would conclude by saying that there is no substitute for an expert and trained professional.

However at places where hiring the services of a professional are not possible, it is advisable to follow the guidelines mentioned in the article to get the best possible outcome with the resources available.

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Review Research Paper

Forensic Meteorology: Tip of the Iceberg

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Abstract

The master field called Forensic science has been playing pivotal roles in solving the umpteen varieties of crimes taking place across the globe. As technology infiltrates every aspect of our lives, it is no wonder that solving crimes has become almost futuristic in its advances. But, as climate change is intensifying, there is an increase in natural calamities and cataclysmic related phenomenon throughout the world leading rise to an increase in the criminal issues related to it. The ability to accurately characterize weather events supports the successful litigation of many types of cases. Hence, Forensic meteorology is one such stream which has the potential to form the basis of some inventive plot lines by helping to determine the role of weather in crimes and in the loss of lives and money. It is the science of using historic weather records, atmospheric data, eyewitness accounts, and reenactment simulations in order to determine the weather conditions at a specific time and location. This review paper aims at highlighting the said stream of forensics by bringing to notice the role and scope of Forensic meteorology.

Key Words: Climate Forensic; Climatology; Weather Elements; Crime and Weather

Introduction:

The use of science or technology in the investigation and establishment of facts or evidence in a court of law is what Forensic Science deals with. Forensic science has proved its mettle in a variety of cases and has gained recognition in almost every branch of science. Forensic meteorology is the science of using historic weather records, atmospheric data, eyewitness accounts, and reenactment simulations in order to determine the weather conditions at a specific time and location. [1]

It is thus an upcoming field that deals with the application of various meteorological data to legal cases and related investigations in which weather may have been a factor. [2] The ever changing lifestyle of people has led to grave changes in the atmospheric conditions and its related phenomenon.

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The issue of climate change is being responsible for the alarming increase in natural calamities and disasters. This in turn has led to an increase in the criminal activities related to it. With increasing losses from severe weather in recent years, the demand for Forensic meteorological services has also grown. [3]

During a severe drought in upstate New York in the late 1800s, a Presbyterian minister, Duncan McLeod, organized a community prayer for rain. Within an hour, small clouds had formed and the temperature had begun to fall.

A few hours later a severe thunderstorm moved through the region, bringing almost two inches of rain and washing out a highway bridge. Worse, though, was the bolt of lightning that hit and burned to the ground a barn owned by Phinneas Dodd. The sole objector to the community prayer, Dodd did not believe in tampering with Mother Nature.

He asked McLeod for \$5000 to replace the barn, and when McLeod refused, Dodd slapped him with a lawsuit. It was one of the first court cases involving weather and the law. [4-6]

In the end, "the defense counsel finally persuaded the court to dismiss the action on the grounds that defendants had prayed only for rain, and that the lightning had been a gratuitous gift of God." [4] Forensic meteorology deals with determining the magnitudes of each weather element at the exact location of issue.

Meteorological data like historic weather records, local atmospheric records, radio and satellite imaging, eyewitness accounts etc. is

retrieved and analyzed with an aim to recreate a time line of relevant meteorological events required to solve the case. The types of cases regarding forensic meteorology can be categorized as litigation proceedings (civil and criminal) and Investigations (insurance, environmental impact assessment etc.).

Various events where Forensic meteorology takes the stand include snow, rain, hurricanes, cyclones, tornadoes, floods, drought, storms, pollution and the list is vast.

The range of crimes involving meteorological aspects can be equally as diverse as vehicle accidents, traffic accidents, murders, suicides, skiing accidents, kite surfing accidents, bad aircraft landings, bombing, agricultural disputes, property insurance disputes, building collapses, slip and fall cases, fires etc. [1] For instances where a blistering heat wave overwhelms electrical transformers and thousands of people lose the power.

When a plane plummets into a sea while the sky is hazy and dark or when a person dies while he was snowboarding, or a case where a vehicle falls into a valley on account of low visibility and rains, or be it the petty insurance claims in a flooded area. In all such cases, it's a good bet that forensic meteorologists will be working alongside government investigators and civil litigators to assess the role of weather in the losses of lives and money.

Role of Forensic Meteorologists:

Forensic meteorologists aim at carefully explaining what the weather conditions were and how it impacted the environment.

They acquire and interpret data, perform specialized analysis, prepare written reports and even deliver expert testimony. [2] The various roles of a Forensic meteorologist ranges from a variety of tasks including Investigation, Visitation

Source of Data/Information:

The use of high quality, reliable data is crucial to ensure the accuracy of forensic meteorological analyses. The required data and information in regards of the investigation under forensic meteorology can be obtained from the authorized meteorological organizations and departments of respective nations.

In India, this can be retrieved from the Indian Meteorological Department (IMD) of the Government of India. [9] IMD has 6 regional meteorological centres and different types of operational units such as meteorological Centres at state capitals, Forecasting Offices, Agro-meteorological Advisory service centres, Flood Meteorological Offices, Area cyclone warning centres and cyclone warning centres along with

to loss and/or injury sites and review of work procedures, methods and conditions, Inspection of failed products, equipment, buildings and systems, Retrieval and Analysis/interpretation of the data, Preparation of written reports, Production of visual aids for presentation, Presentation of conclusions, reports and testimony, Delivery of expert testimony, Evaluation of opposing theories, reports and conclusions, Discredit or refuse another witness's testimony and even to Assist the court in understanding the relevance of certain technical facts.

Forensic meteorologists have the expertise to determine inaccuracies that frequently exist in data that is available to the general public. They also have access to many more resources and the knowledge to interpret those resources.

The interpretation of these resources allows forensic meteorologists to pinpoint weather conditions at the exact location of incident, even when the nearest reporting site may be several miles away. [7]

Data/Information Required:

Depending upon the factors involved, each specific case or incident requires a somewhat different matrix of meteorological data and information. Data required for some commonly occurring cases are depicted in tabular form. (Table 1)

These data includes surface weather observations, upper air soundings, radar imagery, satellite imagery, three-dimensional analysis meteorological models, lightning data, snow and ice cover data, and climatological data and summaries. If needed, high-resolution numerical modeling can be coupled with available data to reconstruct an event.

separate divisions to deal with specialized subjects like civil aviation, seismology etc.

In some cases, the visible and infrared imagery from satellites, as well as the time-lapse imagery from geostationary satellites, has proved to be most useful in assessing cloud cover, the occurrence of severe weather, the timing of weather events and the presence of certain phenomena such as fog.

This can be obtained from the National Remote Sensing Centre of the Indian Space Research Organization (ISRO). [10] The knowledge of the professional meteorologist of these institutional publications and the data tabulations they include should be relied upon to assure the best possible meteorological and climatological assessments.

Conclusion:

The field of Forensic meteorology is growing fast, although its use in criminal cases is probably under-exploited at present. Forensic experts can determine the progression and magnitude of different weather elements throughout any questioned event. The involvement of an expert professional meteorologist in the assembly and interpretation of the required data and information can greatly benefit the legal proceedings. The knowledge that we have about this particular field is indeed the “tip of the iceberg”.

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Table 1: Data Required in Some Commonly Encountered Cases: [8]

Case	Data Required
Slip and fall cases	<ul style="list-style-type: none"> • Time-history of precipitation • Character of the precipitation.
Wintertime incidents	<ul style="list-style-type: none"> • Air temperatures • Ground surface temperatures • Cloud cover • Surface wind speeds • Exposure of a specific accident site to the night sky and any available direct sunlight. • Rate of radiative cooling/heating of ground surfaces • Prevailing humidity
Automobile accidents	<ul style="list-style-type: none"> • Time-history of precipitation • Character of the precipitation. • Horizontal visibility and occurrence of natural obstructions to driver visibility • Fog, haze, blowing dust and blowing snow. • Level of natural illumination from sunlight, twilight or moonlight • Impact of sun glare on a driver's ability to see
Building damage and roof collapse cases	<ul style="list-style-type: none"> • Time history of precipitation rate or intensity • Amount of snow and ice that accumulates on a roof • Heavy rains • Precipitation climatology • Thunderstorm downburst (straight-line) winds, tornadoes, lightning
Local stream and urban flooding	<ul style="list-style-type: none"> • Time-history of the precipitation, • Local topography • Precipitation climatology
Other common cases	<ul style="list-style-type: none"> • Timing of events such as freezing and thawing, the onset of strong winds, the changeover from rain to snow or snow to rain, the onset and duration of freezing rain and so forth • Climatological factors, such as whether or not specific weather events were unusual in their extent and/or intensity (Act of God Defense)

Review Research Paper

New Section 375 Indian Penal Code (IPC) Confusion and Controversies

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Abstract

The 2012 Delhi gang rape of a college student, infamously referred to as the Nirbhaya incident has forced the law makers of the country to sit up and make long-pending amendments to the sections of the Indian Penal Code (IPC) that deal with sexual violations. The result was that the Criminal Law Amendment Act was passed in 2013 in which the existing Section 375 of the IPC has been revamped and a new section substituted in its place.

This paper compares certain aspects (few) of the old Sec 375 IPC and new Sec 375 IPC. It also deals with the controversies and confusion arising out of the new IPC 375 and existing IPC 377. It neither reviews the whole criminal amendments Act 2013 nor does it review all aspects of IPC 375. This paper also deals with a situation (third person) where the new IPC 375 is silent.

Key Words: IPC 375 New, IPC 375 Old, IPC 377, Difficulties in interpretation

Introduction:

The 2012 Delhi gang rape of a college student, infamously referred to as the Nirbhaya incident has forced the law makers of the country to sit up and make long-pending amendments to the sections of the Indian Penal Code (IPC) that deal with sexual violations. The result was that the Criminal Law Amendment Act was passed in 2013 in which the existing Section 375 of the IPC has been revamped and a new section substituted in its place.

The Earlier Section 375 IPC:

As per the old section 375 IPC, rape has been defined as follows:

"A man is said to commit 'rape' who, except in the case hereinafter excepted, has sexual intercourse with a woman under circumstances falling under any of the following descriptions:

- Firstly, against her will
- Secondly, without her consent
- Thirdly, with her consent, when her consent has been obtained by putting her or any other person in whom she is interested in fear of death or of hurt

- Fourthly, with her consent, when the man knows that he is not her husband and her consent is given because she believes he is another man to whom she is or believes herself to be lawfully married
- Fifthly, with her consent, when, at the time of giving consent, by reason of unsoundness of mind or intoxication or the administration by him personally or through another of any stupefying or unwholesome substance, she is unable to understand the nature and consequences of that to which she gives consent
- Sixthly, with or without her consent, when she is under 16 years of age.

Explanation: Penetration is sufficient to constitute the sexual intercourse necessary to the offence of rape.

Exception: Sexual intercourse by a man with his own wife, the wife not being under fifteen years of age, is not rape.

Thus the salient features of the old section are:

- Man is the accused.
- Woman is the victim.
- Penetration [of penis into vulva] would constitute an offence

Other points of the said section of IPC are at present not important for the present paper and hence will not be discussed.

The New Section 375 IPC:

The Criminal Amendment Act 2013 has replaced the old section 375 of the IPC with the new section 375 IPC which reads as follows:

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"A man is said to commit "rape" if he—

- a) Penetrates his penis, to any extent, into the vagina, mouth, urethra or anus of a woman or makes her to do so with him or any other person; or
- b) Inserts, to any extent, any object or a part of the body, not being the penis, into the vagina, the urethra or anus of a woman or makes her to do so with him or any other person; or
- c) Manipulates any part of the body of a woman so as to cause penetration into the vagina, urethra, anus or any part of body of such woman or makes her to do so with him or any other person; or
- d) Applies his mouth to the vagina, anus, urethra of a woman or makes her to do so with him or any other person;

Under the circumstances falling under any of the following seven descriptions:

- **First-** Against her will.
- **Secondly-** Without her consent
- **Thirdly-** With her consent when such consent has been obtained by putting her or any person in whom she is interested, in fear of death or of hurt.
- **Fourthly-** With her consent, when the man knows that he is not her husband and that her consent is given because she believes that he is another man to whom she is or believes herself to be lawfully married.
- **Fifthly-** With her consent when, at the time of giving such consent, by reason of unsoundness of mind or intoxication or the administration by him personally or through another of any stupefying or unwholesome substance, she is unable to understand the nature and consequences of that to which she gives consent.
- **Sixthly-** With or without her consent, when she is under eighteen years of age.
- **Seventhly-** When she is unable to communicate consent.

Explanation 1: For the purposes of this section, "vagina" shall also include *labia majora*.

Explanation 2: Consent means an unequivocal voluntary agreement when the woman by words, gestures or any form of verbal or non-verbal communication, communicates willingness to participate in the specific sexual act:

Provided that, a woman who does not physically resist to the act of penetration shall not by the reason only of that fact, be regarded as consenting to the sexual activity.

Exception 1- A medical procedure or intervention shall not constitute rape.

Exception 2- Sexual intercourse or sexual acts by a man with his own wife, the wife not being under fifteen years of age, is not rape."

Comparison of the Old and New Sec 375 IPC:

A. Accused and the Victim:

In both the old and the new sections, it is the Man who is the accused and the Woman who is the victim. Both the sections are clear on this issue and there is no disagreement.

B. What constitutes an Offence?

In contrast to old IPC 375 the new one deals with

- a) Penetration
- b) Insertion
- c) Manipulation and
- d) Application

Therefore sub-section b, c, and d are new.

- As per Sec 375 (a), "... **penetrates his** penis, to any extent, into the vagina, mouth, urethra or anus of a woman or makes her to do so with him or any other person;"

At this juncture we are talking about an action of an accused. In other words it is the accused who is penetrating his penis into the vagina of a victim.

- In sub section (b) ("... **inserts**, to any extent, any object or a part of the body, not being the penis, into the vagina, the urethra or anus of a woman or makes her to do so with him or any other person; ...")

It is insertion of any other object or part of the body other than penis in the vagina that constitutes the offence. Thus 'penetration' and 'insertion' constitute an offence under the relevant sub sections of Sec 375 IPC.

- A reading of subsection IPC 375 (c) ("...manipulates any part of the body of a woman so as to cause penetration...") raises some questions.

Is this an independent clause? Or, is this subsection to be read with subsections (a) and (b)?

An issue that arises is whether this clause will apply when the penetration is executed along with provisions of sub-section (a) or when penetration has failed and therefore sub-section (a) cannot be applied but any or multiple parts of the woman have been manipulated?

Will this clause apply only with sub-section (a) and not with sub-section (b), i.e., either successful or failed attempts at penetration/insertion?

Will the subsection be applied with both subsections (a) and (b) irrespective of whether

the action mentioned in the respective subsection has been executed or not?

C. Could a Man be the Victim?

Another newer phrase seen in the new Sec 375 IPC is: 'makes her to do with him or any other person'. This phrase is scripted in all subsections of IPC 375 i.e., (a), (b), (c), and (d). Therefore, now there are three component of the section:

- i. Accused himself penetrates or insert or does an act as per the section
- ii. Accused compels the victim to do the same with him
- iii. Accused compels the victim to do the action with 'any other person'

The law makers have specifically refrained from using the word man and instead used the words 'any other person'. The gender of other person is not specified and the phrase is kept open. Does it impliedly mean the other person could be man, woman or otherwise. (All included).

Cavity/Orifice Confusion:

The new section 375 IPC talks about the following four orifices i.e. (vagina, mouth, urethra, and anus) in sub-sections (a), (b), (c) and (d). Thus logically the following combinations can be possible:

As per sub-section (a), the penetration could be:

- i. penile-vaginal
- ii. penile-oral
- iii. penile-urethral
- iv. penile-anal

Hence, it is clear that (ii), (iii) and (iv) were not there in the old IPC 375. Traditionally penile-oral intercourse was called as 'Fellatio' and penile-anal penetration as 'anal intercourse' or 'sodomy'. Penile-urethral penetration in a true sense may not be possible but still it was deemed to be part of penile-vulval penetration and thus constituted rape as per the old definition. Now whether this new subsection of the IPC 375 eliminates the need for the relevant older sections of IPC dealing with unnatural offences (Sec 377) is not clear.

As per sub-section (d), application of mouth to various orifices raises the following possibilities:

- i. oro-vaginal contact
- ii. oro-anal contact
- iii. oro-urethral contact

In none of these combinations, there is penetration and the action indicated is 'applies his mouth'. Oral manipulation of the female genitals has been conventionally referred to as 'cunnilingus'; oro-urethral thus becomes a part

of cunnilingus and oro-anal manipulation has been termed as 'rimming'. In none of these there is a penetration.

What shall constitute an Offence under this Section is not Clear in the Script Law. (?????)

The 'Other Person':

Now see the twist in the tale-

As we have seen earlier, a new component of the new section 375 is the 'other person'. Could this 'other person' be a man or woman? Let us consider the following example. A man (accused) compels a woman (victim) to manipulate and insert the finger of another man into his (the other man's) anus. Would this constitute rape? The same logic applies to other orifices as well.

The new section 375 IPC is silent on role of the 'other person', thus raising many possibilities.

What would be the status of such 'other person'? Would that 'other person' be called - an accused, his accomplice (abettor) or a victim himself/herself? Is it necessary to prove that the 'other person' has a common interest along with accused man in committing a crime?

Does it apply even when such person is a woman? If this person is considered an accused in whatever way does he/she require having 'mens rea' which is an essential component of criminal law? If he/she is an accused, does she fall in the same category of offence as an original accused or lesser than that? If lesser, under what section(s) of the IPC?

To understand and interpret vague wordings of the law, there are few derivatives from case laws which we shall now try to see.

A benignant provision must receive a benignant construction, and even if two interpretations are permissible, that which furthers the beneficial object should be preferred. [2] Normally the Court should stick to the literal meaning of an expression in the absence of any alternative meaning.

However, it can go beyond the strict grammatical construction when a new and ambiguous provision is to be construed. [3]

A construction which frustrates the objects of the legislation and leads to a manifest absurdity should not be preferred. [4]

Courts must interpret words and their meanings so that public good is promoted and misuse of power is interdicted. [5] When two constructions are possible in a criminal trial the one which is beneficial to the accused will have to be adopted. [6]

Though there are case laws to interpret the law and use them for administration of justice, in our three tier system it is left with the learned Judges of the Sessions Courts and the High Courts to use them the way they deem fit.

Sec 377 IPC: [7]

It deals with unnatural sexual offences. Whoever voluntarily has carnal intercourse against the order of nature with any man, woman or animal shall be punished with imprisonment for life, or with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine. Explanation—Penetration is sufficient to constitute the carnal intercourse necessary to the offence described in this section.

The ambit of Section 377 extends to any sexual union involving penile insertion. Thus, even consensual heterosexual acts such as fellatio and anal penetration may be punishable under this law. The various possibilities of the offence include intercourse between man and man, man and woman (anal) – Sodomy, or it could be intercourse between man and animal (penile-vaginal, penile nasal, penile-anal) – Bestiality. Now there can be a situation where a man would be charged under IPC 375 (a) as well as IPC 377 when he has anal and oral intercourse with a woman.

