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(Registration No.349, 12th May, 1972, Panji, Goa)



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# **Journal of Indian Academy of Forensic Medicine (JIAFM)**

*The Official Publication of Indian Academy of Forensic Medicine*

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Printed and published by Dr. Mukesh Yadav, Editor, JIAFM and Dr. A. D. Aggarwal, Joint Editor, JIAFM on behalf of Indian Academy of Forensic Medicine at name of the press [SHIVANI PRINTERS, NOIDA, [U.P.]

# Journal of Indian Academy of Forensic Medicine

Volume: 36 • Number: 2 • April- June 2014

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Print ISSN: 0971-0973. Electronic ISSN: 0974-0848. IndMED [www.medind.nic.in/jal/jalm.shtml](http://www.medind.nic.in/jal/jalm.shtml)

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## From Editor's Desk

# JIAFM

A Quarterly Publication  
Volume 36, Number 2, April-June, 2014

I feel immense pleasure to present before you the second issue of 2014. I would like to inform all of you that our esteemed Journal of Indian Academy of Forensic Medicine which is published quarterly since 1991 has been started gaining wide recognition not only in India but globally among the scientific community. I am trying to maintain your faith and trust in me to bring this journal to highest level of its achievements.

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

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

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

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

**Professor [Dr.] Mukesh Yadav  
Editor, JIAFM**

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The journal is indexed with IndMed and made available online by following website:

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## Editorial

# Police Information and Registration of FIR: Medico-legal Issues needs to be addressed on Priority

The FIR is a pertinent document in the criminal law procedure in India and its main object from the point of view of the informant is to set the criminal law in motion and from the point of view of the investigating authorities is to obtain information about the alleged criminal activity so as to be able to take suitable steps to trace and to bring to book the guilty.

Historical experience has thrown up cases from both the sides where the grievance of the victim/informant of non-registration of valid FIRs as well as that of the accused of being unnecessarily harassed and investigated upon false charges have been found to be correct. Police information sent by hospitals in medicolegal cases are also not given due importance.

### Reasons for Not Registering FIR:

SC observed it means that the number of FIRs not registered is approximately equivalent to the number of FIRs actually registered. Keeping in view the NCRB figures that show that about 60 lakh cognizable offences were registered in India during the year 2012, the burking of crime may itself be in the range of about 60 lakh every year.

### Violation of Rights of Victims:

Thus, it is seen that such a large number of FIRs are not registered every year, which is a clear violation of the rights of the victims of such a large number of crimes.

### Impact on Rule of Law:

SC observed that burking of crime leads to dilution of the rule of law in the short run; and also has a very negative impact on the rule of law in the long run since people stop having respect for rule of law. Thus, non-registration of such a large number of FIRs leads to a definite lawlessness in the society.

### Observations of Justice V. S. Malimath Committee on Reforms of Criminal Justice System:

The Committee on Reforms of Criminal Justice System headed by Dr. Justice V.S. Malimath also noticed the plight faced by several people due to non-registration of FIRs and recommended that action should be taken against police officers who refuse to register such information. The Committee observed:

“According to the Section 154 of the Code of Criminal Procedure, the office in-charge of a police station is mandated to register every information oral or written relating to the commission of a cognizable offence. Non-registration of cases is a serious complaint against the police. The National Police Commission in its 4th report lamented that the police “evade registering cases for taking up investigation where specific complaints are lodged at the police stations”.

It referred to a study conducted by the **Indian Institute of Public Opinion, New Delhi** regarding “**Image of the Police in India**” which observed that over 50% of the respondents mention non-registration of complaints as a common practice in police stations.

The Committee recommends that all complaints should be registered promptly; **failing which appropriate action should be taken.** This would necessitate change in the mind – set of the political executive and that of senior officers.

There are **two more aspects** relating to registration. The first is minimization of offences by the police by way of not invoking appropriate sections of law. We disapprove of this tendency. Appropriate sections of law should be invoked in each case un-mindful of the gravity of offences involved. The second issue is relating to the registration of written complaints. **There is an increasing tendency amongst the police station officers to advise the informants, who come to give oral complaints, to bring written complaints.** This is wrong. Registration is delayed resulting in valuable loss of time in launching the investigation and apprehension of criminals. Besides, the complainant gets an opportunity to consult his friends, relatives and sometimes even lawyers and often tends to exaggerate the crime and implicate innocent persons. This eventually has adverse effect at the trial. The information should be reduced in writing by the SHO, if given orally, without any loss of time so that the first version of the alleged crime comes on record. It has come to the notice of the Committee that even in cognizable cases quite often the Police officers do not entertain the complaint and send the complainant away saying that the offence

is not cognizable. Sometimes the police twist facts to bring the case within the cognizable category even though it is non-cognizable, due to political or other pressures or corruption. **This menace can be stopped by making it obligatory on the police officer to register every complaint received by him. Breach of this duty should become an offence punishable in law to prevent misuse of the power by the police officer.**"

### **Case before the Five Judge Constitution Bench of SC:**

The important issue which arises for consideration in the referred matter is **whether "a police officer is bound to register a First Information Report (FIR) upon receiving any information relating to commission of a cognizable offence under Section 154 of the Code of Criminal Procedure, 1973 (in short 'the Code') or the police officer has the power to conduct a "preliminary inquiry" in order to test the veracity of such information before registering the same?"**

The issues before the Five Judge Constitution Bench of the Supreme Court arise out of two main conflicting areas of concern, viz.,

- (1) Whether the immediate non-registration of FIR leads to scope for manipulation by the police which affects the right of the victim/complainant to have a complaint immediately investigated upon allegations being made; and
- (2) Whether in cases where the complaint/information does not clearly disclose the commission of a cognizable offence but the FIR is compulsorily registered then does it infringe the rights of an accused. [Para 22]

Ensuing compliance to the above direction, the matter pertaining to Lalita Kumari was heard by a Bench of three-Judges in **Lalita Kumari vs. Government of Uttar Pradesh & Ors.** (2012) wherein, the SC, after hearing various counsel representing Union of India, States and Union Territories and also after adverting to all the conflicting decisions extensively, referred the matter to a Constitution Bench while concluding as under:

"97. We have carefully analysed various judgments delivered by this Court in the last several decades. We clearly discern divergent judicial opinions of this Court on **the main issue:** whether under Section 154 CrPC, a police officer is **bound to register an FIR when a cognizable offence is made out** or he (police officer) has an **option, discretion or latitude** of conducting some kind of preliminary inquiry before registering the FIR.

98. The learned counsel appearing for the Union of India and different States have expressed **totally divergent views** even before this Court. This Court also carved out a **special category in the case of medical doctors** in the aforementioned cases of **Santosh Kumar and Suresh Gupta (2004)** where preliminary inquiry had been postulated before registering an FIR. Some counsel also submitted **that the CBI Manual** also envisages some kind of preliminary inquiry before registering the FIR.

99. **The issue which has arisen for consideration in these cases is of great public importance.** In view of the divergent opinions in a large number of cases decided by this Court, it has become extremely important to have a clear enunciation of law and adjudication by a larger Bench of this Court for the benefit of all concerned—the courts, the investigating agencies and the citizens.

100. Consequently, we request the Hon'ble the Chief Justice to refer these matters to a Constitution Bench of at least five Judges of this Court for an authoritative judgment."

### **Medical Negligence Cases:**

In the context of medical negligence, in **Jacob Mathew (2005)**, it was held by the SC as under:

"51. We may not be understood as holding that doctors can never be prosecuted for an offence of which rashness or negligence is an essential ingredient. All that we are doing is to emphasise the need for care and caution in the interest of society; for, the service which the medical profession renders to human beings is probably the noblest of all, and hence there is a need for protecting doctors from frivolous or unjust prosecutions. Many a complainant prefer recourse to criminal process as a tool for pressurising the medical professional for extracting uncalled for or unjust compensation. Such malicious proceedings have to be guarded against.