Which of the two sections would be sustained in the court; and would it be at the whims and fancies of the presiding officer of the Court or otherwise is a matter to be discussed.

As the new law continues to refer to a man as the accused and penetration as an essential component to constitute an offence it does not include female homosexuality where sexual gratification is obtained by various means.

Conclusion:

Obviously, law has been made in hurry. Though there are few case laws to interpret the script of the law, it is going to create multiple subjective interpretations of the law. It would require many explanations and would create multi-tier appeals. It would probably take many years to settle down the uniform interpretation and application of law. It would be **better if the law can be amended in light of the above and made unequivocal**. The overlapping of few of the clauses with existing IPC 377 requires to be suitably dealt with.

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Review Research Paper

Not taking Standard Precautions in Retinopathy of Prematurity (ROP): Cost Hospital/Doctors Damages in Crore

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Abstract

This is fourth case in the kitty of more than one crore compensation in medical negligence cases in India pronounced by the Hon'ble SC on 1st July 2015 i.e. on the Doctor's Day. This case highlighted and applied various doctrines like: vicarious liability, importance of proper and relevant record keeping, timely referral and standard precautions and method of calculation of amount of compensation and factors relevant for computation of compensation. Two pediatrics doctors were held negligent in this case and Government of Tamil Nadu and Director General of Health Services were also held liable for compensation by applying the doctrine of apportionment of liability and vicarious liability.

This paper deals with critical review of decision of the Hon'ble SC in V. Krishnakumar vs. State of Tamil Nadu & Ors., 2015, its impact on the healthcare scenario in India and other stakeholders. Various doctrines relevant to the cases of medical negligence have been discussed to create awareness and understanding the factors responsible for high cost of compensation. Thus, help in sensitizing healthcare professionals about the issue of medical negligence and their prevention in future.

Key Words: Standard Precaution, Pediatrics, Ophthalmology, Retinopathy of Prematurity, Blindness, Screening Test, Vicarious Liability, Jointly and Severally, Apportionment of Liability

Introduction:

Cases of medical negligence with increased amount of claim for compensation have been increasing day by day in India. It can be attributed to many variables, important of which includes: increased cost of healthcare, increased cost of medicines, increased cost of medical education and increased cost of litigation along with inflation rate.

Impact of non information about consequences of ROP and mandatory screening for ROP, on patient and parents have been taken consideration by the SC.

Various doctrines like vicarious liability and apportionment of liability and compensation in a case of composite negligence has been applied in this case. V. Krishnakumar vs. State of Tamil Nadu & Ors., 2015 [1] is the Fourth case in the series in which more than one crore compensation has been awarded by the courts, two of them in the year 2015 including this case.

Highest compensation in a medical negligence case of Dr.Kunal Saha [2] in which more than 11 crore compensation has been awarded included interest on claim.

This trend of high amount of compensation is alarming as for as Indian context are considered seeing proportion of poor population in India. Recent Annual survey reports of NSSO [3] The Times of India highlighted the impact of high cost of healthcare and role of private healthcare service providers and government hospitals.

High cost of compensation will certainly leads to increase cost of indemnity insurance premium, defensive medicine practices and unethical practices of unnecessary investigations and procedures and referral and consultations.

Background of the Case:

Two Civil Appeals have been preferred before the SC against the judgment of National Consumer Disputes Redressal Commission (NCDRC) rendering a finding of medical negligence against the State of Tamil Nadu, its Government Hospital and two Government Doctors and awarding a sum of Rs.500000/- to V. Krishnakumar.

Civil Appeal was preferred by V. Krishnakumar for enhancement of the amount of compensation. Another Civil Appeal was preferred by the State of Tamil Nadu and

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another against the judgment of the NCDRC dated 24th May 2009. As facts of both the appeals were same, SC Bench disposed both the appeals by the common judgment dated 1st July 2015. [1]

Facts of the Case:

On 30.8.1996, V. Krishankumar's wife Laxmi was admitted in Government Hospital for Women and Children, Egmore, Chennai. Against the normal gestation period of 38 to 40 weeks, she delivered a premature female baby in the 29th week of pregnancy. The baby weighed only 1250 grams at birth. The infant was placed in an incubator in intensive care unit for about 25 days. The mother and the baby were discharged on 23.9.1996.

Relevant Fact and Issue:

SC Bench observed that a fact which is relevant to the issue was, that the baby was administered 90-100% oxygen at the time of birth and underwent blood exchange transfusion a week after birth. The baby had apneic spells during the first 10 days of her life.

Parties to the Dispute:

Appellant No1: P-1: V. Krishankumar (Husband of the Patient Laxmi and Father of the Minor (Sharanya) who suffered blindness due to ROP as a result of alleged negligence of not warning the mandatory screening test for ROP.

Respondents Parties:

1. **Respondent No.1: R-1:** Director, Government Hospital for Women and Children, Egmore, Chennai
2. **Respondent No.2: R-2:** State of Tamil Nadu under the Department of Health
3. **Respondent No.3: R-3:** Dr. S. Gopaul, Neo-Paediatrician (Treating Doctor) and Chief of Neo Natology Unit of the Hospital
4. **Respondent No.4: R-4:** Dr.Duraiswamy of the Neo Natology Unit of the Hospital.

Important Observations of the SC:

The baby and the mother visited the hospital on 30.10.1996 at the chronological age of 9 weeks.

Follow up treatment was administered at the home of the appellant by R-4, during home visits. The baby was under his care from 4 weeks to 13 weeks of chronological age.

Apparently, the only advice given by R-4 was to keep the baby isolated and confined to the four walls of the sterile room so that she could be protected from infection.

SC Bench emphasized that what was completely overlooked was a well known medical phenomenon that a premature baby who has been administered supplemental oxygen and has been given blood transfusion is prone to a higher risk of a disease known as the

Retinopathy of Prematurity (ROP), which, in the usual course of advancement makes a child blind. The R-3, who was also a Government Doctor, checked up the baby at his private clinic at Purassaiwakkam, Chennai when the baby was 14-15 weeks of chronological age also did not suggest a check up for ROP.

Issue of ROP and Blindness:

Division Bench of the SC observed that one thing was clear about the disease, and, that the disease occurs in infants who are prematurely born and who have been administered oxygen and blood transfusion upon birth and further, that if detected early enough, it can be prevented. It is said that prematurity is one of the most common causes of blindness and is caused by an initial constriction and then rapid growth of blood vessels in the retina.

When the blood vessels leak, they cause scarring. These scars can later shrink and pull on the retina, sometimes detaching it. The disease advances in severity through **five stages 5 (5 being terminal stage)**.

Medical literature suggests that stage 3 can be treated by Laser or Cryotherapy treatment in order to eliminate the abnormal vessels. Even in stage 4, in some cases, the central retina or macula remains intact thereby keeping intact the central vision.

When the disease is allowed to progress to stage 5, there is a total detachment and the retina becomes funnel shaped leading to blindness. There is ample medical literature on the subject.

Review of Literature:

Some material relevant to the need for check up for ROP for an infant is:

"All infants with a birth weight less than 1500 gms or gestational age less than 32 weeks are required to be screened for ROP." [1]

SC Bench concluded that applying either parameter, whether weight or gestational age, the child ought to have been screened. As stated earlier, the child was 1250 gms at birth and born after 29 weeks of pregnancy, thus making her a high risk candidate for ROP.

It was undisputed that the relationship of birth weight and gestational age to ROP as reproduced in NCDRC's order is as follows:

"Most ROP is seen in very low-birth weight infants, and the incidence is inversely related to birth weight and gestational age.

About 70-80% of infants with birth weight less than 1000 gms show acute changes, whereas above 1500 gms birth weight the frequency falls to less than 10%."

SC emphasized that again, it seems that the child in question was clearly not in the

category where the frequency was less than 10% since the baby was below 1500 gms. In fact, it is observed by the NCDRC in its order that the discipline of medicine reveals that all infants who had undergone less than 29 weeks of gestation or weigh less than 1300 gms should be examined regardless of whether they have been administered oxygen or not. It is further observed that ROP is a visually devastating disease that often can be treated successfully if it is diagnosed in time. The need for a medical checkup for the infant in question was not seriously disputed by the respondents. [1]

Defense Argument:

The main defence of the respondents to the complaint of negligence against the appellant's claim for compensation was that at the time of delivery and management, no deformities were manifested and the complainant was given proper advice, which was not followed.

Issue of Discharge Summary:

It was argued on behalf of the respondent that they had taken sufficient precautions, even against ROP by mentioning in the **discharge summary** as follows:

"Mother confident; Informed about alarm signs; 1) to continue breast feeding 2) to attend postnatal O.P. on Tuesday." [1]

It must, however, be noted that the discharge summary shows that the above writing was in the nature of a scrawl in the corner of the discharge summary and we are in agreement with the finding of the NCDRC that the said remarks are only a hastily written general warning and nothing more.

After a stay of 25 days in the hospital, **it was for the hospital to give a clear indication as to what was to be done regarding all possible dangers which a baby in these circumstances faces.** It is obvious that it did not occur to the respondents to advise the appellant **that the baby is required to be seen by a paediatric ophthalmologist since there was a possibility of occurrence of ROP to avert permanent blindness.**

This discharge summary **neither discloses a warning to the infant's parents that the infant might develop ROP** against which certain precautions must be taken, nor any signs that the Doctors were themselves cautious of the dangers of development of ROP. [1]

Division Bench observed that we are not prepared to infer from '**Informed about alarm signs**' that the parents were cautioned about ROP in this case. [1]

Bench find it unfortunate that the respondents at one stage took a stand that the appellant did not follow up properly by not attending on a Tuesday but claiming that the mother attended on a Wednesday and even contesting the fact that she attended on a Wednesday. It appears like a desperate attempt to cover up the gross negligence in not examining the child for the onset of ROP, which is a **standard precaution** for a well known condition in such a case.

In fact, it is not disputed that the R-3 attended to and examined the baby at his private clinic when the baby was 14-15 weeks and even then did not take any step to investigate into the onset of ROP. The R-4 also visited the appellant to check up the baby at the home of the appellant and there are prescriptions issued by the R-4, which suggests that the baby was indeed under his care from 4 weeks to 13 weeks. [1]

Opinion of Medical Board of AIIMS, New Delhi:

The NCDRC has relied on the report dated 21.8.2007 of the All India Institute of Medical Sciences (AIIMS), New Delhi. In pursuance of the order of the NCDRC, a medical board was constituted by AIIMS consisting of five members, of which, four were ophthalmological specialists. The board has given the following opinion:

"A premature infant is not born with Retinopathy of Prematurity (ROP), the retina though immature is normal for this age. The ROP usually starts developing 2-4 weeks after birth when it is mandatory to do the first screening of the child.

The **current guidelines** are to examine and screen the babies with birth weight <1500 gm and <32 weeks gestational age, starting at 31 weeks post-conceptual age (PAC) or 4 weeks after birth whichever is later. Around a decade ago, the guidelines in general were the same and the premature babies were first examined at 31-33 weeks post-conceptual age or 2-6 weeks after birth.

There is a general agreement on these **authoritative guidelines published in national and international literature** especially over the last decade. (Table 1) However, in spite of ongoing interest world over in **screening and management of ROP** and advancing knowledge, it may not be possible to exactly predict which premature baby will develop ROP and to what extent and why."

ROP Screening Guidelines:

SC observed that one thing this report reveals clearly and that is that in the present case the **onset of ROP was reasonably foreseeable**. Division Bench said this because it was well known that if a particular danger could not reasonably have been anticipated it cannot be said that a person has acted negligently, because a reasonable man does not take precautions against unforeseeable circumstances. Though it was fairly suggested to the contrary on behalf of the respondents, there is nothing to indicate that the disease of ROP and its occurrence was not known to the medical profession in the year 1996.

This is important because **whether the consequences were foreseeable or not must be measured with reference to knowledge at the date of the alleged negligence, not with hindsight**. We are thus satisfied that we are not looking at the 1996 accident with 2007 spectacles. [2]

It is obvious from the report **that ROP starts developing 2 to 4 weeks after birth when it is mandatory to do the first screening of the child**. The baby in question was admitted for a period of 25 days and there was no reason why the mandatory screening, which is an accepted practice, was not done. The report of the AIIMS states that **'it may not be possible to exactly predict which premature baby will develop ROP and to what extent and why'**.

This in view of the Division Bench of the SC underscores the need for a checkup in all such cases. In fact, the screening was never done. There is no evidence whatsoever to suggest to the contrary.

Opinion of Pediatrician from Mumbai:

SC emphasized that it appears from the evidence that the ROP was discovered when the appellant went to Mumbai for a personal matter and took his daughter to a Pediatrician for giving DPT shots when she was 4½ months.

That Doctor, suspected ROP on an examination with naked eye even without knowing the baby's history.

Opinion of Ophthalmologists:

But, obviously R-3 and R-4 the **Doctors entrusted with the care of the child did not detect any such thing at any time**. The helpless parents, after detection got the baby's eyes checked by several doctors at several places. Traumatized and shocked, they rushed to Puttaparthi for the blessings of Shri Satya Sai Baba and the baby was anesthetically examined by Consultant, Department of Ophthalmology, Baba Super Specialty Hospital at Puttaparthi.

. After coming back from Puttaparthi, the baby was examined by Dr. Tarun Sharma along with the retinal team of Shankar Netralaya, who were also of the **same opinion**.

The parents apparently took the baby to Dr. Namperumal Swamy of Arvind Hospital, Madurai, who advised against surgery, stating that the baby's condition was unfavourable for surgery. The appellant then learnt of Dr. Michael Tresse, a renowned expert in Retinopathy treatment for babies in the United States.

Opinion from USA:

Father of the baby obtained a reference from Chief of Shankar Netralaya and took his only child to the United States hoping for some ray of light. **The appellant incurred enormous expenses for surgery in the United States but to no avail**. [1]

SC Approved NCDRC Judgment:

Having given anxious consideration to the matter, Division Bench of SC find that no fault can be found with the findings of the NCDRC which has given an unequivocal finding that at no stage, the appellant was warned or told about the possibility of occurrence of ROP by the respondents even though it was their **duty to do so**.

SC further observed that neither did they explain anywhere in their affidavit that they warned of the possibility of the occurrence of ROP knowing fully well that the chances of such occurrence existed and **that this constituted a gross deficiency in service**, nor did they refer to a **pediatric ophthalmologist**.

Bench observed that further it may be noted that R-3 & R-4 have not appealed to the SC against the judgment of the NCDRC and have thus accepted the finding of medical negligence against them.

Deficiency in Service:

In the circumstances, SC Division Bench agreed with the findings of the NCDRC [4] **that the respondents were negligent in their duty and were deficient in their services in not screening the child between 2 to 4 weeks after birth when it is mandatory to do so and especially since the child was under their care**. Thus, **the negligence began under the supervision of the Hospital i.e. R-2**.

Issue of Private Practice:

The R-3 and R-4, who checked the baby at his private clinic and at the appellant's home, respectively, were also negligent in not advising screening for ROP. It is pertinent to note that R-3 and R-4 carried on their own private practice while being in the employment of R-2, which was **a violation of their terms of service**.

Bench of SC find from the impugned order of the NCDRC [R-4] that the compensation awarded by that Forum is directed to be paid only by R-1 and R-3 i.e. the State of Tamil Nadu and Dr. S. Gopaul, Neo-Pediatrician, Government Hospital for Women & Children, Egmore, Chennai. No reason has been assigned by the Forum for relieving R-2 and R-4. Dr. Duraiswami, Neo Natology Unit, Government Hospital for Women & Children, Egmore, Chennai, who also treated Sharanya during the course of his visits to the house of the appellant.

Issue of Vicarious Liability:

SC Bench clarified that it is settled law that the hospital is vicariously liable for the acts of its doctors vide *Savita Garg vs. National Heart Institute*, (2004) [4], also followed in *Balram Prasad's case*. [2] Similarly in *Achut Rao Haribhau Khodwa vs. State of Maharashtra*, (1996) [5] the SC unequivocally held that the state would be vicariously liable for the damages which may become payable on account of negligence of its doctors or other employees.

Bench added that by the same measure, it is not possible to absolve R-1, the State of Tamil Nadu, which establishes and administers such hospitals through its Department of Health, from its liability. [Para 27]

Apportionment of Liability among Respondents:

In the circumstances, Bench considered it appropriate to apportion the liability of Rs.13800000/- among the respondents and shall be paid by R-1 to R-4 **within three months from 1st July 2015** otherwise the said sum would attract a penal interest at the rate of 18% p.a. [4]

Similarly, Bench directed that the amount of Rs.4287921/- in lieu of **past medical expenses**, shall be apportioned among all four respondents jointly and severally with interest of 6% p.a. from 27th May 2009. [6]

Summary and Conclusions:

Not informing important side effects or not referring to the concerned specialist for mandatory screening for ROP amount to deficiency in service and medical negligence on the part of treating doctor. Court takes inflation and future cost of treatment, financial hardship faced by the parents and mental suffering, etc. in computing the quantum of compensation in such a case of medical negligence. SC held Government of Tamil Nadu and the Director of Health Department vicariously liable for damage caused to the patient due to negligence of its employee and apportionment of liability among all four respondents.

There is need for keeping updates about development in the field of medicine by attending CMEs, conference and workshops in concerned specialty to avoid case of such medical negligence on the part of doctors.