52. Statutory rules or executive instructions incorporating certain guidelines need to be framed and issued by the Government of India and/or the State Governments in consultation with the Medical Council of India. So long as it is not done, we propose to lay down certain guidelines for the future which should govern the prosecution of doctors for offences of which criminal rashness or criminal negligence is an ingredient. A private complaint may not be entertained unless the complainant has produced *prima facie* evidence before the court in the form of a credible opinion given by another competent doctor to support the charge of rashness or negligence on the part of the accused doctor. The investigating officer should, before proceeding against the doctor accused of rash or negligent act or omission, obtain an

independent and competent medical opinion preferably from a doctor in government service, qualified in that branch of medical practice who can normally be expected to give an impartial and unbiased opinion applying the **Bolam test** to the facts collected in the investigation. A doctor accused of rashness or negligence, may not be arrested in a routine manner (simply because a charge has been levelled against him). Unless his arrest is necessary for furthering the investigation or for collecting evidence or unless the investigating officer feels satisfied that the doctor proceeded against would not make himself available to face the prosecution unless arrested, the arrest may be withheld.”

### **Police Discrimination to hold Preliminary Inquiry:**

By pointing out Criminal Law (Amendment) Act, 2013, particularly, Section 166A, it was contended that as far as other cognizable offences (apart from those mentioned in Section 166A) are concerned, police has discretion to hold preliminary inquiry if there is some doubt about the correctness of the information.

### **Mandatory Registration of FIR:**

In addition, it was contended that insertion of Section 166A in IPC indicates that registration of FIR is not compulsory for all offences other than what is specified in the said Section. By Criminal Law (Amendment) Act 2013, Section 166A was inserted in Indian Penal Code which reads as under:

#### **Section 166A: Whoever, being a Public Servant:**

- a. Knowingly disobeys any direction of the law which prohibits him from requiring the attendance at any place of any person for the purpose of investigation into an offence or any other matter, or
- b. Knowingly disobeys, to the prejudice of any person, any other direction of the law regulating the manner in which he shall conduct such investigation, or
- c. Fails to record any information given to him under sub-section (1) of Section 154 of the Code of Criminal Procedure, 1973, in relation to cognizable offence punishable under Section 326A, Section 326B, Section 354, Section 354B, Section 370, Section 370A, Section 376, Section 376A, Section 376B, Section 376C, Section 376D, Section 376E, Section 509 shall be punished with rigorous imprisonment for a term which shall not be less than six months but which may extend to two years and shall also be liable to fine.”

Section 166A(c) lays down that if a public servant (Police Officer) fails to record any information given to him under Section 154(1) of the Code in relation to cognizable offences punishable under Sections 326A, 326B, 354, 354B, 370, 370A, 376, 376A 376B, 376C, 376D, 376E or Section 509, he shall be **punished with rigorous imprisonment for a term which shall not be less than six months but may extend to two years and shall also be liable to fine.**

Thus, it is the stand of learned counsel that this provision clearly indicates that registration of FIR is imperative and police officer has no discretion in the matter in respect of offences specified in the said section. Therefore, according to him, the legislature accepts that as far as **other cognizable offences** are concerned, police has **discretion to hold a preliminary inquiry if there is doubt about the correctness of the information.**

Although, the argument is as persuasive as it appears, yet, we doubt whether such a presumption can be drawn in contravention to the unambiguous words employed in the said provision. Hence, insertion of Section 166A in the IPC vide Criminal Law (Amendment) Act 2013, must be read in consonance with the provision and not contrary to it. The insertion of Section 166A was in the light of recent unfortunate occurrence of offences against women. The intention of the legislature in putting forth this amendment was to tighten the already existing provisions to provide enhanced safeguards to women.

Therefore, the legislature, after noticing the increasing crimes against women in our country, thought it appropriate to expressly punish the police officers for their failure to register FIRs in these cases. No other meaning than this can be assigned to for the insertion of the same.

### **Mandatory Police Information in POC SOA, 2012:**

Any personnel of the hospital (including media, hotel, lodge or club or studio or photographic facilities), by whatever name called irrespective of the number of persons employed therein, shall on coming across any material or object which is sexually exploitative of the child (including pornographic, sexually related or making obscene representation of a child or children) through the use of any medium shall provide such information to the Special Juvenile Police Unit, or to the local Police, as the case may be.

### **Punishment for Failure to Report/Record a Case:**

Any person, who fails to report the commission of an offence under sub –section (1) of section 19 or section 20 or who fails to record such offence under sub – section (2) of section 19 shall be punished with imprisonment of either description which **may extend to six months or with fine or with both.**

### **Responsibility of In-charge to Inform:**

Any person being in-charge of any **company** or an **institution** (by whatever name called) **who fails to report the commission of an offence** under sub – section (1) of section 19 or section 20 or **who fails to record** such offence under sub – section (2) of section 19 shall be **punished with imprisonment of either description which may extend to one year and or with fine.** [Chapter V, 21 (2)]

### **Brought Dead Cases in Casualty or Hospital:**

Hospitals and doctors especially dealing with casualty services and otherwise may receive brought dead cases and/or dead on arrival, many of which may be of medicolegal nature. Police has to be informed in such cases. But police refuses to entertain information in such cases and required to do at least **'preliminary enquiry'** to ensure or exclude the possibility of cognizable offence.

### **Delayed Information to Police Possible Consequences:**

In Rahul Mahajan case admitted to Apollo Hospital, Delhi, Delhi High Court decline to issue an order for quashing the proceedings against administration, doctors and nurses of Apollo Hospital and observed that I, therefore, see no reason to grant the prayer of the petitioners for issuance of a writ of prohibition restraining the learned ACMM from proceeding with case FIR No.305/2006 and for quashing of the orders dated 8th June, 2006 and 4th November, 2006 passed by the learned ACMM. The learned ACMM shall accordingly be at liberty to proceed with the case in accordance with law." [Para 55]

### **Bombay High Court answered, is Non-information to Police in Accidental Cases Attracting Punishment u/s 176 IPC?**

Situations may arise when even police can make allegations of intentionally omitting to inform the police. Applicability of Section 39, CrPC, 176 IPC, Ss. 279, 337, 338 or 304A I.P.C. and section 134 of the Motor Vehicle Act can be questioned; one such case is discussed as follows:

Whether really the doctor was legally obliged to give information to the police when he treats a patient who has met with an accident?

### **Brief Facts of the Case:**

The petitioner was a registered medical practitioner at Pune. On 7.8.1987 at about 12.30 p.m. one patient Ravindra Salunke came to hospital with history of skidding of motor vehicle and sustained some injuries. He was admitted to the hospital. On 8.8.1987 he was discharged on his request.

It transpired that the patient was admitted to Ruby Nursing Hall, Pune where he succumbed to the injuries and died on 8.8.1987. In the first instance, the police registered a case for accidental death and then they came to know that a vehicle had been involved in the accident.

Then the police registered a case for offences under Sections 279, 337, 338 and 304A of I.P.C. against the driver of the vehicle who had unfortunately died.

Subsequently, the police made some enquiries and filed a charge-sheet against the present petitioner, viz. the doctor alleging that he did not inform the police about the accident which he had come to know through the patient and thereby he has committed an offence punishable under Section 176, IPC. A writ petition was filed by the petitioner (Doctor) to quash the charge-sheet.

### **Observations of Bombay High Court:**

It was argued on behalf of the petitioner that even admitting all the allegations made in the charge-sheet and the statements of the charge-sheet and the statements of the witnesses, **there is no material to show that the petitioner was under legal obligation to inform about the accident to the police.** Even otherwise there is **no material to show that there is any intentional lapse on the part of the petitioner doctor to attract Section 176 of the I.P.C.**

### **Scope and Meaning of Section 176 IPC:**

Section 176 I.P.C. clearly provides that whoever is legally bound to give any notice or information to any public servant intentionally omits to give such notice or information, then he is **liable for punishment which may extend to one month or fine which may extend to five hundred rupees.**

### **Ingredients:**

The **two ingredients of the offences** are:

- (1) Intentional omission to give information to a public servant and
- (2) That the accused was legally bound to give such information to a public servant.

### **Observations of Bombay High Court on first Ingredient:**

As far as the first point is concerned, the statements of the witnesses do not disclose that the doctor intentionally omitted to inform the police. When the important ingredient of the offence is not alleged by the witnesses, there is no question of improving on the same during the course of the trial. If that important ingredient is wanting, then there is no necessity to prosecute the accused for the offence.

On the other hand, the statement of the Constable clearly shows that he talked to the doctor on phone when he gave the information about admitting the patient in the hospital. If there was any intention on the part of the doctor to suppress the facts, he would not have given any information to the Constable and he would have even denied having admitted the patient in the hospital.

On the other hand, the doctor informed the constable that the patient along with his friend visited the hospital and had sustained injuries in accident.

Hence in any view, the materials on record do not indicate one of the most important ingredient viz. intentional omissions to give information to the police about the accident. This ground itself is sufficient to quash the proceedings. **It will be travesty of Justice if on this scanty material the accused should be asked to face the trial.** [Para 5]

### **Observations of Bombay High Court on Second Ingredient:**

Then we come to the **second point** mentioned above **whether really the doctor was legally obliged to give information to the police when he treats a patient who has met with an accident.**

The only one provision which casts a duty on public to give information to the public about commission of offence is **Section 39 of the Code of Criminal Procedure.**

### **Scope and Meaning of Section 39 CrPC:**

It provides that every person who is aware of the commission of the offence mentioned in that section is obliged to give information **to the nearest Magistrate or Police Officer.**

**It is relevant to mention that Section 39 of the Code casts a statutory duty on every person to inform about commission of certain offences which includes offences covered by Sections 121 to 126, 302, 64-A, 382, 392 etc., of the IPC.**

It would be incongruous to suggest that though it is the duty of every citizen to inform about commission of an offence, **but it is not obligatory on the officer-in-charge of a Police Station to register the report.**

The word 'shall' occurring in Section 39 of the Code has to be given the same meaning as the word 'shall' occurring in Section 154(1) of the Code. [Para 46]

Certain offences are mentioned in that Section 39 as mentioned above, but **it does not refer to Section 279, 337, 338 or 304A I.P.C. with which we are concerned.**

There is no statutory obligation on a citizen to inform police about other offences which are [not] mentioned in Section 39 of the Code of Criminal Procedure. It may be that there is a **moral duty on every citizen to inform the Magistrate of police**, if they come to know of any offence.

But we are concerned about **punishing a person for not informing the police.** Penal provisions must be construed strictly. **If there is no statutory or legal liability for a citizen to inform the police regarding a particular offence, then the prosecution under Section 176 of the I.P.C. cannot stand.**

### **Provisions under MVA: Duty of Driver to inform the Police**

Under the Motor Vehicles Act there is a statutory provision in Section 134 which clearly casts a **duty on the driver of a vehicle to inform the police about an accident** caused by him. If he does not do it, he will be committing an offence under the Motor Vehicles Act, **there is no provision making it compulsory for public or a doctor to inform the police about a motor vehicle accident.**

**Court further observed that** what is more, Section 134 of the Motor Vehicles Act has since been amended **making it obligatory on a doctor to treat the patient who is involved in a vehicle accident in the light of the judgment of the Supreme Court.**

Court made it clear that even then there is no provision in the amended section making it statutory obligation on the part of the doctor to inform the police about having treated such a patient.

### **Only Rash and Negligent Driving is an Offence:**

Court further clarified that even otherwise, mere causing an accident is not an offence. If the accident was due to rash and negligent driving, then it becomes punishable under all or any of the offences, viz. under Ss. 279, 337, 338 or 304A I.P.C.

### **Duty of Doctor in an Accident Case:**

Even if the doctor is informed that some accident has taken place, it is not an offence unless it was a rash and negligent driving.

The prosecution papers do not show that the doctor had been told by the deceased or pillion rider that the accident had taken place due to rash and negligent driving.

A doctor is not required to make enquiries with the patient about the accident. The main duty of a doctor is to save the life of the patient. He is not bothered about legal implications of the accident.

In the present case we find that the petitioner who is a medical practitioner of repute at Pune has done his duty in attending and treating a patient who was involved in an accident.

He cannot be prosecuted for an offence under Section 176 I.P.C. **in the admitted facts and circumstances as made out in the prosecution papers.** The prosecution of the petitioner is **wholly misconceived.**

The learned Magistrate has not at all applied his mind and has mechanically issued the process since the charge-sheet was filed. It will be sheer **waste of public time and money** if the petitioner is tried and subsequently honourably acquitted. It will be **abuse of process of the Court** if the prosecution is allowed to continue. Hence this is a fit case where this Court should interfere and quash the prosecution.

In such situations remedy lies with the concerned High Court as in this case in the result, the petition was allowed and the charge-sheet, filed by the police and the subsequent proceedings in Criminal Case No.276 of 1987 were quashed by the Bombay High Court.

### **Directions of the SC:**

In view of the aforesaid discussion, SC holds:

- (i) Registration of FIR is mandatory under Section 154 of the Code, if the information discloses commission of a cognizable offence and no preliminary inquiry is permissible in such a situation.
- (ii) If the information received does not disclose a cognizable offence but indicates the necessity for an inquiry, **a preliminary inquiry** may be conducted only to ascertain whether cognizable offence is disclosed or not.
- (iii) If the inquiry discloses the commission of a cognizable offence, the FIR must be registered. In cases where preliminary inquiry ends in closing the complaint, a copy of the entry of such closure must be supplied to the first informant forthwith and not later than **one week.** It must disclose **reasons in brief** for closing the complaint and not proceeding further.
- (iv) The police officer cannot avoid his duty of registering offence if cognizable offence is disclosed. Action must be taken against erring officers who do not register the FIR if information received by him discloses a cognizable offence.
- (v) The **scope of preliminary inquiry** is not to verify the veracity or otherwise of the information received but only to ascertain whether the information reveals any cognizable offence.
- (vi) As to what type and in which cases preliminary inquiry is to be conducted will depend on the facts and circumstances of each case. The **category of cases** in which preliminary inquiry may be made are as under:
  - (a) Matrimonial disputes/ family disputes
  - (b) Commercial offences
  - (c) Medical negligence cases
  - (d) Corruption cases
  - (e) Cases where there is abnormal delay/laches in initiating criminal prosecution, for example, over 3 months delay in reporting the matter without satisfactorily explaining the reasons for delay. The aforesaid are only illustrations and not exhaustive of all conditions which may warrant preliminary inquiry.
- (vii) While ensuring and protecting the rights of the accused and the complainant, a preliminary inquiry should be made time bound and in any case it should not exceed 7 days. The fact of such delay and the causes of it must be reflected in the General Diary entry.
- (viii) Since the General Diary/Station Diary/Daily Diary is the record of all information received in a police station, we direct that all information relating to cognizable offences, whether resulting in registration of FIR or leading to an inquiry, must be mandatorily and meticulously reflected in the said Diary and the decision to conduct a preliminary inquiry must also be reflected.

### **Summary and Conclusions:**

There is need to create sensitization and awareness among general public, police officers and doctors dealing with medicolegal cases especially in the Casualty Department about legal provisions and recent directions of the Hon'ble Supreme Court to protect the rights of the innocent victims. Doctor can use Information technology and Computer for informing to police to avoid any complications related to non-receipt of information and refusal of information. Similarly use of PCR No.100, Child Help Line No.1098, Women Help Line No.1090, facebook pages of Police Department, etc. Casualty department should keep record updated about contact details of nearest Magistrate, Police Station Officers, SDM, SSP Office, DM Office, etc. Alternatively complaint can be sent through Speed Post/Registered letter and Fax which can be proved as and when occasions arise in this regard.