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Table 1: Review of literature of ROP Screening Guidelines

Year	Source	First Screening	Who to screen?
2006	American Academy of Pediatrics et al.	31 wks PCA or 4 wks after birth whichever later	<1500gms birth weight or <32 wks GA or higher
2003	Jalali S et al. Indian J Ophthalmology	31 wks PCA or 3-4 wks after birth whichever earlier	<1500g birth weight or <32 wks GA or higher
2003	Azad et al. JIMA	32 wks PCA or 4-5 wks after birth- whichever earlier	<1500g birth weight or <32 wks GA or higher
2002	Aggarwal R et. Al Indian J. Pediatrics	32 wks PCA or 4-6 wks after birth whichever earlier	<1500 gm birth weight or <32 wks GA
1997	American Academy of Paediatrics et al.	31-33 wks PCA or 4-6 wks after birth	<1500 gm birth weight or <28 wks GA or higher
1996	Maheshwari R et al. National Med. J. India	32 wks PCA or 2 wks after birth whichever is earlier	<1500 gm birth weight or <35 wks GA or 02>24 hrs
1988	Cryotherapy ROP Group	4-6 wks after birth	<1250 gms birth weight
Source: Para 10, page 8-9			

Review Research Paper

Challenges and Issues in DNA extracted from formalin fixed and paraffin embedded human tissues for forensic investigations

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Abstract

Preservation of human tissues in fixatives is an important constituent of medical diagnostic procedures and clinical research employed to prevent the autolysis, putrefaction and degradation of the tissue and tissue components. Utility of such materials is important for forensic investigations where archived pathology specimens represent the only reference source of DNA available for positive identification, vast majority of which have been preserved in formalin. Apart from the excellence of this fixative for maintaining tissue integrity, it has no doubt a profound effect on extracting DNA from the tissues because of time dependent degradation, extensive covalent protein-protein network and protein-nucleic acid cross-link network generated by buffered formalin which heavily challenge DNA recovery for downstream PCR- based STR typing applications for forensic related issues. Since the success of comparative genetic analyses lies in the acquisition of comparable quality and quantity of DNA extracts, it is important to stress on contamination free working environment along with optimization of the extraction procedure in order to recover the highest percent of DNA from the sample without introducing any chemicals or reagents that may interfere with subsequent downstream analysis

Key Words: Fixation, Formalin, Histopathology, DNA, STR, Forensic

Introduction:

Fixation being the crucial step in histotechnology and diagnostic pathology is in essence employed to prevent the autolysis, putrefaction and degradation of the tissue and tissue components for preserving cellular architecture and composition of cells in the tissue to allow them to withstand subsequent processing so that they can be observed both anatomically and microscopically following sectioning. [1] Fixatives can be placed in 4 major groups, which are the aldehydes, oxidizing agents, alcohol based and the metallic group of fixatives. The aldehydes (formaldehyde, glutaraldehyde) and oxidizing agents (osmium tetroxide, potassium permanganate) acts by cross-linking proteins and are, therefore, called cross-linking fixatives.

Alcohol based fixatives (methyl alcohol, ethyl alcohol, acetic acid) are protein-denaturing agents and are more appropriately called denaturing fixatives, where the presence of alcohol in the solution causes protein denaturation by removing water from the free carboxyl, hydroxyl, amino, amido and imino groups of the proteins resulting in protein coagulation and tissue shrinkage. Metallic group of fixatives acts by forming insoluble metallic precipitates like mercuric chloride and picric acid. [2] Most objects are wet preparations of malformed bodies or organs that have been preserved by fixation with formaldehyde. Because of handling convenience, high degree of accuracy and extreme adaptability, it is the one that has been in widespread use and a method of choice in histology and pathology for maintaining the tissue integrity since its first preparation by Butlerow in 1859. [3] Experimenting with the chemical for its power, Ferdinand Blum in 1893 discovered its use in pathological applications. [4] Since then it has been a main ingredient in many fluids used for preserving biological and medical samples. This so called Pathologic-Anatomical collection in the fools tower hence represents one of the oldest and the largest collections of pathological preparations worldwide. Formalin fixation and

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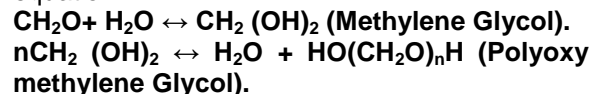
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subsequent paraffin embedding have been the clinical standard and a well-established essential approach for long-term preservation of these valuable tissue samples. Formalin fixed paraffin embedded (FFPE) tissues have several advantages over fresh or frozen tissue samples in that it is easy to handle and has inexpensive long-term storage. [5] As a matter of fact these archival post-mortem or biopsy paraffin-embedded tissues are potential samples for DNA extraction for subsequent genetic testing for forensic applications. However, the DNA extracted from these samples is often disposable in low amount (depending on the nature and quantity of the tissue included) and degraded to various extents due to the fixing and inclusion conditions (type and time of fixing, time and storage conditions). Due to DNA-protein cross-linkages, nucleic acid fragmentation occurs as a result of formaldehyde solution; therefore, the DNA extracted from these samples may be characterized by low copy number where brief sequences of the degraded target DNA predominate, generally smaller than the STRs conventionally used in the PCR. This negatively impacts on the amplification process leading to ambiguous results (artificial formations such as allele drop-out) or failure of the PCR process partly due to the presence of inhibitory remnants of substances such as formalin or the effects of xylene used in extraction process which inhibit the functioning of proteinase K. The risk of contamination during manipulation of samples may also lead to PCR failure. [6]

Nature of Formaldehyde:

Formaldehyde is undoubtedly the most investigated fixative for its mechanism of action. Butlerow (1859) first discovered formaldehyde followed by Ferdinand Blum who in 1893 investigated its use for pathological applications. [3] [4] Formaldehyde a small molecule with the formula CH_2O and molecular weight of 30, at room temperature exists as a flammable, colorless gas, which condenses on chilling to give a liquid that boils at -19°C and freezes to a crystalline solid at -118°C . [3] [7] Formaldehyde is marketed chiefly in the form of aqueous solutions containing about 35–50% by weight dissolved CH_2O , the standard being 37% contains 7–15% methanol to prevent precipitation of polymers, by acting as a stabilising agent and is commonly created by bubbling formaldehyde gas through water until saturation point is reached. The standard 37% formaldehyde solution known under the trade names "Formalin" and "Formol" has a pH usually ranging from 2.8–4.0. In aqueous solution,

formaldehyde forms a series of low molecular weight polymeric hydrates, monohydrate and a principal active ingredient glycol (hydrated formaldehyde) called methylene glycol. These hydrated methylene glycol molecules react with one another to form polymers as given by the equation:



A tissue is likewise fixed by both the hydrated and non-hydrated forms of formaldehyde. [7] Oxidisation of formaldehyde produces an unknown amount of formic acid, making the solution (unbuffered formalin) acidic. The relationship between the rate of penetration of formaldehyde and its rate of fixation may be due to the fast penetration speed of methylene glycol and the slow fixation rate of formaldehyde. The mechanism of action occurs through the formation of intra and intermolecular cross-links formed by the action of formaldehyde, with the principal cross-links occurring between side chain amino groups of lysine resulting in over time formation of methylene bridges. [8] By virtue of Mannich reaction, cross-linking can also occur between the aminomethylol groups and phenol, indole and imidazole side chains. However, formaldehyde affects variety of amino acids which include lysine, arginine, tyrosine, asparagine, histidine, glutamine and serine. [4]

Formalin DNA Interaction:

Several basic chemical reactions due to formalin fixation of nucleic acids are similar as observed in formalin-protein interactions. [9] DNA denaturation (interchain hydrogen bonds break and bases unstack) at the AT-rich regions of double-stranded DNA is initiated by formaldehyde, creating sites for chemical interaction. Four types of DNA formaldehyde interactions are noticed:

- 1) Addition reaction, where formaldehyde is added to the nucleic acid base to form a hydroxymethyl (methylol) group ($-\text{CH}_2\text{OH}$).
- 2) Formaldehyde, being a reactive electrophilic species, reacts readily with various functional groups of biological macromolecules in a cross-linking fashion. The second is due to reactive electrophilic nature of formaldehyde where a slower electrophilic attack of *N*-methylol occurs on an amino base to form a methylene bridge between two amino groups
- 3) Generation of AP (apurinic and apyrimidinic) sites due to formaldehyde treatment initiates hydrolysis of the *N*-glycosylic bonds, leaving free pyrimidine and purine residues. AP sites having

highly unstable cyclic carboxonium ion hydrolyzes rapidly to yield 2-deoxy-D-ribose.

4) Short chains of polydeoxyribose with intact pyrimidines are formed due to slow hydrolysis of the phosphodiester bonds. Formalin-fixed tissues exhibit a high frequency of nonreproducible sequence alteration when compared to the DNA isolated from frozen tissues, because the artifact formation is thought to be the result of formalin cross-linking cytosine nucleotides on either strand.

The consequences of this phenomenon, lead Taq-DNA polymerase failure in recognizing the cytosine, which in turn incorporates an adenine in place of a guanosine, thus creating an artificial C-T or G-A mutation. [10] It is worth to mention that jumping between templates during enzymatic amplification occurs and is known to be promoted by the damaged DNA, permitting Taq-DNA polymerase to insert an adenosine residue at the end of a template molecule, and then jump to another template, continuing the extension, thus producing an artificial mutation which is subsequently amplified. When fewer cells are used and isolated, such detectable random mutations are more likely to occur in the early PCR amplification cycle. Upto 1 mutation artifact per 500 bases have been recorded [10] The actual frequency of errors is thus a cumulative error including the reported Taq polymerase (normal) error frequency and the errors due to DNA damage and/or cross-linking depending on the degree of dilution. Many other specific errors introduced to nucleic acids by formaldehyde fixation are currently unknown. Cross-linking, fragmentation of DNA, modification of bases including acid hydrolysis, methylol adducts and oxidative damage are important which must be taken into consideration. [4] However conformational sequencing of independent amplification can distinguish between artifacts and true mutations, it has been cautioned that non recognition of such artifacts may have profoundly influenced mutation databases in formalin-fixed material. [9] [10]

Effects of Formalin on DNA Extraction:

Fixation- a physico-chemical process is gradual and complex in nature, involves diffusion of fixative into the tissue and a variety of potential physical phenomenon and chemical reactions. Formalin penetration into the tissue specimen makes it to reach the innermost layers of cells by the physical process of diffusion, where its movement is governed by several physical factors. Formalin though an excellent preservative for maintaining tissue morphology and cytological details in addition to the

prevention of immunoreactivity of many antigens, has no doubt a profound effect on extracting DNA from the tissues. Apart from the cross-linking which occurs with the surrounding histones, formaldehyde can react directly with nucleotides. As a consequence, of this process, nucleic acid retrieval along with degradation of nuclear material and alteration of sequences has been reported by formaldehyde fixation. [2] [9]

Effects of Formalin on PCR amplification:

Polymerase chain reaction is one of the easiest molecular biology techniques for the *in-vitro* replication of specific DNA segments extracted from FFPE tissues. However, the efficiency of PCR for the replication of the target DNA is influenced by a number of parameters in terms of quantity and quality includes viz a viz the type of fixative and the fixation time, storage time, the DNA extraction procedure, PCR amplicon size, the concentration of template DNA and optimization of PCR. [11][12] Other reasons which account for PCR failure are DNA-protein cross-linkages generated in formaldehyde solution that results in nucleic acid fragmentation. Presence of remnants of substances that inhibit the amplification reaction along with the risk of contamination during manipulation of samples may contribute in the failure of PCR. [6] The isolation of DNA from fixed specimens has till date remained the most time consuming and tedious step of the analysis process, making the technique of extraction a popular subject of research. In order to overcome the obstacles to extract high-quality DNA from fixed type of biological samples, various studies with different extraction protocols comparing different methods have been attempted. However, no standard protocol has ever been devised which will give the effect of period available with special reference to time and quality of formaldehyde fixation. As pointed in the literature, DNA extracted from 24 hours longer period formalin fixed specimen showed a marked decline in DNA amplification efficiency as well as an inferior DNA amplification by PCR.

Conclusion

Formalin though in original purpose an excellent preservative for maintaining tissue morphology and cytological details in addition to the immunoreactivity of many antigens has undoubtedly been investigated more often than other fixatives for downstream molecular analysis. However for the success of comparative genetic analyses in forensic arena acquisition of comparable quality and quantity of DNA extracts is important. When FF PET are used, a significant myriad of challenge in the

recovery of DNA for downstream molecular applications is seen due the extensive network of covalent protein–protein and protein–nucleic acid cross-links that are generated by buffered formalin as well as acid-driven hydrolytic fragmentation of nucleic acids by unbuffered formalin solution. Other reasons which appear to account for PCR failure for the DNA extracted from FF-PET are the remnant nature of formalin inhibiting the amplification reaction, inhibitory effect of xylene on proteinase K functioning, the contamination risk due to manipulation of samples as well as the declining state of the collections containing minute amounts of tissue per sample. In order to overcome the above mentioned obstacles several DNA extraction methods were devised and compared in relation to their relative performance. [13][14][15] However a little success was achieved in some studies by improved tissue digestion by way of increasing the proteinase K concentration [16], prolonging of digestion period [9] [13] [16], or an increase in the incubation temperature. Effect of including heat treatment steps prior to tissue digestion [13] [16] or after digestion with proteinase K [9] [11] [13] was also attempted giving an indication to some extent of reversing the DNA protein cross links by this treatment. Varying the composition of the extraction buffer, like addition of detergent for increasing the extractability was also studied. High-temperature heating under alkaline conditions without enzymatic tissue digestion was attempted. [8] A modified protocol based on heat and alkali treatment was also presented. [17] In addition, a completely different strategy was reported wherein instead of trying to improve the DNA extraction process, improvement in the quality of extracted DNA by using a DNA repair enzyme was attempted. [4] Despite the aim of extracting high amounts of amplifiable DNA from formalin fixed (and in most cases paraffin embedded) tissues, no agreement was drawn on the single applications of DNA extraction procedures under different conditions that can give better results for all the techniques. Several reports indicate that formalin-fixed tissue typically yields only low quantities of often severely fragmented DNA species with average base pair lengths of approximately 200 bp or less. However, different characteristics of extracted nucleic acids (DNA & RNA) may be viewed as important in studies with different aims/end point requirements -e.g some may require increased length of amplicon, others may require increased effective amplifiable copy number while still others may require increased level of extracted nucleic acids. At this point of time it is important to

stress on the contamination risk particularly when using FF PET for genetic studies. To avoid the risk of contamination from exogenous sources, when working with human DNA, strict laboratory conditions with clean rooms and dedicated facilities should always be initiated. The whole process will ensure generation of authentic data. [18] All over the world researchers working on FF PET are unable to choose a method that allows them to recover high amounts of nucleic acids but that also yields amplifiable copies. It is a proven fact that DNA extraction is the most critical step in the processing of FF PET samples for PCR-based forensic analysis. A sufficient quantity and appropriate quality of DNA must be isolated from the sample of interest before a DNA profile can be analyzed. For the same special consideration should be emphasized on the extraction method which has to be robust and capable of overcoming obstacles inherent to the sample, including but not limited to, low quantities of DNA. In addition the extraction procedure should be optimized to recover the highest percent of DNA from the sample without introducing any chemicals or reagents that may interfere with subsequent downstream analysis.

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Case Report

An Unusual Case of Ante-mortem Prolapse of Abdominal Viscera through Anus

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Abstract

Expulsion of intestine outside the body is very rare phenomenon. In living person spontaneous passage of a large bowel cast caused by acute ischemic injury is an extraordinary complication of mesenteric ischemia. A literature search revealed few cases in which a short segment ranging between 25 cm of recto-sigmoid and 96 cm of descending colon down to the upper rectum was passed per anum.

However, in an interesting case a corpse of 61years hospitalized female was referred to our tertiary care institute for autopsy without any significant history. The organs including small and large intestines in parts, kidneys, internal genital organs and fatty tissues were carried in different bag along with dead body which was allegedly expelled out during life. Meticulous autopsy was performed along with all possible necessary samples for laboratory and histo-pathological analysis. Case was also discussed for all probabilities and possibilities with experts of different faculties including Surgeons, Plastic surgeons, Gastroenterologists, Pathologists and police officials, medical & paramedical staff of concerned hospital along with detailed examination of previous medical history, investigation & treatment record papers. The exact conclusion and possibility of fatality is still awaited for concluding research.

Key Words: Ischemia, Mesentery, Autopsy, Internal organs

Introduction:

Intestinal ischemia is a devastating disease process that could lead to bowel gangrene and death if either not diagnosed early or left untreated. Death is usually caused by irreversible shock, intestinal necrosis or septicemia. Usually it is seen in elderly patients with atherosclerotic disease.

Case History:

A 61years old female Bahraini patient, who was a known case of hypertension, underwent Right Frontal Craniotomy and removal of Tuberculum Sella Meningioma. She developed following complications after the surgery:

1. Acute streptococcal meningo-encephalitis
2. Post encephalitic Parkinsonism.
3. Post encephalitic epilepsy.

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4. Post meningitic Hydrocephalus with V-P shunt
5. Post V-P shunt Infection.

She travelled to India for rehabilitation at Mumbai and got admitted in a hospital. On the same day she went to attend the nature's call, all of a sudden her organs prolapsed through anus and she died eventually. Body was sent to Mortuary of Govt. Medical College, Mumbai along with visceral organs in a plastic bag for post-mortem examination.

Autopsy Examination: (Fig. 1-7)

External Examination:

- Laceration present over anal opening of size 6cmx3cm muscle deep, extending upwards and involving anal sphincter and peri-anal muscles.
- Evidence of catheterization in form of punctured wound present 3cm above the umbilicus.

Internal Examination:

Thoracic cavity and its internal organs were intact and unremarkable.

- **Peritoneal cavity:** Tags of tissue & mesentery attached to peritoneal cavity with clots of 700 to 800 cc with blood noted.
- **Small and Large intestine:** part of small & large intestine in multiple pieces with blood and fecal matter brought in separate carry bags.

- **Pancreas, Suprarenal, Spleen, Kidney, Bladder and Uterus:** Seen prolapsed out of body and were congested.
- **Skull & Brain:** Evidence of Right frontal craniotomy & VP shunting noted.

Histo-pathological Examination:

Tissue bits for histo -pathological examination showed congestion of Cerebellum, lungs and kidneys. Lungs were edematous and kidneys also showed focal chronic pyelonephritis.

No poison was detected on toxicological examination of viscera and blood.

Discussion:

Acute ischemic injury is an extraordinary complication of mesenteric ischemia. A literature search revealed 8 cases in which a short segment ranging between 25 cm of recto-sigmoid and 96 cm of descending colon down to the upper rectum was passed per anum. [1–6]

However, in our interesting case not only was there a spontaneous expulsion of the whole of the colon and small bowel but also kidneys, ureter and uterus expelled per anum.

Out of the eight reported cases, ischemic complication occurred following abdominal aortic aneurysm repair in five cases. All patients survived this complication except for one case, which was reported by Sado et al in J Jpn Soc. Colorectal Dis in Japanese. [1]

Infarcted muscularis propria was also found in addition to necrotic mucosa and sub-mucosa. [1–6] The mortality following bowel ischaemia remains high although it has dropped from 85% to 60% over the last 30 years due to advances in early diagnosis and management.

The etiology of bowel ischemia is obviously a compromise in blood flow to the bowel. This may be attributed to a predisposing obstructive factor causing segmental ischemia or to a non-obstructive etiology. The latter is usually secondary to cardiovascular events and could affect the major supply of the celiac axis and superior and inferior mesenteric arteries.

The likely causes of non-obstructive intestinal ischemia include:

1. Dissecting aortic aneurysm with secondary compression of both main mesenteric arteries
2. Vasospasm of both mesenteric arteries secondary to medications for example, digoxin, ergot, and cocaine intoxication [7]
3. Low-flow phenomenon precipitated by hypovolemia, severe hypotension or shock. [8]
4. Hematological clotting causes predisposing to excessive clotting mechanism.

In our case report, there was no history of clotting disorder, vasoactive medication, or aortic dissection.

NOMI (Non-Obstructive Mesenteric Ischaemia) accounts for 15–20% of acute cases of intestinal ischemia and is mostly seen in patients who are already critically ill. [7] Systemic hypotension is often followed by splanchnic and peripheral vasoconstriction.

This physiological response will predispose to NOMI particularly in the elderly population whose vascular bed is already compromised by systemic atherosclerosis. [9,10]

Mere body preservation is another aspect which is followed in some religions. In ancient times to preserve body organs that could decay early were removed by priests, who use to have some knowledge of human anatomy. Brain was first to be removed by means of specialized hooks through nostrils in this procedure. Next were abdominal organs by a side port entry over lower abdomen.

Evisceration was used as means of torture in Vietnam War also. It was described in Japanese literature as punishment for samurais and punishment to Mexicans who were passive agent in homosexual act.

Conclusion:

This case was discussed exhaustively for all probabilities and possibilities with experts of different faculties including Surgeons, Plastic surgeons, Gastroenterologists, Pathologists. So also the police officials, medical and paramedical staff of concerned hospital along with detailed examination of previous medical history, investigation and treatment record papers. But the exact conclusion and possibility of fatality is still awaited for concluding research.

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Fig. 1: Body of Victim with catheterization



Fig. 2: Parts of prolapsed organs & intestine in multiple pieces in separate polythene bag



Fig. 3: Laceration of Anal opening



Fig. 4: Abdominal Cavity with Blood Clots and Tags of Tissues



Fig. 5: Prolapsed small & Large intestine in pieces



Fig. 6: Prolapsed both kidneys with part of ureter brought in polythene bag

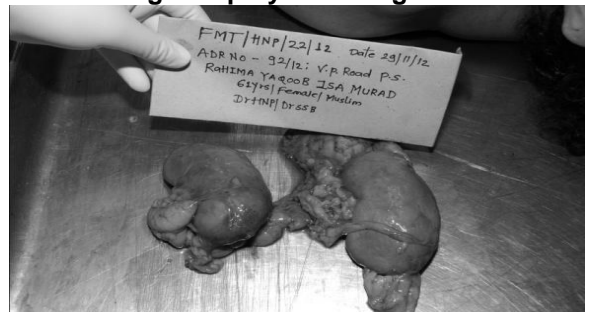


Fig. 7: Prolapsed uterus in multiple pieces



Case Report

Lack of Reasonable Care and Skill: A Report on a Series of Five Mismanaged Cases

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Abstract

Any negligence of a medical practitioner, by an act of commission or omission, in performing his/her duty is known as medical negligence. Failure to exercise reasonable care and skill in the management of a case is a potential problem area with legal liabilities in medical practice. Autopsy is an efficient method of clarifying medical malpractice claims. In this paper, a report on a series of five mismanaged cases is presented. In this series, the case one was a post-caesarean case who died after the operative procedure. The case two and three were cases of uterine rupture. The case four was also a post-caesarean case who died because of bleeding and complications. The case five was a case of laparoscopic cholecystectomy and appendectomy who died of haemorrhagic shock following the operative procedure. Lack of proper care and monitoring, failure to recognize the complications in time and failure to take prompt life saving measures like emergency surgical intervention have led to the fatal outcomes in these cases.

Key Words: Reasonable Care and Skill, Negligence, Bleeding, Complications, Death

Introduction:

Medical malpractice is professional negligence by act of commission or omission by a health care provider in which the treatment provided falls below the accepted standard of practice in the medical community and causes injury or death to the patient, with most cases involving medical error. [1]

A doctor can be held liable for negligence only if one can prove that she/he is guilty of a failure that no doctor with ordinary skills would be guilty of if acting with reasonable care. [2] Lately, Indian society is experiencing a growing awareness regarding patient's rights. This trend is clearly discernible from the recent spurt in litigation concerning medical professional or establishment liability, claiming redressal for the suffering caused due to medical negligence, vitiated consent, and breach of confidentiality arising out of the doctor-patient relationship. [3]

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Case Series:

In this paper, the callous and injudicious acts of some of the members of medical fraternity are highlighted. It also emphasizes the importance of exercise of reasonable care and skill by medical practitioners in dealing with patients so as to avoid unwanted legal hassles.

Case One:

A 32-year old primigravida (at full term) died following caesarean section (CS) under spinal anesthesia at a private hospital in Imphal on 2/7/2007. Shortly after the operation, she was complaining of pain in the abdomen and her condition was reassessed by the surgeon almost four hours after the operation. There was rapid deterioration in the patient's condition after the operative procedure and she expired shortly before the re-exploration could be done.

A case of negligence was filed against the surgeon, and autopsy was performed at a tertiary care teaching hospital at Imphal.

No abnormal physical or laboratory findings were detected on the assessment of the case sheet of the patient.

On autopsy, there was marked generalized pallor, distended abdomen with blood oozing out of the stitched surgical abdominal wound. (Fig 1) About 2 liters of blood was present in the abdominal cavity (Fig. 2), and the stitches on the uterine wound were found to be loose with hematoma formation in the surrounding area. (Fig. 3)

The cause of death was due to haemorrhagic shock resulting from excessive bleeding.

Fig. 1: Blood Oozing Out of the Abdominal Wound

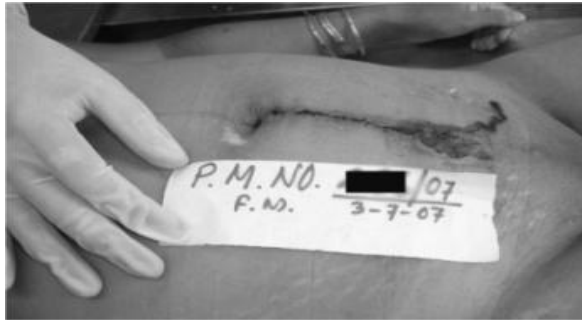


Fig. 2: Blood in the Abdominal Cavity



Fig. 3: Uterine Wound with Loose Stitches and Hematoma Formation



Case Two:

On 6/10/11, a 35-year old woman (second gravida at full term) was admitted in the antenatal ward of Obstetrics & Gynaecology Department of a government hospital, Imphal. She had been attending the hospital regularly for her antenatal check-ups.

The next day i.e., on the EDD (expected date of delivery); normal delivery was planned since her previous baby was also delivered by normal vaginal delivery and labour was accordingly induced at 6 a.m. using cervical gel (progesterone).

At around 1 p.m. intravenous syntocinon (oxytocin) drip was started. At about 8 p.m., she complained of unbearable pain but she was left

unattended, and she expired at 10 pm of the same day.

The post-mortem examination was done on 10/10/11 at the morgue of a tertiary care teaching hospital, Imphal after a case of negligence was filed against the attending doctors. On autopsy, generalized pallor was present, bleeding per vaginum was seen and the abdomen was distended.

On internal examination, the heart was empty and the peritoneal cavity was filled with about 4 litres of blood. A dead fetus along with placenta and cord was present in the abdominal cavity. (Fig. 4 and 5)

The uterus was ruptured in the lower segment in the anterior wall involving the left uterine vessels. The dimensions of the rupture were 15cmX11cmXcavity. (Fig. 6)

Hematoma was seen in the whole of the left broad ligament. On examination of the fetus, rigor mortis was developed all over the body and cyanosis was present. It was a full-term female fetus weighing 3kgs and 54cm in length.

The stomach contained about 15ml of brownish fluid mixed with blood. Based on the post-mortem findings and the histopathology report, the death of the mother was due to haemorrhagic shock produced by rupture of the uterus leading to hypovolemic shock and acute renal failure.

The fetal death was attributed to asphyxia resulting from aspiration of blood.

Fig. 4: Blood in the Abdominal Cavity with a Dead Fetus



Fig. 5: The Dead Fetus



Fig. 6: The Ruptured Uterus**Case Three:**

The dead body of a 34-year old pregnant lady was brought for autopsy to the mortuary of a tertiary care teaching hospital at Imphal on 7/9/2007. As per the history given by the police and the relatives, the lady was a second gravida at full term with a previous history of caesarean section four years before and the EDD was on the 12/9/2007.

She used to go for regular check up to a local doctor in his private clinic. She was asked to get admitted on the 5th September to his clinic for a normal vaginal delivery. Accordingly, the lady got admitted to the doctor's clinic in the evening of 5th September. The doctor instructed his nursing staff to start Oxytocin drip at about 8 PM of the same day.

At about 10 PM, the patient developed severe abdominal pain and only the nurses on duty, not the doctor, attended to her even though the doctor was informed repeatedly. The next morning i.e. on 6th September, the doctor came and referred the case to a local district hospital after assessing her condition.

However, the patient died on the way to the hospital at about 5.40 A.M. Following this, a case of medical negligence was filed against the doctor by the relatives of the patient.

On examination, marked generalized pallor was present and the abdomen was distended with full flanks. An old caesarean scar mark was present in the midline below umbilicus. (Fig 7) Internally, the heart was empty and the peritoneal cavity contained about 3 litres of blood mixed with liquor amnii and a dead female fetus. (Fig. 8)

The uterus was ruptured along the site of old scar of lower segment caesarean section on the anterior wall, horizontally placed, 15 cm x 19 cm X whole thickness (Fig. 9) and it contained blood clots, placenta and amniotic membrane. The cause of death was hemorrhage and shock resulting from post caesarean uterine scar rupture.

On examination of the fetus, cyanosis was present and the stomach contained

brownish fluid and the death of the fetus was due to asphyxia.

Case Four:

On 29/6/2007, a 29-year old married woman had caesarean section at a private hospital after which her condition deteriorated for which she was referred to a government hospital, but she died on 1/7/2007 at around 8 pm. The post-mortem examination was done on 2/7/2007 at a tertiary care hospital morgue.

On post-mortem examination, jaundice was present and blood stained fluid was oozing from the vagina. Ecchymosis and multiple petechiae were present on the chest, abdomen and buttocks. A stitched transverse caesarean section incision was present on the lower part of the abdomen.

Internally, the viscera had a yellowish tinge all over. About 1.5 litres of serous fluid was present in the pleural cavity on both sides. Both lungs were partially collapsed.

In the peritoneal cavity, there was about 1.5 litres of dark blood. (Fig. 8) The surgical site of caesarean section on the uterus was stitched in one layer (muscle) and the peritoneum was not stitched. Four placental cotyledons were present inside the uterine cavity. The histopathology report showed confluent hepatic necrosis and cholestasis.

Fig. 7: Distended Abdomen with Caesarean Section Scar**Fig. 8: Blood in the Abdominal Cavity and Dead Fetus**

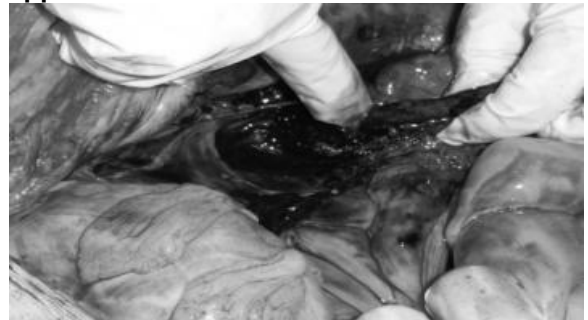
Fig. 9: Ruptured Uterine Scar**Case Five:**

On 17/11/2014 at 11am, 59 year old man was operated on by a surgeon at a private hospital at Imphal. The patient then expired on 18/11/2014 at 7 am at the same hospital. The post-mortem examination was done on 20/11/2014 at the morgue of a tertiary care teaching hospital at Imphal.

On post-mortem examination, generalized pallor was present. There were 5 surgical wounds. Out of these, 3 were of laparoscopic surgery located in the epigastrium, right hypochondrium and the umbilical region. The fourth was the appendectomy incision in the right iliac fossa and the last one was a surgical drainage incision in the right lower part of abdomen. (Fig 10)

Internally, all the organs were pale and about 100ml of serous fluid was present in the pleural cavity on both sides. In the peritoneal cavity, there was about 2.5 litres of dark fluid blood. The gall bladder was absent and surgical staples were present with some ecchymosis in the gall bladder bed. The appendix was absent, and about 750gm of semi-clotted blood was present around the cut end of the appendicular vessels. (Fig. 11)

The ligature around the appendicular vessels was found to be loose. (Fig. 12) The death was due to shock and haemorrhage produced by bleeding from the appendicular vessels, following surgical operation on the gall bladder and the appendix.

Fig. 10: Surgical Wounds for Laparoscopic Cholecystectomy and Appendectomy**Fig. 11: Blood Clot in the Abdominal Cavity Post-Laparoscopic Cholecystectomy and Appendectomy****Fig. 12: Loose Ligature around the Appendicular Vessels****Discussion:**

It is a known fact that even the most experienced specialist doctors could make a mistake in detecting or diagnosing the exact nature of a condition. However, in the present series, certain loopholes were observed in the management of these cases.

Some of the immediate causes of maternal deaths following caesarean section (within 24 hours) include hemorrhagic shock because of postpartum hemorrhage or internal leakage, pulmonary embolism/thromboembolism or disseminated intravascular coagulation (DIC).

Approximately one litre of blood is lost during caesarean section and exceeding the amount without correcting pre-existing dehydration and ketoacidosis may lead to immediate death. [4]

Shortcomings in the Management of the Case One Include: Failure to detect slippage of stitches, lack of postoperative care and assessment of the condition of the patient, failure to recognize the complications in time and failure to take prompt life saving measures like emergency surgical intervention, etc.

Uterine rupture in pregnancy is a rare and often catastrophic complication with a high incidence of fetal and maternal morbidity. From 1976-2009, 20 peer-reviewed publications that described the incidence of uterine rupture reported 1,864 cases among 2,863,330 pregnant women, yielding a low overall uterine

rupture rate of 1 in 1,536 pregnancies (0.07%). [5] Incidence of rupture uterus varies from 0.3/1000 to 7/1000 deliveries in India accounting for 5% to 10% of all maternal deaths. [6]

Uterine rupture is defined as a full-thickness separation of the uterine wall and the overlying serosa. It is associated with clinically significant uterine bleeding, fetal distress, expulsion or protrusion of the fetus, placenta or both into the abdominal cavity and the need for laparotomy and prompt delivery of the baby, uterine rent repair or hysterectomy. [7]

It may develop as a result of pre-existing injury like scar or perforation or anomaly. The most common cause of uterine rupture is dehiscence of a previous caesarian section scar; it may be associated with trauma or it may complicate labour in a previously unscarred uterus [8] as was in the Case two.

Rupture during labour is considered to be more dangerous than that occurring in pregnancy because shock is greater and infection is almost inevitable. [9, 10] In this case, rupture of uterus during labour has resulted in the unfortunate death of the mother and the baby. All induction agents can **cause uterine** hyper stimulation, which carries an increased risk of uterine rupture and this is what actually happened in this case.

In most cases, an emergency cesarean delivery or cesarean hysterectomy can be life-saving but this necessary intervention was not done. A delay in diagnosis and treatment had resulted in the fatal outcome.

On the other hand, the case three was a case of VBAC (vaginal birth after caesarean). Rupture of uterine scar is the most serious complication of VBAC (vaginal birth after caesarean) which can be life threatening for both mother and baby. In a study by Mozurkewich EL, Hutton EK, [11] it was observed that uterine rupture rate for women undergoing a trial of labour after previous CS was 0.39 % whereas in a study by Chauhan et al, it was 0.62%. [12]

The use of prostaglandins for cervical ripening and induction of labour after previous caesarean section delivery increase the risk of uterine rupture by 15.6 fold. [13] In vaginal births after caesarean delivery (VBAC), litigations out of use of oxytocin may come from the injudicious use of oxytocin and failure to monitor the patient appropriately during its administration.

Lack of proper care and monitoring after induction of labour in a high risk case was evident from the history as well as findings in the present case. It was further learnt that neither the lady nor her relatives were explained about the high risk of post caesarean section

pregnancy even though she used to go for regular antenatal check- ups. Moreover, the trial of labour in a VBAC case was attempted in the centre where there was no blood bank and no facilities for emergency surgical operations.

Failure to foresee the complications in such a case in absence of proper care and monitoring, have led to the filing of negligence suit against the doctor.

The causes of postpartum haemorrhage (PPH) have been described as the "four T's" viz. Tone: uterine atony, distended bladder; Trauma: lacerations of the uterus, cervix, or vagina; Tissue: retained placenta or clots; Thrombin: pre-existing or acquired coagulopathy; the most common cause of PPH is uterine atony, followed by retained placenta. [14]

The retained four cotyledons of placenta in the uterine cavity could have led to PPH in the Case four.

The autopsy findings in this case were also consistent with some features of disseminated intravascular coagulation (DIC). A proper postoperative assessment of the condition of the patient and a timely intervention could have averted the fatal outcome.

The Case five underwent both laparoscopic cholecystectomy and classical appendectomy. Even though the gallbladder bed was not showing any evidence of bleeding, the cause of bleeding was a loose ligature tied around the appendicular vessels.

Soon after the operative procedure, the patient started complaining of pain in the abdomen and his condition was assessed several hours after the operation.

In this case also, a timely assessment and surgical intervention by the doctors could have saved the life of the patient.

In all these five cases, it is evident from the history and findings that failure to exercise reasonable care and skill i.e. lack of proper care and monitoring, failure to foresee and recognize the complications in time and failure to take prompt life saving measures like emergency surgical intervention, etc. have led to the fatal outcomes.

Conclusion:

Failure to exercise reasonable skill and care is a potential problem area with legal liabilities in medical practice. A doctor may be charged u/s 304A IPC (for causing death due to negligence) or under the Consumer protection Act (COPRA). Moreover, a negligent doctor may face penal erasure of his/her name from the Medical Register.

As per the Supreme Court of India ruling, negligence in medical profession calls for

a treatment with a difference and a simple lack of care, an error of judgment or an accident is not proof of negligence on the part of the medical profession.

However, doctors should not be emboldened by this shield, and turn careless and inhumane. It should be remembered that the Supreme Court has only emphasized the need for care and caution in prosecuting doctors.

The apex court has not stated that doctors can never be prosecuted for medical negligence. *"We are all human and fall short of where we need to be but we must never stop trying to be the best we can be"* – **Richard Adams, English Novelist**

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Case Report

Buoyant Forces Uncovers a Crime: A Case Report

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Abstract

It's an old saying that "dead men tell no tales" which means that dead people will not betray any secrets. However in this case, the secret could not be held in the depths of water and criminal intent lost battle to the laws of physics. Archimedes' principle, the physical law of buoyancy, discovered by the ancient Greek mathematician and inventor Archimedes, states that a body completely or partially submerged in a fluid at rest is acted upon by an upward force equal to the weight of the fluid displaced by the body. The buoyant force on a body floating in a liquid or gas is also equivalent in magnitude to the weight of the floating object and is opposite in direction; the object neither rises nor sinks. This long found principle found application in Forensics in the context of flotation of dead bodies after submersion in water bodies which led to revelation of crime.