**Dr.Mukesh Yadav**  
**Editor, JIAFM**

## Original Research Paper

# Profile of Unnatural Deaths in Females A Retrospective Study

<sup>1</sup>CK Pawar, <sup>2</sup>DS Bhullar, <sup>3</sup>SS Oberoi, <sup>4</sup>KK Aggarwal

### Abstract

Right from the time of conception in her mother's womb, till her death, a woman is subjected to one or the other crime/ torture/ inhuman behavior. Crimes against women are increasing at an alarming pace in our country. The male-female ratio is also declining.

This study was undertaken at the Department of Forensic Medicine, GMC Patiala, to understand the contribution of social conditions towards the main causes of unnatural female deaths. A total of 100 cases were studied. Of these, 55% cases were from rural area; 68% were in the age group of 18 to 30 years. Majority of the victims comprised married female. Forty one percent of them died within seven years of marriage; 55% victims were matriculate and 11% were illiterate. Most of the deaths, 57% were reported as accidental, while 30% were reported as suicidal and 11% were homicidal in manner. The most common precipitating factor was dowry. Maximum victims died as a result of burn injuries. In homicidal cases, 45% victims were killed by burning. Poisoning was the commonest cause of suicidal deaths, 60%. In accidental deaths, 53% victims died as a result of accidental burning.

**Key Words:** Dowry deaths, Bride burning, Kitchen accidents, Crime

### Introduction:

From time immemorial, instances of crime against women existed; only the pattern varied with time and place. Women always have been at receiving end in the male dominated society. Types and trends of crime however, kept changing with change in mind sets and techniques. With the modern woman coming out of the confines of her home, either to study/ socialize or work, situational and institutional crimes have been on rise.

In the recent times, there has been a phenomenal spurt in violence and crime against females and this has not only been the concern of the contemporary society but also is present since time immemorial.

Working women were most commonly affected and they have to go through various vital events such as marriage, change of social environment, job responsibility, bearing and rearing children, for which they have to face mental, physical, psychological or social stress.

Among all these evils, "bride burning" commonly known as dowry deaths, assumes much importance. Constitutionally women were provided special protection under Article 21 and Article 14. Time and again the Hon'ble Supreme Court of India extended the ambit of Article 21 and held that mere existence is not the right to live; to live be to have the right to live with dignity. [5] In the present study, an attempt was made to find out various causes of unnatural deaths in women with special reference to death within 7 years of marriage.

### Aims & Objective:

The present study was undertaken in order to find out a correlation between marriage, socio economic status, educational background and other significant factors responsible for such deaths and to understand the pattern of unnatural female deaths and analyze the same.

### Material and Method:

The material for the present study comprised 100 cases of unnatural female deaths aged between 18–45 years, brought to the mortuary of the Department of Forensic Medicine and Toxicology, Government Medical College, Patiala, Punjab, during the year 2010 and 2011. The cases were taken randomly from the cases brought to the mortuary.

A standardized pro-forma specially designed for this purpose was used and filled in each case after detailed interviews with the

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DOR: 01.10.2013 DOA: 29.05.2014

investigating officials and accompanying regarding manner of death, age, socio economic background, level of education, occupation, marital status and rural/ urban residence status.

The relevant samples/ viscera were subjected to chemical analysis on autopsy to establish the poison consumed in suspected cases of poisoning.

**Results and Discussion:**

A total of 100 cases were included in this study, the most common age group in our study was 18-30 years and married females outnumbered the unmarried ones by 2.6:1. (Fig. 1) Our results are in consonance with those of other workers in the field. [2-5]

Majority of the victims (41%), died within 7 years of marriage (Fig. 2), while 55% were from rural background. (Fig. 3) Again, 55% were educated up to matriculation level. (Fig. 4) Similar findings were reported by others. [4-8]

In our study Sixty-two percent females were house-wives while 35% females were employed in the private sector. (Table 1)

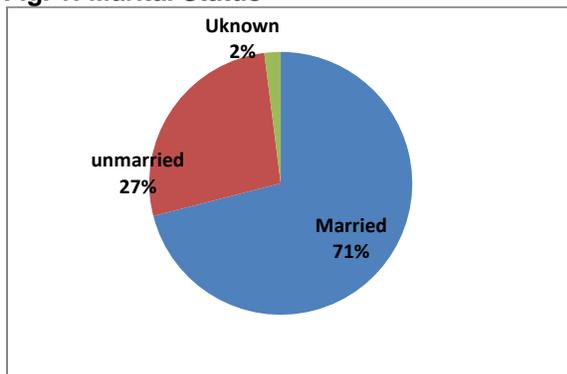
Maximum victims belonged to the Sikh community (60%), followed by Hindus, (32%). (Table 2) This can be explained by the fact that Patiala, being a Sikh dominates city and the Punjab state’s most common religion being Sikhism; the victims were also mostly Sikhs.

The most common manner of death was accidental, 57%, followed by suicides, 30%. Burns were involved in 38% of unnatural female deaths, followed by poisoning, 31%.

Burns also accounted for maximum cases of Accidents (53%) and homicides (45%); while poisoning was responsible for maximum cases of suicides, 60%. (Table 3)

Dowry was the most common precipitating factor in the deaths of married women. (Fig. 5) A host of other researchers reported similar findings. [9-14]

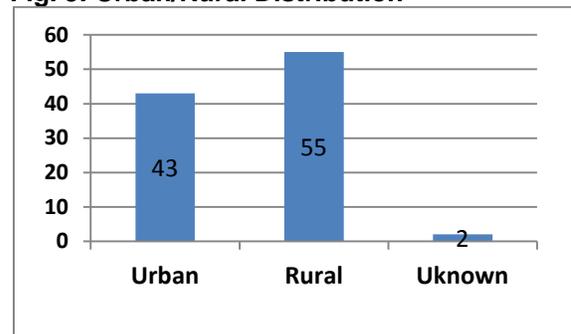
**Fig. 1: Marital Status**



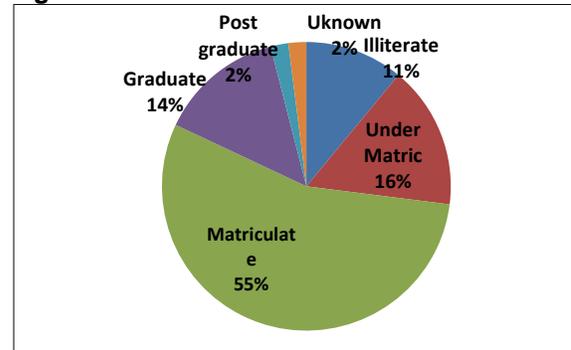
**Fig. 2: Marital duration**



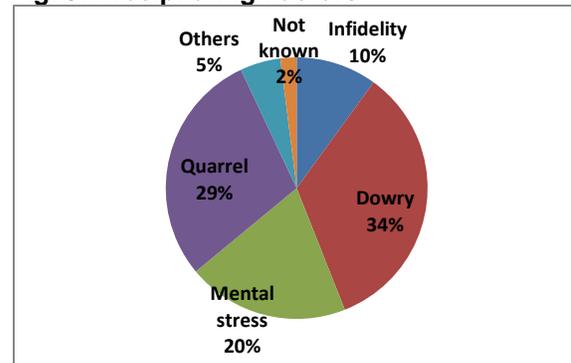
**Fig. 3: Urban/Rural Distribution**



**Fig. 4: Educational Status**



**Fig. 5: Precipitating Factors**



**Table 1: Occupational Status**

S. No.	Occupation	Number(n=100)
1	House wife	62(62%)
2	Govt. service	1(1%)
3	Private service	35(35%)
4	Unknown	2(2%)

**Table 2: Religion wise Distribution**

S. No.	Religion	Number(n=100)
1	Sikh	60(60%)
2	Hindu	36(36%)
3	Muslim	2(2%)
4	Unknown	2(2%)

**Table 3  
Causative Agents and their Distribution in Homicidal, Suicidal & Accidental Deaths (As Reported By Police)**

S. No.	Causative Agent	Homicidal Deaths	Suicidal Deaths	Accidental Deaths	Total
1	Burn	5(45%)	3(10%)	30(53%)	38
2	Poison	-	18(60%)	13(21%)	31
3	Drowning	-	3(10%) + 1(UDT)	-	4
4	Hanging	-	6(20%)	-	6
5	Strangulation	1(9%)	-	-	1
6	Vehicular Accidents	-	-	10(18%)	10
7	Railway Accidents	-	-	3(6%) + 1(UDT)	4
8	Combination	1(9%)	-	-	1
9	Homicidal Injuries	2(19%)	-	-	2
10	Criminal Abortion	1(9%)	-	-	1
11	Acid intake	-	-	1(2%)	1
12	Firearm	1(9%)	-	-	1
	Total	11	30	57	100