Key Words: Drowning, Decomposition gases, flotation, homicidal intent

Introduction:

For a crime to be established against a human being, the injured or the body has to be recovered in order to set the law enforcement agencies in motion. Keeping this in mind, a perfect murder would be one wherein the perpetrator commits the crime and gets away with it in want of a dead body and no evidence of the crime ever being committed.

Nowadays, with the increased brutality in committing such crimes, the culprit goes to lengths to ensure the non-availability of the dead body itself. Even when recovered, the identification of the dead body is in question.

This makes it difficult to establish the corpus delicti. Various methods are in vogue to dispose off the body after committing a murder.

Such methods ensure not only the disposal of the body but also the disappearance of the victim's identity from the face of the earth.

This present case was intended to be a similar vanishing act but simple physics defied it, leading to recovery of the body and thereby the whole crime.

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Case History:

In the month of August, a gruesome appearance of both hands and a distorted face in the murky waters of a pond led to the discovery of a hidden tale which was meant to be buried and forgotten.

The body was found to be floating just beneath the surface of water in supine position, which is unusual because a submerged body usually floats face down, buttocks up, with limbs hanging down in front of the body. [1] (Fig. 1)

Upon being pulled out, it was observed that the body was tied to a cement slab measuring 5 feet by 1 foot by 0.5 feet, which it had carried upwards along with it. (Fig. 2)

The hands and feet were tied with a nylon rope and body was tied around the abdomen to the cement slab.

Face and antero-lateral aspect of chest wall of the deceased were burnt and charred exposing the underlying subcutaneous tissues up to variable depths, which was done in order to conceal the identity of the victim.

The body was in advanced stage of putrefaction. Maggots were crawling all over the body of the deceased and multiple gnawed off skin defects were present over the neck and chest region of the deceased. Because of such complexities, the case was brought to PGIMS, Rohtak for autopsy.

Autopsy Findings:

After the basic external examination, the body was radiographed for fractures and other foreign bodies that might have been embedded in the body and especially the charred area that could not be well examined with naked eye.

The radiograph films showed a single radio-opaque shadow on the front of chest which, on physical examination of the dead body, was found to be a bullet. The bullet was directed anteriorly, lying on the anterior surface of tracheal lumen in suprasternal notch which by itself was exposed as the skin of front of chest was burnt in varying depths. (Fig. 3)

The entry wound, measuring 0.9 by 0.9 cm, was present on the left side of upper back in the paraspinal area at the level of T1 and T2, situated 14 cm below the external occipital protuberance, 4 cm left of midline and 140 cm above the left heel. (Fig. 4) The wound margins were irregular and had nibbling effect. Maggots were seen crawling in and out of the wound.

The bullet followed the track from posterior to anterior, left to right and slightly upwards. From its point of entry, it moved medially, rupturing the ligamentous structures and then fracturing T1 and T2 thoracic vertebral body and transverse process, it deflected upwards.

Thereafter, it entered the lumen of trachea with just enough energy to rupture the trachea. The bullet, after striking these structures, lost momentum to come to lie in the supra-sternal notch, from where it was recovered lying superficially.

The surrounding structures were ecchymosed. The left lung was collapsed. The cause of death was opined to be shock due to the firearm injury and the thermal burns were labeled as postmortem in character.

Fig. 1: Hands and Face Found Afloat in the Pond



Fig. 2: Body Tied to the Cement Slab at the Trunk

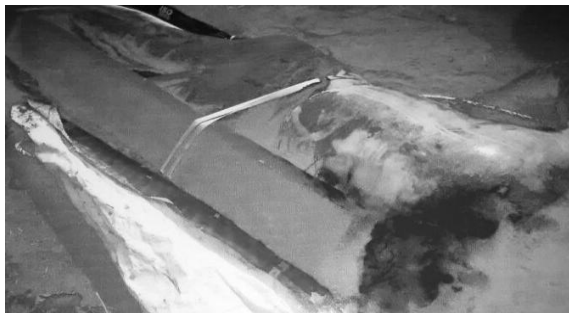


Fig. 3: Bullet Lying in the Suprasternal Notch

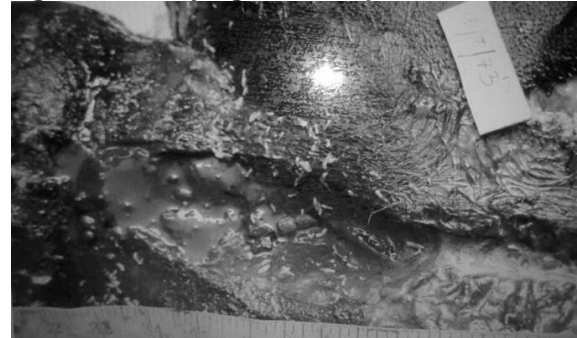


Fig. 4: Entry Wound at the Back of Upper Chest



Discussion and Conclusion:

It must be appreciated at the outset that not all persons whose bodies are recovered from water will have died from its inhalation, although they may show features reflecting immersion in water. Such bodies should therefore be particularly carefully examined, both externally and internally, to catalogue and subsequently to explain satisfactorily all injuries present, to determine whether death indeed followed immersion in water, and to see whether any natural disease, such as ischemic heart disease, cerebrovascular disease, and hypertension, may have contributed to, precipitated, or even caused death. [2]

It is also important to determine whether the deceased was under the influence of alcohol or other drugs at the time of death (although interpretation of laboratory results should be influenced by the knowledge that, as discussed below, classic fresh water drowning may increase the blood volume by as much as 30-35%). Finally, the pathologist has a vital role in determining, from all pathological and circumstantial evidence available, whether the overall findings are consistent with or even point directly towards accident, suicide, or homicide. [2]

Besides being an aide in the drowning, these water bodies are a common site for disposal of human corpses, both legally and illegally. The commonly practiced methods of legal disposal are as per religious beliefs and

customs, such as burial of entire body in earth (coffined or not) and cremation, wherein the body is burnt and the cremains are then scattered in water or on land.

In the Zoroastrian community, the dead body is thrown into a 'tower of silence' wherein the dead body is left for scavenger birds to feed upon. The disposal by illegal means are often seen when the body is the victim of a homicide. In some cases, the victim may be unconscious but alive and is thrown in the river or lakes only to die as a result of drowning.

In homicidal drowning, the victim is weighed down by tying heavy weights to their legs or torso to reduce retaliation by him and to ensure his sinking and remaining there forever. The underworld mafias in the western countries are known for disposal of their enemies by casting their feet in a concrete block or tying one to the body and throwing off at sea. [3]

The well acknowledged Chicago-style method involves wrapping heavy chains around the victim. In European cities like Venice, the bodies are stuffed into barrels and thrown in canals. Further, if the dead bodies are dismembered and then disposed of individually, the likelihood of finding all these parts is very meager. Even the dead or stillborn neonates are disposed off in running streams.

In India, where the artificial canal system has brought prosperity to the agricultural lands by providing water even in remote locations, it has also provided easy access to disposal of dead bodies. These flowing water sources dispose of the dead body to such far off places that even the identity of the victim becomes questionable, let alone establishment of the crime scene and the crime. [4, 5]

These channels are fitted with nets at places, so that weeds and garbage thrown into these can be cleaned. Corpses get entangled in these nets and are retrieved, but only after having traveled a long distance.

Bodies thrown in to the sea are sometimes discovered in the nets or lines of fishermen or they wash up at the shore. Small pools and lakes by the side of villages are also used to dump bodies by criminals but once the decomposition sets in, these sunken bodies resurface revealing their presence.

In our particular case, the deceased was first shot on the back by a rifled handgun. The perpetrator then tried to dispose of the body by burning it off but it did not come through and only the upper part of trunk and face were partially burnt. So, he tied a heavy cement slab about 5.5 feet long, 25 cm wide and 10 cm thick, to the deceased's trunk with a rope and sank it

in a pond on the outskirts of a village. The cement slab weighed around 50-60 kg.

As per laws of physics, a body in water will usually sink but because the density of a body is very close to that of water, small variations (like air trapped in clothing) can have a considerable effect on buoyancy.

Having sunk to the bottom the body will remain there until putrefactive gas formation decreases the density of the body and creates sufficient buoyancy to allow it to rise to the surface and float. Heavy clothing and weights attached to the body may delay but will not prevent the body rising. [6, 7]

According to Archimedes' principle, a body immersed in liquid experiences an upward force that opposes the weight of the body.

The buoyant force is given by

$F_B = \rho_l \times v_b \times g$ where ρ_l is the density of the liquid in which the body is immersed, v_b is the volume of part of the body immersed, and g is the acceleration due to gravity. On the other hand, the downward force of gravity on a body is given by

$F_G = mg$ where m is the mass of the body in question.

If the block is attached to the body for immersing, gravity pulls the block and the person downwards while the buoyant force pushes them towards the surface.

Here, the block's weight aid the gravitational pull and weighing the body down to drown but the volume of block add to the buoyant force trying to keep the body afloat. Therefore, for the body to float, the net buoyant force must be greater than the gravitational pull.

In our case, the dimensions of the concrete block are 5.5 ft. by 10 cm by 25 cm. This gives a volume of 42 liters for the block.

The masses of the body and the block are both known to be 60 kg. The earlier data mentioned is that of a case wherein the body rose to surface with attached weight of 25 kg. [8]

So, it is emphasized that not all bodies recovered from water bodies are victims of drowning. The key questions that need to be answered in such cases are regarding the identity of the person, the duration for which the person was immersed in water, the cause of death and the reason for drowning.

In our case, the face and upper chest wall region of the deceased were burnt off to conceal the identity of the victim.

These burns, however, performed an additional task of concealing the only external wound over the body all too well. It was the clue that was against suicidal or accidental drowning. Secondly, the body having the concrete slab tied

to it around the waist generally goes against the suicidal theory, as it wouldn't have been feasible by the person to do this himself. If a body is found with heavy weights attached to it, then the nature of weights, whether they are tied by ligature or fixed in clothing or found in pockets, are important. [9, 10]

The body was recovered in advanced stages of putrefaction and was bloated due to which establishing the cause of death was a difficulty. So, having ruled out the possibility of accidental and suicidal drowning, the most important question is to establish an identity and find the cause of death in such cases of homicide.

In this case, in absence of any common database of all citizens, the identity establishment is still a task relying on age old photographs and accessories identification.

This reason is solely responsible for the 'unknown' status of this deceased. The burns and the decomposition concealed the gunshot wound making it further unappreciable, but the radiographic presence and subsequent recovery of the bullet emphasized the need for a complete and careful autopsy, which in this case could have been easily overlooked.

All these efforts came into picture only after the body resurfaced, defying gravity with the help of the force of buoyancy.

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Case Report

Fatal Blast Wave Injuries Due to Tyre Burst An Unusual Case

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Abstract

Injuries caused by explosion of tyres during servicing are similar to those occurring from landmine explosions with neither thermal nor chemical effects. Though such incidents are rare they may result in a severe injury pattern. This destructive potential of tyre explosions has so far received little attention in medical literature. A 30 years old truck driver was fatally injured by explosion of a truck tyre when he was inflating it at a service station. Due to the blast wave liberated following the explosion he was thrown several feet away. He died upon admission to emergency department. Medico-legal autopsy revealed abrasions over posterior aspect of the body at places, multiple rib fractures, internal organ contusions and lacerations. Paramedical and medical staff should be aware of fatal internal damages caused by such blasts and immediate intervention must hence be initiated. Occupational safety measures, timely screening and proper management is essential for prevention of such deaths.

Key Words: Tyre blast, Blast injuries, Barotraumas, Zipper rupture, Tyre pressure

Introduction:

An explosive blast creates a pressure wave that can induce barotraumas. The pressure wave is followed by a transient zone of low pressure (below atmospheric), so that a rapid double change in pressure is suffered by the body. The blast wave causes most damage at an interface between tissues in contact with the atmosphere, which is why the lungs usually suffer the most, followed by the gastrointestinal tract and ears. [1]

Inflated tyres, especially the large truck and bus tyres, contain a tremendous amount of potential energy. Injuries caused by exploding tyres can be seen as direct injuries caused by rim fragments and barotraumas as a result of high pressures.

Blast injuries of large tyres are similar to those resulting from landmine explosions, except there is no thermal or chemical damage. Bursting of tyres is not an uncommon phenomenon these days.

The factors attributed are driving with under or over pressurized tyres, overloading, using of worn out tyres, mechanical impact damaging the tyre structure, incorrect mounting on the rim, contamination while manufacturing of tyres etc.

This study presents a fatal case of overpressure blast due to the accidental explosion of a truck tyre while the deceased was inflating it.

Case History:

A 30 years old truck driver was fatally injured by explosion of a truck tyre when he was inflating it at a service station. Due to the blast wave liberated following tyre explosion he was thrown several feet away. He died upon admission to the emergency department.

Autopsy Findings:

At autopsy he was averagely built with rigor mortis well marked throughout. Post-mortem lividity was present on the back and dependent parts of the body in the supine position. Multiple abrasions were present over posterior aspects of both forearms, medial aspect of left scapula, lateral aspect of left thigh and anterior aspect of right thigh.

On internal examination serial fractures of right 4th to 8th ribs and left 5th to 7th ribs at

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different lines were noted. (Fig. 1) Multiple contusions and lacerations were present over both lungs (Fig. 2) with accompanying right and left sided haemo-pneumothorax comprising of about 400 ml and 300 ml blood respectively.

Multiple contusions were seen over mesentery, anterior wall of stomach and intestines. Toxicological screening of the samples obtained during autopsy did not reveal any intoxicating substance.

On Histopathological examination lungs showed inflammatory infiltrate, dilated blood vessels and alveolar spaces with interstitial oedema suggestive of blast lung. Multiple haemorrhages were seen in the omentum while intestinal walls showed intact muscularis mucosa, dilated blood vessels and inflammatory infiltrates. The deceased died due to a **haemo-pneumothorax as a result of blast wave injury to the lungs.**

Discussion:

The severity of injury is directly associated with the blast loading to which the body was exposed and its duration.

The cause of death from an explosion is usually obvious but in certain circumstances it may remain obscure. [2] Blast injuries of large tyres are similar to those resulting from grenade explosions, except there is no thermal or chemical damage. [3]

The injuries can be caused by the pressure wave of the blast, directly by the tyre rim or its fragments, or by the victim's body being thrown away off the ground. [4]

The deceased was inflating the tyre which was lying flat on the ground after being repaired. When the tyre exploded he was thrown several feet away off the ground. The blast wave led to fatal internal damage to the chest and abdomen. A pressure of about 100psi is the minimum threshold for producing serious damage to human beings. [7]

For numerous heavy vehicles, trucks and semitrailers, the maximum recommended pressure for the most common tyres is generally 100psi (689.5 kpa). [5] In the present case, the deteriorated side wall of the tyre resulted in an explosion. (Fig. 3)

A deteriorated sidewall limits its ability to hold pressure. These types of explosions leave a zipper pattern in the tyre sidewall.

"Zipper rupture" occurs in tyre sidewalls when the ply cords start to deteriorate. Possible causes of zipper failure include deterioration of the envelope exposing the ply's or the belts of the tyre to contamination by air and humidity, mechanical impact that damages the tyre's structure, driving with over or under pressurized

or tyres, overloading, loss of mechanical properties due to heat, pyrolysis or thermo-oxidation, significant carcass wear and design defect in the weave of the tyre cord. [5]

Hefny et al [6] in a study comprising of 763 cases of tyre blast injuries reported that most of the explosions usually occurred during tyre servicing especially during inflation.

Injury is caused by the pressure impact of the explosion or by a direct hit from the rim. The overall mortality was high (19%) and is mainly caused by head injuries.

Three types of injuries can be expected in such cases of tyre blast - primary, secondary and tertiary injuries. The primary injury results from the initial pressure wave (shock wave).

This shock wave caused barotrauma in our case resulting in pulmonary and abdominal damage. Secondary injuries are caused by flying object fragments propelled by the blast such as the rim and ring. Tertiary injuries are caused by falling, striking of the body to ground and other nearby objects. [7]

Rib fractures in the present case were possibly due to impact of the victim with the ground when he was thrown off several feet away due to the tyre blast.

Conclusion:

Inflated large tyres contain a tremendous amount of potential energy. Tyre blast injuries during servicing have a high morbidity and mortality. Paramedical and medical staff should be aware of fatal internal damages caused by such blasts and immediate intervention is hence initiated.

Occupational safety devices like a protection cage with an automatic inflating gadget will help to minimize the risk of injury from tyre inflation. A safety distance of 2.5 metres from the inflating tyre is recommended.

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Fig. 1: Fractures of Right 4th to 8th ribs and Left 5th to 7th ribs at Different Site



Fig. 2: Multiple Contusions and Lacerations over Lung



Fig. 3: Deteriorated Side Wall of the Tyre resulted in an Explosion



Case Report

Incidentally Discovered Uterine Leiomyoma with Ossification on Autopsy

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Abstract

Ossification of leiomyoma is a rare phenomenon occurring in long-standing tumors. In the case reported herein, a 69-year-old postmenopausal female died due to burn injury. In the course of the medico-legal autopsy, a stony hard uterus with yellowish streaks was found. Histologically there was extensively calcified myometrium with areas of ossification, with smooth muscle fibers being arranged in whorled fascicles in the background. A diagnosis of leiomyoma uterii with extensive calcification and ossification was reached. To our knowledge this is the second reported case of post-mortem diagnosis of an ossified leiomyoma. This case underlines the importance of the autopsy not only as a means to find the cause of an individual's death, but also as a tool for furtherance of knowledge to medical fraternity.

Key Words: Ossification, Leiomyoma, Autopsy, Burn injury, Post-menopausal Female

Introduction:

Autopsy, derived from the Greek *autopsia*, literally means "self-study of the dead". It provides a wealth of information to human pathology. A number of incidental pathology that was unknown during the life of the deceased can be revealed during autopsy.

We report an incidentally discovered autopsy finding in an unfortunate 69 year 3rd degree burn victim - a stony hard uterus with extensive calcification and ossification in leiomyoma proved by histopathological examination. This is a rare complication of uterine leiomyoma which did not get revealed during her life due to lack of medical attention.

A brief review of the previously reported cases of the above condition is also discussed.

Case History:

A 69 year old lady was brought to the hospital with 3rd degree burns and unfortunately succumbed to death during initial management.

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A medico-legal autopsy was sought. No significant past medical or surgical history could be obtained from the next of kin of the deceased apart from occasional pain in lower abdomen for which medical advice was never sought. The victim was multiparous with four living children and no history of abortion.

Autopsy Findings:

Autopsy revealed burn changes in various organs and multi-organ failure due to burn was made out as the cause of death. The uterus was found to be stony hard and was sent to the Department of Pathology for a histopathological examination.

On gross examination the uterus weighed 180g and measured 9.5 x 6.5 x 3.0 cm, with stony hard consistency. The tissue was cut with a bone knife and cut surface showed distorted endometrial cavity with diffusely hard myometrium having yellowish streaks, like bony spicules scattered throughout.

Areas of whorling were also seen in between. Serial slices taken had identical appearance. (Fig. 1) The cervix and bilateral adnexa were grossly unremarkable.

Sections were taken from different areas and subjected to decalcification. Routine histologic sections from paraffin-embedded tissue were stained with haematoxylin-eosin (H & E) stain.

The H & E stained sections showed extensively calcified myometrium with areas of ossification, smooth muscle fibers being arranged in whorled fascicles in the background. (Fig. 2 and 3) Atypia, increased mitotic activity or coagulative tumor cell necrosis were absent.

A diagnosis of Leiomyoma uterii with extensive calcification with ossification was thus reached. The endometrium showed atrophic changes while the cervix and the bilateral adnexa were histologically within normal limits.

Discussion:

Leiomyoma, a benign smooth muscle neoplasm of the uterus is the most common tumor known to occur in the female. They are seen in hysterectomy specimens regardless of the causes in as many as 77% cases [1] although producing clinical symptoms in only up to 25% cases. [2]

As leiomyomas enlarge, they may outgrow their blood supply, which results in various types of degeneration, like hyaline fibrosis, edema and marked hydropic changes, infarct type necrosis, hemorrhage, cystic change and micro calcification. [3]

Rarely leiomyomas may have presence of heterologous elements in the form of adipose tissue, skeletal muscle, osseous or cartilaginous differentiation. Pathologic calcification is the abnormal tissue deposition of calcium salts, together with smaller amounts of iron, magnesium, and other mineral salts.

When the deposition occurs locally in dying tissues it is known as *dystrophic calcification*; it occurs despite normal serum levels of calcium and in the absence of derangements in calcium metabolism. In the course of time, heterotopic bone may be formed in the focus of calcification. [4]

Secondary change of ossification is generally present in the long-standing leiomyomas with other degenerative changes like hyalinization and calcification, as seen in the present case. An interesting hypothesis about the pathogenesis of leiomyomas with heterologous elements has recently been put forward.

This argues in support of myometrial stem-like or progenitor cells that retain the capability to differentiate not only into myocytes but also into adipocytes and osteocytes, thus giving rise to lipo-leiomyoma and leiomyoma with ossification. [5]

Ossification in leiomyoma is, indeed, a rare event. In a study of retrospectively diagnosed uterine leiomyomas by H Mohan et al, [6] out of 900 cases the most common degenerative change seen was hyaline degeneration (70%) and only 5 cases (0.55%) showed changes of ossification. In a study from West Indies [7]

Common degenerative changes enlisted in uterine leiomyoma were hyaline change (63%), myxomatous change (13%), calcification

(8%), cystic change (4%), fatty change (3%), and sarcomatous change (0.7%), none of the cases having changes of ossification.

Surangi et al [8] recently reported a similar case of an incidental large leiomyoma found at autopsy, showing extensive calcification and ossification, occurring in a postmenopausal female dying of Organophosphorus poisoning. This case, to the best of the knowledge of the authors, represents only the second published case of ossified leiomyoma, found incidentally at autopsy.

The above two cases of postmenopausal females also highlight the lack of medical attention commonly associated with the women of Indian subcontinent.

Conclusion:

To conclude, we report a rare case of an extensively ossified leiomyoma of the uterus found incidentally during a medico-legal autopsy in a woman in her seventh decade dying due to an unrelated cause.

Prof. Bernard Knight commented that an autopsy often "reveals the diseases and lesions that the person lived with and not necessarily those which killed him". [9]

This lady's finding corresponds to one of these entities. This case underlines the importance of the autopsy not only as a means to find the cause of an individual's death, but also as a tool for furtherance of knowledge to medical fraternity.

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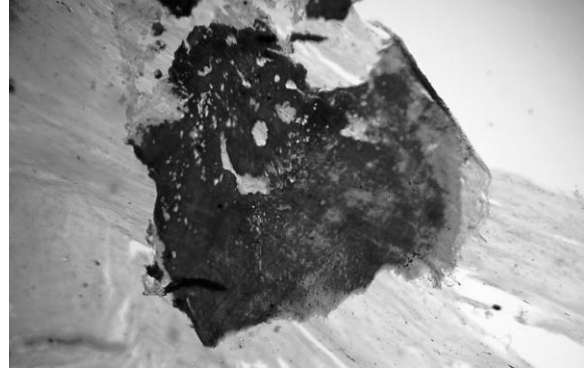
Fig. 1: Gross Cross Section of the Stony Hard Uterus with Yellowish Streaks



Fig. 2: Membranous Ossification with Smooth Muscle Fibers in the Background (H & E, x100)



Fig. 3: Areas of Irregular Calcification with Smooth Muscle Fibers in the Background (H & E, x100)



Case Report

Miliary Tubercles in Abdomen: An Autopsy Case Report

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Abstract

Tuberculosis is one of the major causes of morbidity & mortality in many developing countries. In certain instances, deaths due to tuberculosis are sudden, unexpected and appears to be unnatural. We present a case report of tuberculosis related sudden death of a middle aged apparently healthy man without any significant medical history. The body was brought for medico-legal autopsy, though the police did not find any evidence of unlawful activity. After autopsy, the cause of death was confirmed to be miliary tuberculosis of abdomen with extensive involvement of liver, spleen and kidney. Miliary tubercles were flooded all over the intestine. These types of undiagnosed cases of advanced tuberculosis, where tuberculosis as a cause of sudden death is practically unexpected because of healthy looking body built, always pose serious threat of infection to the mortuary staff. Not only that, the advanced tuberculosis in many cases is being associated with HIV. Henceforth, it is imperative for the every forensic pathologist to be well versed with this dreaded entity.

Key Words: Autopsy; Military Tubercles; Sudden Death; Tuberculosis

Introduction:

Tuberculosis has an ancient history in the world communities, ranging from being identified by Aristotle (384-322 B.C) as a contagious disease to the full blown tuberculosis caused by *Mycobacterium tuberculosis* as studied by Robert Koch in 1882. [1, 2]

Since then, there have been several upheavals in the disease endemicity. Several control and eradication programmes have been running at the world scenario, medicines are being distributed free of costs and even the surveillance work is also on the war foot level, but still virulent form of tuberculosis is seen in one or the other society.

Not only in developing countries but also in developed Nations, Tuberculosis has gained a new significance due to increasing incidents following the HIV threat, immunosuppressive therapies and mass immigration etc. Emergence of Multi Drug Resistance of the bacillus has added up more to this significance. [3]

Globally, it accounts for more than one third amongst all the deaths due to infectious diseases. [4] In spite of various control programmes launched by different agencies like WHO, UNICEF etc in different countries, the endemicity of tuberculosis is yet to be wiped out.

Irrespective of the modern diagnostic tools like PCR & antibody assays etc., its detection sometimes is still escaped resulting in number of cases seen only at autopsy, which uncovers the prevalence of existing endemicity at the world level. [5]

Case History:

A 42 year old married Filipino male was working as an instructor in a motor mechanic school in Malaysia. He was staying alone in a rented house and was attended by a house-maid during day time. One day morning, the house-maid found him motionless on his bed. The ambulance was called and the ambulance crew confirmed him dead.

There was no proper medical and personal history available about the deceased as no family members were in Malaysia at the time of death and autopsy, but some nonspecific medicines were found in his room. He was a heavy smoker and a social drinker.

His body measured 78kg in weight and 186cm in height indicating his well nourishment.

Autopsy Findings:

Post-mortem lividity was present over back & fixed. Rigor mortis was present all over the body. No external injuries were detected on the body.

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On internal examination, the left lung had some cavitations with adhesions to pleural cavity and the right lung had whitish tubercles on the surface as well as on cut sections.

He had similar whitish tubercles widely spread all over the abdominal viscera including liver, spleen, bowels, omentum, mesentery and peritoneal surfaces. (Fig 1, 2) There was enlargement of mesenteric lymph nodes. The left kidney had cortical thinning with caseated material in renal calyces. (Fig 3) The right kidney was hypertrophic. (Fig. 4)

Histopathological examination of Lungs revealed tuberculous granuloma with caseation, fibrosis and new vascularization around the granuloma. The same examination of liver, spleen, kidney, gut and para-aortic nodes showed florid caseating granulomas composed of epithelioid cells, histiocytes, giant cells (Langerhans type) and chronic cellular infiltrate. (Fig. 5-8)

Based on macroscopic and microscopic findings, opinion as to the cause of death was given as Miliary Tuberculosis with multi-organ involvement.

Discussion:

Tuberculosis is transmitted to human being mainly through the droplets infection containing *Mycobacterium tuberculosis*. It has low infectivity in contrast to the popular belief of getting significant illness even by brief exposure. Only 5% of the newly exposed people develop the overt disease. [6] It multiplies in macrophages and later results in bursting of them infecting more and more macrophages until cell mediated immune response is mounted in 2-10 weeks following exposure. [6]

Type IV hypersensitivity associated with this immune response results in characteristic tissue damage and microscopic lesions seen in the disease. It runs more or less predictable course giving rise to primary and secondary tuberculosis and can lead to miliary tuberculosis in either case. [6] Miliary tuberculosis is developed when the bacteria invades different organs through vascular channel (perivascular tuberculoma) or through lymphatics.

Miliary tuberculosis constitutes about 2% of all reported cases of tuberculosis and up to 20% of all extra-pulmonary tuberculosis. The disease manifestations also vary due to various factors ranging from genetics constituent of the host, age, nutritional status, concurrent diseases and medications. [6]

Lot of factors such as poor immunity status, poor nutrition, alcoholism etc. can result in more florid infection. [7] Though, the disease is primarily a disease of respiratory system it

affects all the systems even in patients with intact immune system. There is also a controversy how to name this disseminated form. (8) But it is reasonable to admit that miliary tuberculosis is a subgroup within the disseminated form where the Millet seeds like tubercles are formed in the organs. Some authorities have pointed out that this form indicates good immune response. [8]

But some literature has contradicted this opinion. [9] In the present case also, there were plenty of millet seeds like tubercles seen in the different organs like liver, spleen, bowels, omentum, mesentery and peritoneal surfaces, justifying the presence of florid form of the disease.

In spite of the battery of diagnostic tools like sputum culture, Mantoux Test, radiography, DNA technology etc., available, none of these methods is 100% conclusive. [5] Developed societies tend to overlook the disease due to lack of suspicion with false sense of security without realizing the renewed threat of tuberculosis. [10] Obviously less affluent societies cannot afford for latest advancements in diagnostic technology.

Secondly, the treatment of tuberculosis is also not easy, once it is diagnosed. Prolonged regimes of multiple drugs are required depending on the extent of disease, good commitment from the patients as well as the availability of health care workers.

Another challenge faced in treatment of tuberculosis is the emergence of Multi Drug Resistance of the bacillus. [3]

Immunization against tuberculosis with *BCG vaccine* is also not that effective in preventing the disease in adult population. [11]

Hence, undiagnosed tuberculosis is extremely hazardous as it increases the chance of further spread of the disease in the exposed unprotected society. At the same time, it is also hazardous for the mortuary staff to deal with undiagnosed tuberculosis cases [10, 12] as has been the case under the study.

The present case highlights its occurrence in immigrant workers without any knowledge of past medical history and immunization status and can progress relative silently up to a very advance stage of miliary tuberculosis. In the present case, it is very unrealistic to suspect such florid form of miliary tuberculosis as cause of death because there was no specific medical history and the deceased was not under any treatment.

The deceased was quiet healthy looking & well-nourished when compared to regular TB patients who are usually thin built & cachectic.

In many instances, tuberculosis is associated with HIV, hepatitis. In the autopsy of such cases, where the infectious diseases are least expected, universal work precaution methods are rarely followed.

Such undiagnosed tuberculosis cases are hazardous for the mortuary staff, because tuberculosis invasion may occur through mucous membranes or damaged skin causing prosector wart (skin inoculation of TB). Urine is also infectious in cases of renal tuberculosis. Aerosol transmission has been reported among abattoir workers.

Conclusion:

These types of cases are a threat to the society in general and to mortuary staff in particular. So, we should follow universal work precautions during autopsy to avoid any kind of unfortunate accidental transmission of disease. Autopsy still remains the ultimate tool of diagnosis, which makes the clinician to rejuvenate their skill and knowledge so that the disease may be diagnosed before death and treated properly.

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Fig.1: Abdomen Showing Military Tubercles

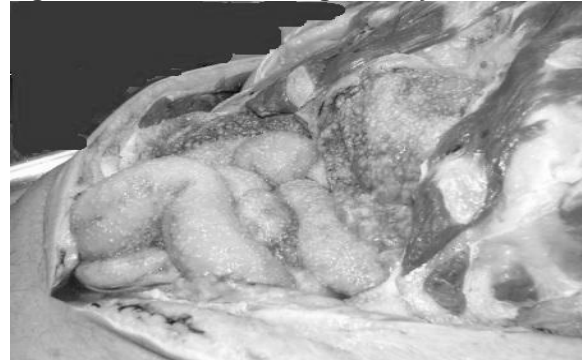


Fig 2: Intestine Showing Military Tubercles

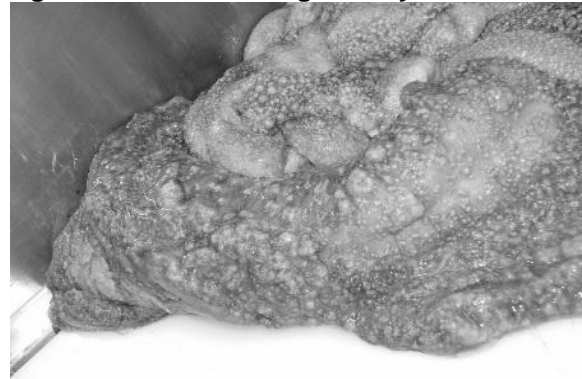


Fig. 3: Left Kidney after Dissection Showing Caseation and Cavitation

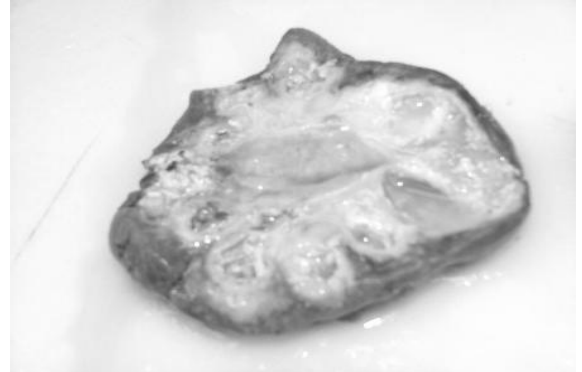


Fig. 4: Right Kidney Showing Hypertrophy



Fig. 5: Lungs Showing Tuberculous Granuloma with Caseation and Langerhans Giant Cell

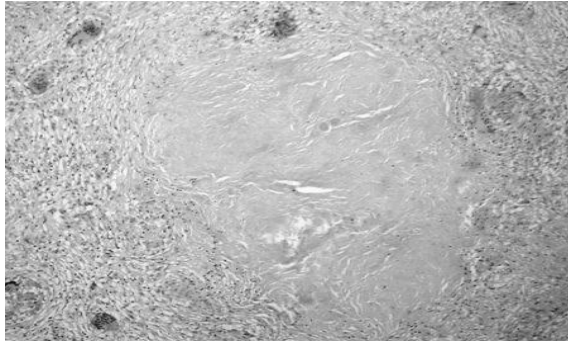


Fig. 6: Lung Showing Fibrosis and New Vascularization around the Granuloma

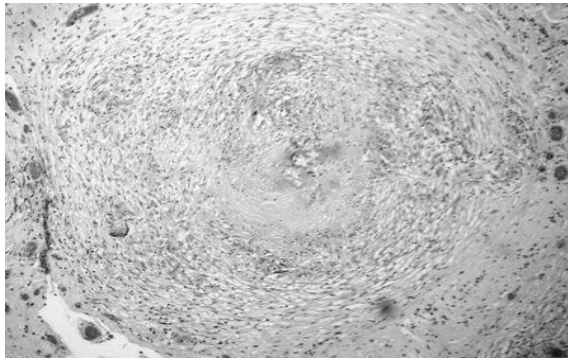


Fig. 7: Liver Showing Tuberculous Granuloma with Langerhans Giant Cell

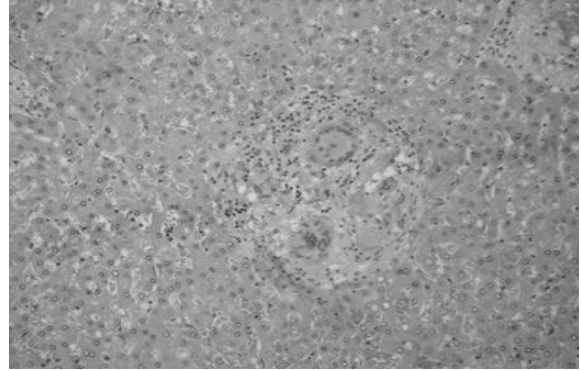
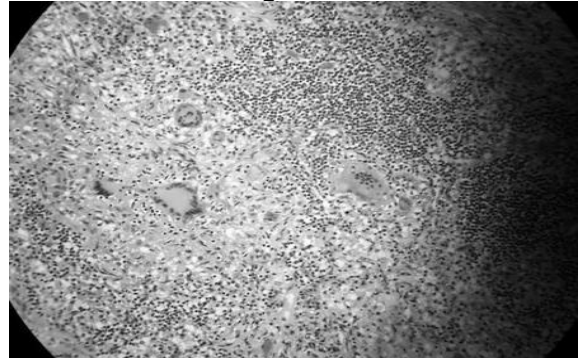


Fig. 9: Spleen Showing Tuberculous Granuloma with Langerhans Giant Cell



Case Report

Uterine Rupture Due to Arrest of After Coming Head: An Autopsy Case Report

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Abstract

Maternal death is an important health as well as social problem. The Government of India has launched schemes to reduce the maternal mortality by increasing awareness in people and many other measures. Obstructed labour is one of the major causes for maternal mortality in our country. It is a condition when presenting part of foetus cannot progress into birth canal in spite of strong uterine contractions. The most common cause of obstructed labour is cephalo-pelvic disproportion.

Here we present a case of 30 year old female brought dead to Dr Shankarrao Chavan Government Medical College, Nanded with history of obstructed labour and arrest of after coming head in breech presentation. On autopsy, external examination showed trunk & limbs of foetus suspended outside the external genitals and head inside the pelvis. On internal examination, uterus was found ruptured and severe pallor of internal organs was evident. The reason for obstruction to the delivery of head was found to be hydrocephalous with congenital malformation of brain.

Key Words: Obstructed labour, Breech presentation, Hydrocephalous, Uterine rupture

Introduction:

In India, despite being vast development and different schemes launched by central and state governments, maternal death continues to be a major problem. Uterine rupture due to obstructed labour is one of the important causes responsible for maternal deaths, more likely in grand multiparas.