Manner of death in 2 victims is undetermined (UDT)

## Original Research Paper

# Pattern of Craniocerebral Injuries in Fatal Vehicular Accidents in Patna (Bihar)

<sup>1</sup>Sanjay Kumar, <sup>2</sup>R K P Singh

### Abstract

Among all type of accidents, those caused by motor vehicle claims the largest toll of life and tend to be the most serious. The present prospective study was conducted in the Department of Forensic Medicine and Toxicology, Patna Medical College and Hospital Patna from September, 2007 to April, 2009 on 100 cases. The primary aim of this study was to find out nature and types of cranio-cerebral injuries (CCI) sustained in fatal road traffic accidents (RTA) and make an attempt to establish various causative factors, patterns and distribution of CCI and thereby to plan successful measures against it. Our study shows that 30% victims were of middle age group, male: female ratio was 4.5:1. Maximum number of cases was during the summer season. 66% victims were pedestrians; in 47% cases heavy vehicles were involved. In 86% cases the death was due to fatal cranio-cerebral injuries alone. In 30% cases the death was instantaneous, 65% cases died within 48 hours after the injury and were able to obtain only minor surgical aid and only 9% cases died after 48 hours of the injury receiving definitive surgical treatment.

**Key Words:** Cranio-cerebral injuries, Fatal vehicular accidents, Pedestrians, RTA

### Introduction:

The term 'ACCIDENT' has been defined as an occurrence in the sequence of events which usually produces unintended injury, death or property damage. [1] It is also defined as "an unexpected, unplanned occurrence which may involve injury". [2]

Among all types of accidents, those caused by motor vehicles claims the largest toll of life and tend to be the most serious.

Over 1.2 million people die each year on the world's roads and between 20 and 50 million suffer non-fatal injuries. Over 90% of the world's fatalities on the roads occur in low-income and middle-income countries, which have only 48% of the world's registered vehicle (WHO, 2004).

The most of such deaths are among "vulnerable road users" such as pedestrians, pedal cyclists and motorcyclists. [3] Developing countries bear the brunt of the fatalities and disabilities from road traffic crashes, accounting for more than 85% of the world's road fatalities.

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About 90% of the total disability adjusted life years (DALYs) lost due to road traffic injuries. The problem is increasing in these countries at a fast rate, while it is declining in all industrialized nations.

During 1990s road traffic injuries ranked ninth among the leading cause of deaths in the world and predicted to become third most major cause by the year 2020. [4]

Accidents have their own natural history and follow the same epidemiological pattern as any other disease- i.e. the agent, the host and the environment interacting together to produce injury or damage. The important human factor could be lack of adequate traffic planning and consumption of alcohol. Accidents occur more frequently in certain age-groups, at certain times of day and week and at certain localities.

Some people are more prone to accidents than others and susceptibility is increased by the effect of alcohol and other drugs as well as physiological state such as fatigue. Besides these many of the psychological circumstances in which accidents occur are still poorly known. [1]

The steep rise in vehicular accidents in present era is the result of urbanization and tremendous growth in road transport sector. Population explosion is a catalyzing factor for a number of accidents. Since accidents are multifactorial, they call for an intersectoral approach to both prevention and care of the

injured. The fatalistic attitude in the form of widespread belief that accidents are inevitable must be curbed as majority of accidents are preventable.

### **Materials and Methods:**

The present prospective study was conducted in Department of Forensic Medicine, Patna Medical College and Hospital, Patna from 01-09-2007 to 31-04-2009. During that period out of 3929 autopsies, 100 cases of road traffic accidents were selected for the present study.

The relatives of the victims of the accidents and accompanying police were interviewed to obtain the information about the circumstances leading to death.

A performa specially designed for this purpose was used at the time of autopsy. The details about the victim regarding the name, age, sex, address, date, time and place of death, type of vehicle involved and the cause of sustaining the injury were noted from the police records. Position of the victim during accident (driver/pedestrian/occupant) was noted.

Postmortem (both external and internal) findings were recorded in the same performa and analyzed.

### **Observations:**

In our study maximum percentages of cases (72%) were from urban area i.e. fatal RTAs were more common in urban area than rural area. (Fig. 1) Highest fatality (30%) was found in the 20-29 years age group and lowest in the old age group (61-80 years). Fatal RTAs were common in males (82%) compared to females (18%) with male to female ratio 4.5:1. (Table 1) Present study showed that maximum victims were pedestrians (66%) followed by occupants of heavy vehicles (22%) and cyclists (12%). (Fig. 2) In 30% cases death was instantaneous, out of which only 8 cases had other major injuries in association with the cranio-cerebral injury. (Table 2)

In this study 65% cases died within 48 hours after the injury and were able to obtain only minor surgical aid or hospital observation and only 9% died after 48 hours of the injury receiving definitive surgical treatment.

In 86% of cases death was due to cranio-cerebral injuries alone and in 14% cases it was associated with injuries sustained in other parts of the body. (Table 3)

The postmortem examination was done within 24 hours after death in 92% cases and in 4% cases it was delayed beyond 36 hours. (Table 4) In our study 71% cases had fracture of the skull bones. Fracture vault of skull was found in 61.97% cases and in 29.58% cases both the

vault and base were involved. Fissured fracture was found in 63.64% cases and comminuted type in 16.89% of cases. Temporal region had highest number (50) of fractures. The right side slightly more involved than the left. (Fig. 3)

Intracranial bleeding was observed in 98 cases, mostly having subdural and extra-dural hemorrhage together (53 cases). Subdural hemorrhage was seen in 33% cases. (Table 5) In associated injuries, chest (ribs, lungs, sternum, Heart) was found to be involved most. (Table 6) Maximum number of cases were during the summer season (March to June) and minimum during the rainy season (July to October). (Fig. 4)

### **Discussion:**

Present study shows that the sex wise distribution of incidence of fatal cranio-cerebral injuries is of male preponderance. Out of 100 cases of fatal Cranio-cerebral injuries observed in the present series there were 82 males and 18 females. The preponderance of males over the females has also been recorded by various authors. [5-7]

This male preponderance can be explained by the fact that in a common Bihari family females are much less exposed to vehicular as they mostly remain indoors as compared to the males who on the contrary usually remain outdoors in numerous everyday pursuits. The highest fatality has occurred in the age group of 20 to 29 years and lowest in the old age group. No case was recorded above 80 years of age. This young age predominance is consistent with other studies. [5, 8, 16]

In our part of India people of young age (20 to 29 years) are the ones who are mostly exposed to vehicular accidents in the form of pedestrians or cyclists or drivers of light motor vehicle. They usually have a craze for speed while driving and a disregard for the general traffic rules. Now-a-days the younger generation is the one which indulges most in alcohol or other forms of intoxication.