Obstructed labour is a disorder of foeto-pelvic relationship characterized by failure to progress despite strong uterine contractions. [1]

Uterine rupture due to obstructed labor is one of the common though preventable causes of maternal and perinatal morbidity and mortality. Spontaneous rupture of an intact uterus may be due to injudicious use of oxytocin, PGs, cephalo-pelvic disproportion (CPD), malpresentation, multiparty, difficult instrument delivery and obstetrical manipulations. [2]

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The management of such obstructed labour where the foetus is already dead and considering rupture uterus as likely complication requires critical decision of destructive procedures to save the life of mother. Here we present a case of uterine rupture due to arrest of after coming head in full term pregnancy where early diagnosis of obstructed labour could have saved the life of mother. We are also discussing preventive aspects of maternal deaths.

Case History:

A 35 year old female, third gravida, was admitted to a rural Hospital in active labour with foot presentation at 07:00 p.m. She did not have antenatal registration or any medical checkup during her pregnancy.

Her previous two deliveries were full term normal vaginal, home deliveries. The staff nurse of rural Hospital attended delivery, but it could not be accomplished due to arrest of the after coming head.

She called on duty doctor who also attempted to deliver the after coming head, but couldn't succeed and hence referred the case to Women's Hospital at District place where she reached at around 10 pm. Due to unusual presentation, the attending Doctor advised ultrasonography which revealed disproportionate large size of foetal head due to hydrocephalus.

The reattempt was made to deliver the head without any instrumentation or any other operative procedure.

As per the narrations of relatives the women was conscious and having good labour pains until 10.30 pm. After that she complained of sharp severe pain in abdomen and landed in shock. The female was then referred to Dr Shankarrao Chavan Government Medical College, Nanded. She became unconscious during transportation and was declared dead on arrival at casualty, Dr SCGMC Nanded same night at around 2.30 a.m. The medico-legal autopsy was carried out on the deceased.

Autopsy Findings:

The deceased was moderately built and was severely pale. The dried blood stains were observed on genital region and lower limbs. The rigor mortis was well marked in the whole body.

The post-mortem lividity was barely observed over the dependent part of body.

External Examination:

The full term female foetus was partly suspended outside the vulva with the head inside the pelvis with stretched and twisted neck.

The genital examination showed lacerated wound at left side of labia of size 3cm x 2cm x muscle deep at lateral wall of vagina at 11 O'clock position of size 3cm x 1cm x muscle deep and at 2 O'clock position of size 3cm x 2cm x muscle deep. The vaginal wall was grossly contused and swollen.

Internal Examination:

Peritoneal cavity showed about 3 litres of fluid blood. The placenta was found in the abdominal cavity below left dome of diaphragm along with umbilical cord. The uterus showed full thickness rupture of the lower segment at left lateral wall of size 10 cm x 4 cm, and the head of foetus was seen through gaping.

During autopsy, the head of foetus was severed at the level of neck and dissected out.

The circumference of head was 45 cm and on dissection, the cranial cavity found to be completely filled with clear, amber colored fluid with rudimentary cortical streak of size 3cm x 1cm x 1cm located at the base of skull.

The cerebellum, brainstem and the spinal cord were well developed and no malformation of other organs was seen.

The cause of death was opined as **"Hemorrhagic shock due to ruptured uterus due to arrest of after coming head."**

Discussion:

In 1987, WHO launched safe motherhood initiative and it was aimed to reduce maternal morbidity and mortality to 50% by year 2000. The initiative did not succeed but maternal health continues the major focus of WHO effort.

The current initiative is to decrease maternal mortality to 75% of 1990 level by 2015.

[3] To make it successful, the developing countries should take appropriate steps at grass root level to increase awareness regarding safe motherhood. In the present case, the female died due to ruptured uterus secondary to obstruction to after coming head. Obstructed labour ranked 41st in Global Burden Diseases 1990, representing 0.5% of the burden of all conditions and 22% of all maternal conditions.

It was estimated to be the most disabling of all maternal conditions. [4] One of the common complications of obstructed labour is rupture of uterus, which is most frequently observed in multigravida.

The cephalo-pelvic disproportion (53.7%) was a major cause for rupture uterus followed by malpresentation and malposition (25.9%). [5] The study of Ehigiegba AE et al observed ruptured uterus due to prolonged obstructed labour (38.6%) as second most common cause. [6] The study conducted by Shau Latika [7] observed incidence of rupture uterus secondary to obstructed labour due to malpresentation in 7.9% cases.

Uterine rupture with severe hemorrhage and shock require early recognition, immediate operative treatment, even sub-total or total Hysterectomy to avoid fatal outcome.

To overcome obstructed labour, the alternatives of caesarean section and destructive operations are often debated. There is a natural tendency to avoid caesarean section if the fetus is already dead but the perforation of uterus and embryotomy carry a grave risk of shock, hemorrhage and trauma. [8, 9]

The study of Gupta U10 et al and Singhal SR et al emphasized the role of destructive operations in some properly selected cases presenting late with obstructed labour, IUFD and intrauterine sepsis. [10, 11]

The study of Adhikari S. et al [12] mentioned about destructive operations performed for obstructed labour like craniotomy (74.44%), Evisceration (23.33%) and Decapitation (2.22%). He also mentioned that craniotomy was performed in 3 cases of obstructed after coming head.

In the present case, a full term multigravida female was presented with breech presentation and on ultrasonography foetal hydrocephalus was diagnosed at District hospital. Considering the health status of foetus and mother, rather than considering immediate destructive operations, the patient was referred to nearest Medical College.

Early and timely intervention could have prevented the life of female.

In the present case, the female had previous two home deliveries and even during third pregnancy, she did not avail facility of antenatal registration and checkup. The foetal hydrocephalus was diagnosed during latent phase of second stage of labour. In such cases early antenatal diagnosis can prevent continuation of unsafe pregnancy.

The pre-natal supervision, proper selection of cases for vaginal delivery, early hospital admission and close supervision in labour and timely intervention can prevent maternal morbidity and/or mortality.

Ultrasonography (USG) is very helpful in diagnosing such anomalies which will guide to early decision making for termination in such cases.

Conclusion:

Early antenatal checkups have important implication in identifying high risk cases. The Ultrasonography is important tool for detection of congenital malformation in early pregnancy and avoiding continuation of unnecessary pregnancies.

The cases of rupture uterus are preventable with early detection, timely referral, intra-partum care and surgical intervention. The high risk cases should have mandatory Ultrasonography for detection of congenital anomaly. Ignorance in the family about care of pregnant women, lack of antenatal checkup, lack of availability of USG facility, mishandling the case or improper /incomplete treatment were the reasons for mortality of pregnant woman in the present case.

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Photo 1: Foetus partly suspended outside vulva with injuries to external genitals



Photo 2: Uterine Rupture



Photo 3: Rudimentary cortical streak at the base of skull of foetus



Case Report

Suicidal Stab Wounds over Neck by Broken Glass Bottle of Country Made Liquor: A Case Report

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Abstract

Stab wounds are usually produced when the force is carried along the long axis of narrow or pointed objects. Narrow or pointed objects like knife, sword, dagger, screw driver, arrow, spear etc. commonly cause stab wounds. Stab wound can also occur by broken objects like glass or wooden material. Stab wounds generally occur by assault, sometimes it may also occur by self-infliction. However, self-inflicted stab wounds are rare. Similarly, self-inflicted fatal stab by broken glass bottle is rare and uncommon. In present case, a 30 years old male was brought with history of stab over neck by broken glass bottle causing fatality. In this case, presence or absence of particular features (e.g., hesitation marks, defence wounds) allows distinction between suicide and homicide. The present case is described for its rarity and pattern of causation by broken glass bottle, which is rarely mentioned in literature to the best of our knowledge.

Key Words: Stab wound, Suicide, Autopsy, Assault, Self-inflicted

Introduction:

According to World Health organisation, Suicide is the act of deliberately killing oneself. As per the data provided by the national crime records bureau, the so called "Soft method of committing suicide" such as hanging (39.8%) and poisoning (27.9%) are the most commonly adopted means of committing suicide in India.

Suicide by "Hard methods" like self-infliction of injuries is rare, constitutes only 0.4% of total cases of suicide. [1] Stab wounds are usually homicidal and very rarely suicidal. The most commonly used weapon to produce a stab wound is knife. [2] Fatal stab wounds with broken glass bottles are usually homicidal, occasionally suicidal, and, rarely, accidental. [2]

The distinction between homicidal, suicidal and accidental wounding is a central issue in forensic medicine. In the early stages of death investigation, the opinion of a forensic expert may be crucial in initiating or aborting a homicide investigation. Thus, the present case is described here for its rarity and pattern of causation by broken glass bottle.

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Case History:

A 30 years old male was brought with history of suicidal stabbing by broken glass bottle in the wee hours of midnight. During evening hours on the day of incidence, he had alleged quarrel with his friend over issue of lending money which the accused was not returning to him. The victim went to his sister's house with an intact sealed bottle of country made liquor. His sister gave him water to drink.

As he was narrating the happened incidence to his sister, suddenly in fit of rage he broke the glass bottle (Fig. 5) on the table and started to inflict stab wound over his own neck. After infliction of the stab wound the victim fell on the floor lying in a pool of blood.

His sister informed the incident to her neighbours who brought the victim to our hospital where he was declared brought in dead condition by the treating physician.

Autopsy Findings:

He was subjected to post-mortem examination at our medico-legal centre. On examination the deceased was averagely built, wearing shirt, jeans pant and underwear. Shirt was soaked with blood. Rigor mortis was well developed in the whole body.

Post-mortem lividity was seen over back and buttocks and was fixed. Dried blood stains were present over face, chest, both forearms, both hands and both feet.

There were four stab wounds over neck of which one stab wound was seen over right lateral aspect of neck, of size 4cm x 0.5 cm

extending up-to cervical spine, directing obliquely downwards and medially, transecting underlying muscle, external jugular vein, and carotid artery with a cut over third cervical vertebra. Margins of the stab wound were clean cut but irregular with angles acute, having multiple side cuts. (Fig. 1)

Three stab wounds present over front of neck of sizes 2.5 cm x 0.5 cm, 1.5cm x 0.5cm, 0.5cm x 0.5 cm, all muscle deep with margins clean cut and having multiple side cuts.

Subcutaneous tissue deep linear cuts were seen over palmar aspect of right index finger of length 0.6 cm and 0.3 cm respectively.

Linear cuts were also seen over palmar aspect of right middle finger, ring finger of length 0.8cm and 0.4 cm respectively. No glass or any foreign particles were found within the stab wounds. (Fig. 3& 3A)

On internal examination visceral organs were intact without any gross trauma or pathology. All internal visceral organs showed gross pallor. Trachea was intact and free from any blood collection.

Stomach contained 500 ml of semi-digested food materials with no peculiar odour, mucosa was pale. (Fig. 2) Toxicological analysis did not reveal any poison or drugs.

On examination we concluded that the victim might have died due to **haemorrhagic shock secondary to stab injuries over neck.**

Discussion:

Suicidal stab injuries over neck are rare. D.A. Rouse in his six years study of patterns of stab wounds observed that out of total 159 cases, only eight cases were due to self-inflicted stab wounds and chest was the commonest site for self-infliction of stab wounds. [3]

Stab wounds inflicted with a broken glass bottle tend to occur as clusters of wounds of different sizes, shapes, and depths. The stab wounds are sharp edged but ragged and there are differences in the depth of penetration for the individual wounds. [2]

This description is consistent with injuries found in this case where margins of the stab wounds were sharp but ragged and showing side cuts.

Self-inflicted stab wounds do show specific patterns. Most suicidal stab wounds are multiple in numbers, clustered together, with many wounds showing minimal penetration or just barely breaking the skin.

The latter are "hesitation" stab wounds. These wounds indicate the divided state of the mind of the victim, as it is normal human instinct

to preserve life. Suicidal stab wounds vary in size and depth with usually only one or two "final" stab wounds causing fatality. [2]

Presence of tentative wounds is strong presumptive evidence of suicide. [4] In our case, the three muscle deep stab wounds can be considered as hesitation stab wounds which are associated with the single fatal stab wound cutting sternocleidomastoid muscle, right external jugular vein and right carotid artery, producing cut over third cervical vertebra.

P. Vanezis and I. E. West in their study of tentative injuries in self-stabbing in 29 cases, observed only two cases of self-inflicted stab injury over neck. Out of these two cases, only one was having tentative wounds. [5]

Presence of unintentional cuts in the hand which has been used for gripping glass is important feature of self-inflicted wounds. [6]

In present case, linear cuts present over palmar aspect of right index, middle and ring fingers are unintentional cuts.

One more feature of self-inflicted wounds is the absence of defence wounds. In this case, no defence wounds were observed.

However, the "unintentional cuts" must be carefully differentiated from defence wounds. In cases of self-inflicted suicidal stab wounds the site of injury is usually on easily accessible areas like front of chest, abdomen, forearms, neck etc. The present case showed similar pattern of injuries in easily accessible region of neck without any significant external trauma to other areas.

Conclusion:

Suicide by self-stabbing is not a common phenomenon. Very few literatures are available on this. Successful suicide by self-stabbing on unusual sites is extremely rare.

The case presented here is unique as the deceased had chosen an unusual site along with unusual weapon to harm him.

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Case Report

Homicide by Three Different Firearms or Single Improvised Weapon: The Forensic Pathologist's Dilemma

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Abstract

The recovery of different constituents of ammunitions in a dead body is of vital importance for investigation of firearm fatalities. The projectile that enters the body depends on the type of firearm used. The wound of entry and the wound of exit and the track are useful guides for reconstructing the incident of firearm injury. Most often, at autopsy, these projectiles are recovered from the body and preserved as materials of evidential values. This is further complicated when changes due to decomposition obscure and modify the appearances of the wounds of the entry and exists. In our country, especially with advent of readily available improvised firearms, the classical assembly of arms and weapons are not found. Handmade or improvised firearms produce injuries that are often unique and special. Here, we report a rare case of finding one revolver bullet, one country-made rifled bullet, and one shotgun felt wad along with multiple metallic pellets, all in a single decomposed body.

Key Words: Homicide, Firearms, Different types of Entry Wound, Forensic-Wound Ballistics

Introduction:

Guns and gunpowder have made bloodshed common in all the crimes reported from all countries. Whether it is war, terror, insurgency or crime; firearms have changed the very dimension of the game. There has been much activism for a world without nuclear weapons, free from weapons of mass destruction. But on the other hand small arms have killed more people than any other weapon in the world. Thus if we review then we shall find that small arms are the real weapons of mass destruction.

Even though, India is regarded as a nation having one of the toughest gun control legislations in the world (Indian Arms Act 1959 has very stringent rules for granting gun licenses). [1] The total estimated civilian owned firearms in the whole world is about 650 million out of which India accounts for approximately 40 million. What comes as a shocker and is

mindboggling to know, out of these just 6.3 million or 15.75% are "licensed" firearms, the rest are "unlicensed, illegal guns". [2, 3] These may be country made guns called "Desi-Kattas" or factory-made guns smuggled across the international border.

The recovery of different constituents of ammunitions in a dead body is of vital importance for investigation of firearm fatalities. The projectile that enters the body depends on the type of firearm used. Ordinarily, rifled weapons fire bullets while pellets are found in the cartridge of smooth bore firearms.

The wound of entry and the wound of exit and the track are useful guides for reconstructing the incident of firearm injury. Most often, at autopsy, these projectiles are recovered from the body and preserved as materials of evidential values. In case offending weapon is recovered, the autopsy finding of the wound, the recovered material and the alleged firearm are corroborated and used in the trial of the case. In our country, especially with advent of readily available improvised firearms, the classical assembly of arms and weapons are not found. Handmade or improvised firearms produce injuries that are often unique and special.

These autopsy findings are the results of characteristic built of the improvised firearms. Firearm examiners have opined that the characteristic features of country-made firearms are so unique that the fired crime bullet or cartridge can easily be matched with the test ones.

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Therefore, the pathologist encounters cases where different types of projectiles, i.e. bullets, pellets, wads are recovered leading to two pertinent questions:

- Whether different types of firearms were used or
- The same weapon was used several times with improvised country-made ammunitions.

This is further complicated when changes due to decomposition obscure and modify the appearances of the wounds of the entry and exists. Very few cases have been reported regarding the findings of improvised firearms.

Case Report:

We hereby report a case where three different types of projectiles were recovered at autopsy of a homicide by firearms. One twenty three years male subject was found missing from a village. His body was recovered after 3 days on the bank of river Ganges. The body was referred to the Dept. of Forensic State Medicine BMC, Burdwan for autopsy.

Autopsy Findings:

On autopsy, a decomposed body with peeling of epidermis at places was noted. The following wounds were detected:

1. Circular wound of entry (1.5 inch in diameter) on the supra-sternal area 3.5 inch below symphysis menti and 0.5 inch to the left of midline along with one exit wound (2.2 inch X 1.2 inch) along with destruction of lower part of left external ear. (Fig. 2)
2. Asymmetric abrasion collar partly obscured by decomposition seen as peeling of epidermis. (Fig. 3)
3. Wound along with one wound of entry (0.4inch X 0.2inch) over right chin 1.5inch lateral to midline and 1.0 inch below the lower border of mandible. (Fig. 4)
4. One circular wound of entry 0.3inch in diameter on the back of left lumbar area, 2.0 inch lateral to midline and 1.6 inch vertically above left iliac crest. (Fig. 5)
5. One oval 0.4inch in diameter wound of entry, 1.0 inch below right inguinal ligament and 3.5 inch lateral to midline. (Fig. 6)

During autopsy we recovered one shotgun felt wad (0.9inch X 0.7inch), One bullet (1.2inch X 0.4 inch in cross-sectional diameter), One bullet (0.6inch X 0.3inch in cross-sectional diameter) and 10 metallic pellets (2mm diameter each). The bullet of greater caliber was recovered from wound 5 and the bullet of smaller caliber was recovered from wound no.4. (Fig. 1)

The cause of death was **due to the effects of firearm injuries, homicidal in**

nature. From the wounds of entries, there is evidence of firing from:

Wound 1- Close range or near contact and Wound 3, 4, 5-Distant range

Discussion and Conclusion:

The importance of the case is that it leads to two questions:

1. Three different wounds were fired by 3 different assailants by 3 different firearms.
2. Whether some improvised firearm was used to fire 3 times using 3 different types of ammunitions.

The Forensic Pathologist can answer neither of the two questions without further ballistic investigations by the police. The recovered materials are most valuable materials for further studies. We conclude that the autopsy findings are to be supplemented by further ballistic investigations. This warrants intensive co-ordination and co-operation between the pathologist, police and firearm examiners.

On average, guns did not protect those who possessed them from being shot in an assault. Although successful defensive gun uses occur each year, the probability of success may be low for civilian gun users in urban areas. Such users should reconsider their possession of guns or, at least, understand that regular possession necessitates careful safety countermeasures.

Firearm (FA) injuries pose great health burden and presents enormous challenge for health and national economies.

A prior study was undertaken to analyze the characteristics of fatal gunshot injuries, their pattern, associated factors, and postmortem findings in central India, to provide data for such fatalities in this region, which has not been reported earlier. This is a descriptive, retrospective cross-sectional study carried out on the victims of FA injuries referred to the mortuary. Out of the autopsies conducted during study, 2.09% were firearm-related deaths. Of the cases, males (92.42%) notably outnumbered females in a ratio of 12.2:1. Homicidal attacks were maximum, and unlicensed, illegal country-made weapons were the preferred choice. Suicides were least. Result signifies that illegal country-made weapons should be strictly limited to save the precious lives. A holistic approach encompassing public awareness, behavioral modification, and stringent management of law and order is the need of the hour. [9,10]

In order to evaluate the estimated range of fire, detailed measurements are needed for the central hole, the area and pattern of pellet holes, the presence or absence of soot, powder tattooing and wad abrasions. [11]

Certain formulae have been published to determine the range at which a shotgun was fired, but no formula is found to be reliable. One old 'rule of thumb' designed to estimate range of fire for distant shots is 1/3rd of the spread of shot in cms = range of fire in meters [12] can be used with reasonable accuracy. Further, specialized improvisations, such as the sawed-off shot gun will cause alterations in range of fire and makes it difficult to calculate the range of fire in cases if the weapon is not available. [13, 14] These types of cases need to be examined more carefully for greater insight into the wound ballistics of improvised firearms when the crime bullet is recovered from a dead body.

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Fig. 1:



Fig. 2: Circular Entry wound (1.5 inches in diameter) on the Supra-Sternal Area with Exit Wound (2.2 inch X 1.2 inch) along with Destruction of Lower Part of Left External Ear

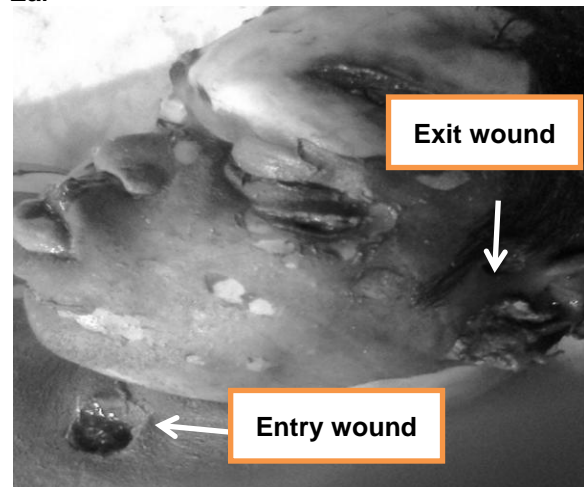


Fig. 3: Asymmetric Abrasion Collar Partly Obscured by Peeling of Epidermis

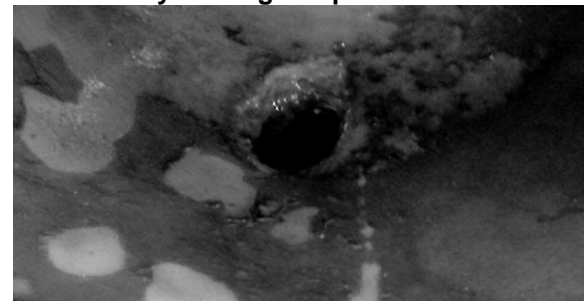


Fig. 4: One Wound Of Entry (0.4inch X 0.2inch) Over Right Chin



Fig. 5: One Circular Wound of Entry (0.3inch In Diameter) on Back Left Lumbar Area



Case Report

Planned Suicidal Hanging Forced To Witness By Spouse: An Unusual Case Report

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Abstract

Suicide by hanging usually takes place in a secluded spot. The act is rarely committed in front of any witness. We report an unusual case, where a 32 year old male committed suicide by hanging from a ceiling fan inside his bedroom in front of his spouse. The victim asked his wife to lock the bedroom door from outside and handed over the key through window. He tied the hands of the wife to the window grill of the bedroom with the help of a ligature and convinced her to watch a stunt performed by him mimicking the act of hanging. During the process, the chair on which the victim was standing broke resulting in death due to hanging. As per the investigating officer the victim was suffering from severe depression due to recent loss of job. After thorough investigation the police concluded the death to be a planned suicide in front of the spouse. The case presented here has not been reported earlier in forensic literature..

Key Words: Planned-hanging; Witness; Suicide; Spouse

Introduction:

Hanging is due to compression of the neck as a result of suspension of the body by means of a ligature in such a way that the weight of the body or a part of the body weight acts as a constricting force. [1] The manner of death in hanging is mostly suicidal, accidental and homicidal hanging is rare. [2, 3] Typically, suicidal hanging is carried out by attaching one end of a ligature to a high point such as a ceiling beam, ceiling fan, window grill etc. The other end is turned into a loop with either a fixed knot or a slip knot which is placed around the neck and the victim stands on a chair or some other platform and then either by jumping off or kicking away the support, the victim is suspended with all or most of his weight upon the ligature. [4] Suicidal hanging usually takes place in solitary places. Suicidal hanging witnessed by a person physically present near the site is rarely reported in literature. This report presents an unusual case of planned suicidal hanging of an adult in front of his spouse who was forced to witness the act by the perpetrator.

Case Report:

A 32 year married male, who had recently lost his job, convinced his wife that he would show her a stunt simulating hanging as seen in a TV show. He went to his bedroom and asked his wife to lock his room from outside. He convinced his wife to give him the keys through the window. He further persuaded her to get both her wrists tied with the window grill of bedroom and watch him from outside. Thereafter, he stood on a plastic chair and tied the ligature (nylon saree) to the ceiling fan and fixed the other end of ligature to the neck. During this process one leg of the plastic chair broke resulting in suspension of the body. On seeing this, the wife started shouting and within a few minutes relatives came to rescue him. They broke open the door, cut the ligature used for hanging and brought down the victim and took him to the hospital where he was declared dead on arrival. During the police investigation, the outer lock of the door was found to be broken and part of the ligature was found hanging from the ceiling fan. (Fig.1) Another ligature was found tied to the window-grill of the room. (Fig.2) A white plastic chair with a broken leg was found lying on the floor. (Fig.3)

Autopsy Findings:

The body was that of a 32 year male, 5' 8" in height and of average built. Face was congested and bluish discoloration was present on lips and nails. A brown, incomplete ligature mark was noted at the front of the neck above thyroid cartilage, directed upwards and backwards

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merging posteriorly with the hairline. (Fig.4) No other external injury was present over the body. Internal examination revealed diffuse congestion of internal organs Toxicological analysis did not detect any drug or alcohol. The cause of death was asphyxia as a result of hanging

Discussion and Conclusion:

Suicidal hanging usually takes place in a secluded place or closed room. If a victim decides to commit suicide by hanging, he/she chooses an isolated place or a closed room to commit the act because presence of a witness may prevent the completion of the process. Suicides that take place in the presence of others have not been the topic of systematic scientific inquiry. The so-called witnessed suicides account for a small percentage of all suicides. [1] Padosch SA et.al in their study in USA, have found the frequency of witnessed suicide in USA to range between 5 and 15%. [4] However, as of now no detailed analysis of this special issue has been given in forensic literature. In their study, out of nine cases, five cases had a medical history of psychiatric disorder with endogenous depression in three cases. Chronic alcohol abuse and drug abuse with concomitant psychosis in one case each. As far as the motive was concerned, domestic arguments were of notable importance.

Friedrich-Scholer E et. al reported a case of suicidal hanging where the act was committed in front of witnesses. [5] A case of suicidal hanging in the presence of public was reported by Indian media where a woman climbed on a lamp-post, made a noose from her Chunni (a kind of scarf worn around the neck by Indian woman) around her neck and jumped off the pole. [6]

In the case presented here, the deceased was in depression due to recent loss of job. The entire act planned by the husband, initially thought of as accidental hanging, was later concluded by the police to be a planned suicide. Investigations brought to light the strained relationship between the couple. The husband blamed his wife for the loss of his job, his financial condition and his stressful mental status. It is possible that he planned the entire scenario to make his wife feel guilty and by the very act of being forced to witness his suicide he wanted to punish her and give her equal psychological trauma. He possibly wanted her to suffer as much as he supposedly had suffered. Forcing her to witness his suicide he must have wanted her to live with the guilt and maybe brand her a culprit in the eyes of friends and family.

A complete medico legal autopsy, a detailed investigation of the scene, statements of the eyewitness and knowledge of the personal history of decedent are essential to make the decision of the manner of death. The forensic experts and investigating agencies must be aware of this unusual circumstance of suicidal hanging.

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Fig.1: Piece of ligature hanging from ceiling fan



Fig.2: Piece of cloth tied to window-grill



Fig.3: Chair with broken leg

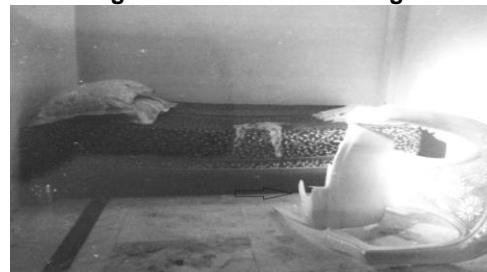


Fig.4: Ligature mark on neck



Case Report

Atypical Exit Gunshot Wound of the Chest, a Push-Up Brassier Effect: A Case Report

¹Weerapong Prayulsatien

Abstract

There are many forensic textbooks and much literature well describing typical and atypical exit wounds. Included are atypical exit wounds, shored exit wounds, and punch out lesions with surrounding abrasion caused by supporting material at the exit area, which may resemble an entry wound. Differentiating entry and atypical gunshot wounds is a major problem in forensic work. Failure to diagnose can cause error in calculating the number of firearm injuries in the body, retained inside the body, or exited through the body causing problems in the direction of firing and direction of the wound tract. The author has reported an atypical shored exit wound at the anterior chest wall from the push-up brassiere effect.

Key Words: Firearms, Wound ballistics, Shored exit wound, Push-up brassiere

Introduction:

Deaths due to firearm injuries are commonly found in Thailand and when a person dies from firearm injuries, the investigation of death falls to the local medico-legal death investigation system which is part of the police system in Thailand. The evaluation of these wounds requires specialized training and expertise, whether by general practice physician or forensic pathologist in crime scene investigation or in autopsy examination. Distinguishing exit wounds from entrance wounds involves critical skills. Failure to diagnose can cause error in calculating the number of firearm injuries in the body, retained inside the body, or exiting through the body and may result in many consequential problems for the family of the deceased, the accused, the legal system, and the physician or forensic pathologist. The characteristic differences between gunshot entrance and exit wounds have been described in many standard textbooks and articles ⁽¹⁻³⁾. An atypical exit wound, reinforced or "shored" exit wounds especially, may be mistaken for entrance wounds because of the presence of marginal abrasion ⁽⁴⁻⁷⁾.

Shored exit wounds are produced when the skin is supported by a firm surface, such a wall, floor, tight clothing, or even other body parts, as the bullet exits. The exiting bullet pushes the skin outward into the adjacent supporting surface, causing it to impact the firm material, and marginal abrasion occurs in the skin surrounding the exit wound. A shored exit wound can closely resemble an entrance wound and may occasionally challenge even an experienced forensic pathologist. The author has reported an atypical shored exit wound at the anterior chest wall from a push-up brassiere effect.

Case History

A teenage girl was reported found dead in the Ping river in Tak province. The corpse was wrapped in a red blanket and stuffed into a black plastic bag and sack. Preliminary examination by a local general physician reported the body was shot using an unknown type of firearm, five shots in the chest and one strike to the left temple. The victim had recently been arrested in a methamphetamine case. The body was referred to the Forensic Medicine Department of Naresuan University Hospital, Phitsanulok, for autopsy.

External findings

No clothes were present on the body, except for black shorts with white polka dots and a red push-up brassiere in the body bag. The face and chest were stained with some blood and the skin of both hands and feet were shriveled, exhibiting washer women's hands and feet. Rigor mortis was present all over the body. Post-mortem lividity was marked on the back except over dependent parts. Signs of

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putrefaction had not developed except cloudiness of both corneas.

Examination of the brassiere

The brassiere was a push-up type with angled cups containing padding and red in color. It had one tear at the right wing near the right cup sized 0.8 cm x 1.0 cm (Fig. 1).

Autopsy findings of injuries

- A firearm entry wound of 1.1 cm x 1.3 cm, surrounded by the collar of abrasion, 0.1 cm width, was situated on the left temple, 2 cm above and lateral to the end of the left eyebrow. No muzzle impression, burning, singeing, smudging, or tattooing was found around the wound. This gunshot wound passed from left to right, slightly front to back and slightly downward, perforating the left temporal bone, left and right cerebral hemispheres. Markedly deformed, three pieces of a split bullet were discovered from the right petrous bone.
- A firearm entry wound of 1.2 cm x 2.5 cm, surrounded by the collar of abrasion, ranging from 0.1-1.2 cm in width, was situated on the right anterior chest wall, 1 cm right lateral to the midline and 9 cm above the right nipple. No muzzle impression, burning, singeing, smudging, or tattooing was found around the wound. This gunshot wound passed from left to right, slightly front to back and slightly upward, perforating the subcutaneous tissue of the right anterior chest wall, right axilla, and right humerus. Markedly deformed, two pieces of a split bullet were discovered from the surgical neck of the right humerus.
- A firearm entry wound of 1.2 cm x 2.5 cm, surrounded by the collar of abrasion, ranging from 0.1-0.2 cm in width, was situated on the left anterior chest wall, 5 cm above and 2.5 cm medial to the left nipple. No muzzle impression, burning, singeing, smudging, or tattooing was found around the wound. (Fig. 2) This gunshot wound passed from left to right, slightly front to back and slightly downward, perforating the subcutaneous tissue of left breast. The exit wound of 0.8 cm diameter, surrounded by the collar of abrasion, 0.1 cm in width, was situated on the right anterior chest wall, 0.8 cm right lateral to the midline and 1.5 cm above the right nipple. (Fig. 3) The re-entry wound of 0.8 cm diameter, surrounded by the collar of abrasion, 0.1 cm in width, was situated on the left anterior chest wall, 0.5 cm left lateral to the midline and 1.5 cm above the left nipple. (Fig. 3) This re-entry wound perforated the subcutaneous tissue of the right anterior chest wall and right breast. The exit wound of 0.8 cm x 1 cm with partial everted

margins was situated on the right breast, 3 cm below the right nipple and 5.5 cm right lateral to the right nipple.

- A firearm entry wound of 1 cm x 1.2 cm, surrounded by the collar of abrasion, 0.1 cm in width, was situated on the left anterior chest wall, 6 cm left lateral to the midline and 10.5 cm below the left nipple. No muzzle impression, burning, singeing, smudging, or tattooing was found around the wound. This gunshot wound passed from left to right, front to back and downward, perforated the left upper abdominal wall, left lobe of the liver, and multiple parts of the intestines. The exit wound of 0.6 cm x 1.4 cm with partial everted margins was situated on the right waist, 26 cm below the right nipple and 18 cm right lateral to the umbilicus.

Opinion

Death was due to brain laceration from firearm injury of the head. All the injuries were ante-mortem. There was no sign of contact or close range firing on the dead body or brassiere and shorts. The upper clothes had been removed and preserved by the police. Only the brassiere was sent with the victim. Therefore, the approximate range of firing at the chest could not be estimated.

Discussion

There are many standard textbooks and articles which describe the characteristic differences between gunshot entrance and exit wounds⁽¹⁻³⁾. Atypical shored exit wounds may be mistaken for entrance wounds because of the similar gross pathological appearances⁽⁴⁻⁷⁾. Shored exit wounds are produced by tight contact with a firm surface, such as a wall, floor, tight clothing, or even other body parts supporting the skin at the exit area, producing a marginal abrasion resembling an entrance gunshot wound.

Some article presences a shored exit wound in which the skin was abraded by supporting material at the site the bullet was recovered, without skin perforation⁽⁸⁾.

In this case, preliminary wound examination by a general physician reported six gunshot wounds to the body; five shots to the chest and one to the left temple. In fact, the autopsy result by a forensic pathologist expert concluded that there were only 4 shots, three to the chest and one to the left temple. Misdiagnosis in number of entrance wounds on the preliminary report might be due to lack of experience of the general physician in atypical exit wounds which mimic the entrance gunshot wound. Failure to differentiate entry and atypical gunshot wounds in this case resulted in error in

calculating the number of firearm injuries to the body, retained bullet inside the body, or exited through the body causing problems in the direction of firing and direction of the wound tract.

The present case represents a shored exit gunshot wound situated on the anterior chest wall (near the left breast). In this case, the supported surface is the opposite anterior chest wall (re-entrance gunshot wound), but the gross anatomical position of both sides of the anterior chest wall indicate that they did not support each other. The red push-up brassiere which was sent with the body is the important key. Examination of this brassiere revealed one tear at the right band near the right cup which was located at the same area as the exit gunshot wound at the right breast. This finding was consistent with the victim wearing this brassiere at the time she was shot. Push-up brassieres are fashion bras that create the appearance of increased cleavage. They use angled cups containing padding that push the breast and soft tissues of the anterior chest wall inward and upwards, towards the centre of chest. The effect of the push-up brassiere made the breasts and anterior soft tissues close and then supported each other, resulting in a shored exit gunshot wound with a marginal abrasion with a punch out lesion at the left anterior chest wall in this case.

Conclusion

Although typical and atypical exit wounds have been discussed extensively in the literature, it is not an easy task to differentiate an atypical exit from entrance gunshot wound. Many atypical shored exit gunshot wounds have been reported in the literature. The author believes this is the first report of a shored exit wound at the anterior chest wall from a push-up brassiere effect.

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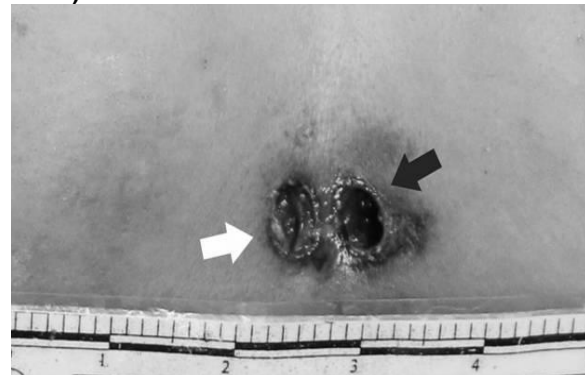
Fig.1 A red push-up brassiere sent with the body, one tear on right wing of the brassiere is demonstrated (black arrow)



Fig.2 An Entrance gunshot wound at the left anterior chest wall



Fig. 3 Area of exit and re-entrance of the gunshot wound at the anterior chest wall, a shored exit gunshot wound with distinct marginal abrasion (white arrow), re-entrance gunshot wound (black arrow)



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Book Review

Legal Issues in Medical Practice

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