Season seems to have some influence over the incidence of fatal cranio-cerebral injuries in vehicular accidents. In the present series, the highest number (38%) has been found to have occurred in the summer season followed by the winter. This may be explained from the fact that during the summer months (March to June) people in this part of the country spend their time mostly outdoors.

Due to the intense heat in this part of the country, the physical and mental state of the drivers of vehicles are not at its best, resulting in error of judgment which frequently cause fatal

accidents. Compulsory air-conditioning of vehicles may contribute a lot in minimizing the number of fatalities. Higher incidence in summer is similar to the study of Biswas G et al. [9] However, study of Ravikiran et al [10] shows monsoon predominance.

Vulnerability of pedestrian as RTA victim is a common phenomenon in all study across the country. [5, 6, 8, 10-12, 15] In analytical study done by Salgado MS et al [16] also showed the highest fatalities in pedestrian. In this study also highest fatality was seen in pedestrians (66 cases) followed by vehicle occupant (22 cases) and cyclists (12 cases).

This pattern indicates that much more attention is needed for safety of pedestrian. One must bear in mind that in a developing country like ours most of the road users are pedestrians, majority of whom are illiterate or are totally unaware of traffic rules. There is no effort on the part of the government to educate the people of all ages about traffic rules and road safety.

Provision of foot-paths for the pedestrians should be made along the roads in order to minimize the high fatality in the pedestrians. Out of 100 cases of fatal vehicular accidents in this series, 86% cases died due to cranio-cerebral injuries alone and in only 14% of the cases it was associated with major injuries elsewhere in the body. (Table 3)

This high incidence of fatality in cases of cranio-cerebral injuries has also been reported by other workers. [5, 13, 16] Hence the role of helmet in two wheeler riders can be enforced for all practical purposes.

In our study the postmortem examinations of 92% of the fatal vehicular accident cases with cranio-cerebral injuries were done within 24 hours after the death of the victim. In only 4% of the cases it was delayed beyond 36 hours. Cases in which postmortem examination was delayed, it was either because the photographs of unknown cases were not taken or due to the delay in the transportation of the dead body from a distant site of accident.

Present study showed that 30% cases died instantaneously out of which 22 died due to cranio-cerebral injuries alone and eight had other major injuries in addition to it. The number of instantaneous death was found to be more than that of other study. [5, 6]

This finding reveals the poor state of cranio-cerebral injury management in hospitals of this part of the country. Patna Medical College is the only hospital with a full-fledged Neuro-surgical unit. By the time the unfortunate victims arrive here from the place of occurrence it is already too late.

Out of different types of fractures of the skull, encountered in cases of cranio-cerebral injuries due to vehicular accidents, Fissured fractures have been most frequently seen (63.64%) in the present series. Next were the comminuted fractures (16.89%). These findings were almost similar to that of Gupta S. et al. [5]

The remarkable point of our study was that 98% of the victims had intracranial hemorrhage and only 2% had none. The subdural variety has been found in 33% cases and subdural and extradural hemorrhage together has been found in 53% of the cases. This agrees with the observations of Singh H et al and Menon A et al. [8, 14]

Chest injury with fracture of ribs, clavicle and sternum and rupture of the lungs and heart are associated with the cranio-cerebral injuries in the highest number of cases. They were followed by the fatal abdominal injuries with rupture of the liver, spleen, kidney and the G.I.T.

### **Conclusion:**

The first recorded pedestrian accident was in Britain in 1896, where a man was killed by a car traveling at 4 miles/hour. Today hundred times the number of vehicles that were playing in 1896, travel at speed of nearly 100 miles/hours. This comparison is enough to throw light on rate of increase in road traffic accidents.

In our study, the triad of middle aged-male pedestrians being most accident prone is very significant which other authors have also revealed. This is good indicator for a faulty traffic management system where pedestrian safety is always overlooked.

The finding that majority of the fatal victims of cranio-cerebral injury of road traffic accidents died on the spot of within twenty four hours of accident highlights the prevalent poor traumatic management infrastructure.

Hence, improvement of road surface infrastructure, strict compliance with road safety rules by drivers & pedestrians, rapid emergency services & establishment of trauma care centers are major factors to reduce this hazard.

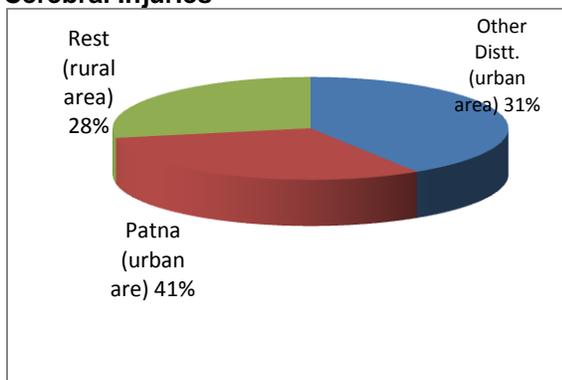
There needs to be a proper national reporting system of road traffic accidents so that an overall picture can be drawn for proper traffic management planning.

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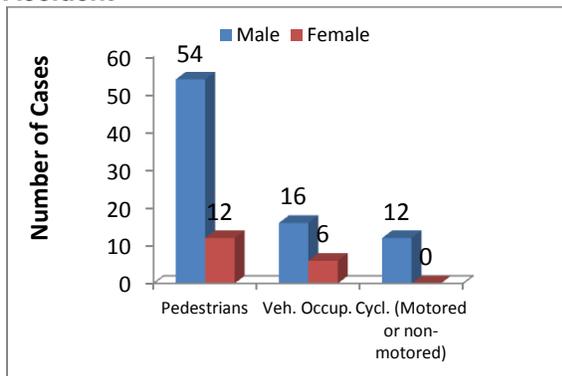
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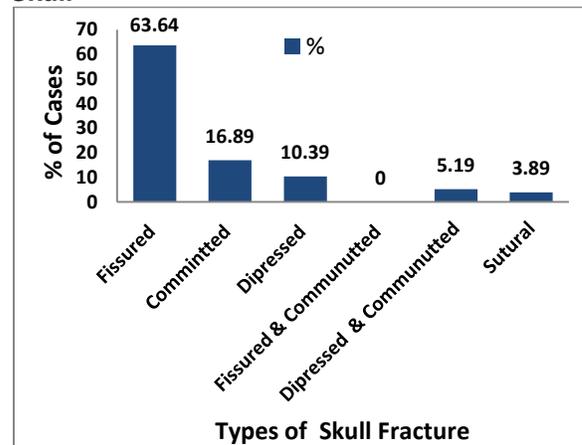
**Fig. 1: Regional Incidence of Fatal Cranio-Cerebral Injuries**



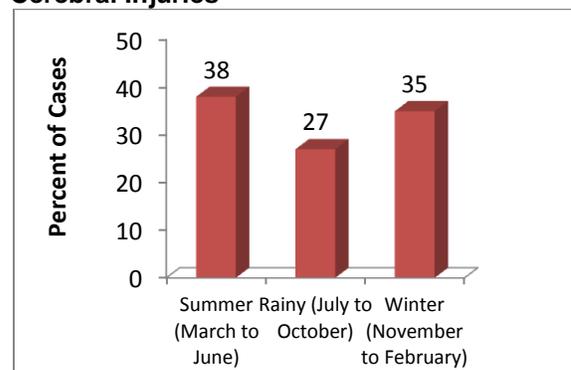
**Fig. 2: Types of Road Users Involved in the Accident**



**Fig. 3: Various Types of Fractures of the Skull**



**Fig. 4: Seasonal Incidence of Fatal Cranio-Cerebral Injuries**



**Table 1: Age and Sex Wise Distribution**

Age (yrs)	Cases	Male	Female
0 – 9	10	9	1
10 – 19	12	10	2
20 – 29	30	27	3
30 – 39	17	13	4
40 – 49	14	9	5
50 – 59	12	11	1
60 – 69	4	2	2
70 – 79	1	1	0
>80	0	0	0
Total	100	82	18

**Table 2: Instantaneous death due to Vehicular Accidents**

Cause of deaths	Cases
Instantaneous deaths due to cranio-cerebral injuries alone	22
Instantaneous deaths due to cranio-cerebral injuries in association with other major injuries	8
Total	30

**Table 4: Time Elapsed Since Death during Postmortem Examination**

Time (hours)	Cases	Percentage
Immediate	-	-
Approximately 6 hrs	4	4.0
Approximately 12 hrs	6	6.0
Approximately 18 hrs	5	5.0
Approximately 24hrs	77	77.0
Approximately 36 hrs.	4	4.0
More than 36 hrs	3	3.0
More than 48 hrs	1	1.0
Total	100	100.0

**Table 5: Various Types of Intracranial Hemorrhage**

Hemorrhage	Cases	Percentage
Extradural alone	2	2.0
Subdural alone	33	33.0
Subarachnoid alone	0	0.0
Intracerebral alone	2	2.0
Extradural and subdural	53	53.0
Subdural and Intracerebral	1	1.0
Subdural and subarachnoid	1	1.0
EDH, subdural and subarachnoid	1	1.0
Crush	5	5.0
No intracranial hemorrhage	2	2.0
Total	100	100.0

**Table 6: Major Injuries of Different Organs in Association with Cranio-Cerebral Injuries**

Organ involved	Cases
Rupture of the lungs	20
Rupture of liver	8
Rupture of spleen	4
Rupture of kidney	3
Rupture of G.I.T.	3
Rupture of the heart	5
Fracture of pelvis	3
Fracture of lower limbs	16
Fracture ribs	20
Fracture sternum	8
Fracture facial bones	13
Fracture of the vertebra	2
Fracture of upper limbs	2
Fracture clavicle	3

**Table 3**

**Incidence of Cranio-Cerebral Injuries in relation to other Regional Injuries in Both Sexes**

Total cases	Death due to cranio-cerebral injuries alone			Death due to cranio-cerebral injuries in association with major injuries elsewhere		
	Male	Female	Total (%)	Male	Female	Total (%)
100	70	16	86(86)	12	2	14(14)

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## Original Research Paper

# Unnatural Deaths of Adult Females in South Bangalore An Autopsy Study

<sup>1</sup>Mandar Ramchandra Sane, <sup>2</sup>Ananda K

### Abstract

Discrimination against women in our society is deeply embedded within the family context of the women. The women are often subjected to violence from their husbands and from relatives in their natal as well as marital homes. This study was designed to determine unnatural deaths of adult females in the age group of 18-50 years in South Bangalore and was conducted from November 2011 to November 2012. Total 85 cases were studied during the study period from 450 total autopsies. Third decade of life was the most common age group. 76.5% of females were married, with 58.6% of deaths occurred in 0-7 years of married life. Most of the unnatural female deaths (88.2%) were suicidal in manner. This study reflects the susceptibility of married women to unnatural deaths, thus need to enhance the multipronged protective system, to curb these potentially preventable unnatural deaths of females.

**Key Words:** Unnatural deaths, Adult females, Married, Suicide, Hanging

### Introduction:

Females of India have suffered violence at the hands of men including family members from conception to death. Gone are the days where women used to die on husband's pyre, but now women are dying within four walls of house due to domestic torture, dowry death being heinous amongst them. A total of 2, 13, 585 incidents of crime against women were reported in the country during 2010 as compared to 2, 03, 804 during 2009. The rate of crime has increased marginally from 17.4 during the year 2009 to 18.0 during 2010. [1]

This shows increase in nature and extent of violence directed at women and which vary according to class, region, culture and the strata of the society across the country.

The women are often subjected to violence from their husbands and relatives in their natal as well as marital homes. The violence against women includes not only physical aggression but sexual, psychological and emotional abuse as well.

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DOR: 04.01.2014 DOA: 28.03.2014

Present study was conducted in South Bangalore to evaluate factors related to unnatural deaths in adult females.

### Material and Method:

This was prospective descriptive study with the aim to establish the state of unnatural deaths occurring in adult females in the age group of 18-50 years in South Bangalore, and to formulate recommendations that could probably help prevent or reduce these deaths.

The objective was to gather epidemiologic information on the unnatural deaths in adult female (18-50 years).

Autopsy was conducted on all cases of unnatural deaths in females between age group 18 to 50 years at Kempegowda Institute of Medical Science Hospital and Research Centre, Bangalore, during the period November 2011 to November 2012.

Performa was filled in each case regarding the history given by relatives, information obtained during inquest and post mortem findings. The comparison was made between these findings and conclusions were drawn after comparing and discussing with similar type of the work carried out by other authors.

### Results:

There were 450 medico-legal autopsies conducted from November 2011 to November 2012. Of those, 75.5% (n=340) deaths were due unnatural causes, out of which, 85 cases (25%) were of adult females belonging to age group of 18 to 50 years. Age wise distribution of the

victim shows that most of the incidences (52.9%, n=45) were noticed in 3<sup>rd</sup> decade. 76.5% (n=65) of victims were married, out of which 58.6% (n=38) were within 7 years of marriage. (Fig. 1)

Hindus (92.9%, n=79) comprised the single largest category followed by Christians and then Muslims. (Table 1) With regard to cause of death, hanging was leading cause of death in 71.8% (n =61) followed by death due to poisoning in 11.8% (n=10). (Table 2)

As per history, circumstantial evidences and post-mortem findings it was noticed that in most of the victims the manner of death was suicidal (88.2 %, n= 75), followed by accidental (7.1%, n=6) and homicidal (4.7%, n=4).

Maximum suicidal cases (54.66%, n=41) were observed in age 3<sup>rd</sup> decade, followed by in age group of 18-20 years (21.33%, n = 16). (Table 3) In the current study, attempt has also been made to study the approximate time of victim's death (Table 4), maximum cases (43.5 %, n=37) occurred in late hours of day (12 noon to 8 PM), followed by (34.1%, n=29) in early hours of day (4 AM to 12 noon).

### Discussion:

Bangalore is the most populous city in the Karnataka state with population share of 15.69%. Sex ratio of Bangalore is Bangalore is 908 females per 1000 male which is lowest in the state, and far below the national average which is 940 females per 1000 males. [2] Son preference and other social factors are responsible for the skewed sex ratio.

Present study was on adult females as more and more women are now coming out of the territory of their homes for education and employment and thus exposing themselves like males to related causes of death, like road traffic accidents and occupational deaths.

Incidence of unnatural deaths of adult females (between age group of 18 to 50 years) was 25% of total number of unnatural deaths. Similar was finding of Sharma BR et al [3] where the incidence observed was 28%.

In our study majority of victims (52.9 %, n=45) were in their 3<sup>rd</sup> decade, followed by in 18-20 year age group (20%, n=17) which is consistent with studies by other authors. [4, 5] Suicide (88.2%, n = 75) was most common manner of death, followed by accidental (7.1%) and homicides (4.7%). This is also observed by Sharma et al, [3] however accidental manner of death was reported by Pathak et al. [4]

Further analysis of age group with manner of death shows that suicidal deaths were maximum in 3<sup>rd</sup> decade of life (54.66%, n=41) consistent with other authors. [6, 7] The

reason for this may be that, this age forms the most important and crucial part of woman's life.

She has to face many types of burden i.e. mental, physical, social, economical etc. and this is the age of marriage leading to change in social environment. About 50 % of homicidal deaths occurred in age group of 30-40 years. This finding is in accordance with other studies [6, 8] making this age group most vulnerable for homicidal violence. Hindu comprised maximum cases (92.9%), followed by Christian (4.7%, n = 4). Hindu females also constituted maximum cases in various other studies. [4, 5, 9]

In this study Distribution according to marital status showed that most cases (76.5%) of unnatural female deaths were from married group, which is consistent with other author findings, [10, 11] where married females constituted maximum unnatural deaths among females. Further analysis of marital females shows that maximum cases (58.6%) were seen in first 7 years of marriage, with 19 cases (29.3%) observed in each category of 0-3 years and 4-7 years of duration of marriage. Similar were findings of other studies. [10, 12]

The reason for high incidence in first 7 years of marriage is mainly dowry related deaths and victim is mentally not mature enough to handle the situation.

Hanging was the most common cause of death (71.8%, n=61), followed by poisoning (11.8%, n=10) and burns (4.7%, n=4) in our study. However, these findings are not similar to other studies [4, 5, 9, 10, 12] where most victims died due to burns, while poisoning was most the common cause of death reported by Prajapati P et al. [7] In present study, maximum deaths (43.5%, n=37) occurred in late hours of day (After 12 noon to 8 PM), followed by 29 cases (34.1%) which occurred in early hours of day (4 AM to 12 noon) and 19 cases which occurred during night hours (After 8 PM to 4 AM).

Similar findings are reported by others. [13-15] The probable reason for above finding may be that in early morning and in afternoon, as most of them were either asleep or gone out to work, the victim take advantage of loneliness in the house.

This study indicates that married, homemaker females are vulnerable to spectrum of stress problems leading to unnatural deaths, more so in first seven years of marriage. Multipronged approach is needed to bring down these potentially preventable deaths and which include measures at society level, strong legislation, counseling of concerned person and preventive measures against further malady.

We suggest following measures and recommendations:

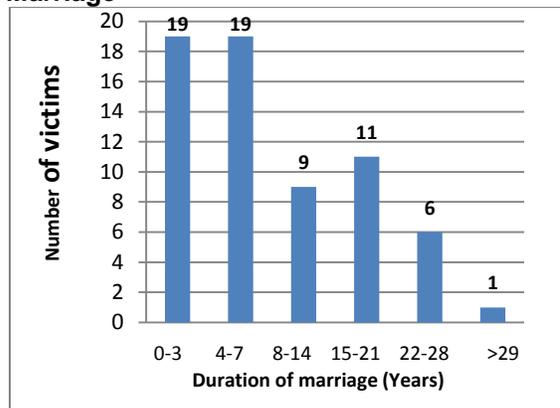
1. Early marriage of women should be discouraged to prevent them from exposure to innate stressful events at an early age.
2. Centres shall be developed to provide free counselling to the families and newly wed couple about their expected problems and their solutions in initial years of marriage.
3. Anti-dowry cell and women protection cell concepts shall be brought up more.
4. An effective coordination should be sought between the NGO's and law enforcing agencies to prevent crime against women.
5. Risk factors of suicides in women should be identified and attended.
6. A change in attitude and mindset of society, judiciary, and the most importantly of a male person (husband/father) who is supposed to be guardian of a woman should be sensitized to make home/workplace a safer and happier place for a woman.

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**Fig. 1: Victims According to Duration of Marriage**



**Table 1: Religion Wise Distribution of Victims**

Religion	Number of victims (Percentage)
Hindu	79 (92.9)
Christian	4 (4.7)
Muslim	2 (2.4)
Total	85 (100.0)

**Table 2: Victims according to Cause of Death**

Cause of death	Number of victims (Percentage)
Hanging	61 (71.8)
Poisoning	10 (11.8)
Burns	4 (4.8)
Road traffic accident	3 (3.5)
Strangulation, smothering	3 (3.5)
Others	4 (4.8)
Total	85 (100)

**Table 3: Age Group Wise Analysis of Manner of Death**

Age group (yrs)	Manner of death			Total
	Accidental	Homicidal	Suicidal	
18-20	1 (16.66)	0 (0)	16 (21.33)	17 (20)
21-30	3 (50)	1 (25)	41 (54.66)	45 (52.9)
31-40	1 (16.66)	2 (50)	13 (17.33)	16 (18.8)
41-50	1 (16.66)	1 (25)	5 (6.66)	7 (8.2)
Total	6 (100)	4 (100)	75 (100)	85 (100)

**Table 4: Cases According to Diurnal Occurrence of Incidence**

Diurnal	Frequency (Percentage)
Early hours of day (4 AM to 12 noon)	29 (34.1)
Later hours of day (After 12 noon to 8 PM)	37 (43.5)
Night hours (After 8 PM to 4 AM)	19 (22.4)
Total	85 (100)

## Original Research Paper

# Reliability of Sternal Index in Sexual Dimorphism In the Haryanvi Population of India

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### Abstract

Assessment of sex is one of the most vital determinations to make when it is necessary to establish identity from skeletal remains. Sternal index, also known as manubrio-corpus index is an important and frequently studied parameter from this point of view. Current study was an attempt to know the reliability of sternal index in the differentiation of sex in the population of Haryana of Northern India. A total of 200 adult sterna (comprising of 100 male and 100 female sterna) from unidentified subjects of confirmed sex were studied and sternal index (length of manubrium divided by length of mesosternum multiplied by 100) was calculated for each of them. The values were subjected to univariate and discriminant function analysis and a comparative analysis was made. The study was further tested for the applicability of Hyrtl's law. Though the values of sternal index were found to be significantly higher in females as compare to males, a thorough statistical analysis found sternal index to be an insignificant parameter in the differentiation of sex in the Haryanvi population of India. Hyrtl's law was also found to be inconclusive with a limited applicability.

**Key Words:** Discriminant function analysis, Hyrtl's law, Identification, Limiting point, Sternum

### Introduction:

Determination of the sex and age is the major criterion for identification of an individual in Forensic practice, irrespective of the fact that the person is living or dead. It is necessary to use bone and dental indicators on decomposed bodies for age-at-death assessment, but sex determination is more problematic when the body is skeletonised. To achieve an assignation of sex, the anthropologist uses biological traits of the skeletal system that vary between the sexes for functional reasons. This variation is exhibited in soft and hard tissue. [1] Largely, Forensic anthropology focuses on sexing skeletal remains, with little or no associated soft tissue.

With a growing appreciation for the importance of population specific standards, the literature is replete with morphometric standards for estimating sex from a variety of bones. [2]

While the skull and pelvis are the most sexually dimorphic regions of the human skeleton and traditionally favored when sex is estimated, the sternum is also sexually dimorphic, with recent research demonstrating an overall classification accuracy above 80% in several populations. [3] Study of sternum as an individual parameter for determination of sex has been attempted by various workers.

Sexual dimorphism in human sternum was first noted by Wenzel as early as in 1788 who observed that manubrium of the two sexes is of almost equal length; the mesosternum is proportionately longer in males than in females. [4] This was followed by Fiegel, Hyrtl and Dwight during the 19<sup>th</sup> century. [5-7] This led to pronouncement of Hyrtl's law that "the manubrium of the female sternum exceeds half the length of the body, while the body in male sternum is, at least, twice as long as manubrium." [6]

Since then a number of anatomists like Strauch and Krause kept on studying the sexual dimorphism of human sterna and suggested that the male sternum is considerably longer than the female and the difference lies in the mesosternal portion of the bone. [8, 9]

An attempt to differentiate sex on the basis of sternal index and the applicability of Hyrtl's law in the same way has been made earlier by various workers across various regions of India and other nations. [7, 10, 11]

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The present study was an attempt to differentiate sex from sternal index and to know its reliability in determination of sex in Haryanvi population of Northern India. The applicability of Hyrtl's law in the sex differentiation was also determined.

### Materials and Methods:

A total number of 200 sterna of both sexes were collected from autopsy subjects brought to the mortuary of the Department of Forensic Medicine and Toxicology, PT. B.D. Sharma Post-Graduate Institute of Medical Sciences, Rohtak (Haryana).

Sterna with fused mesosternum or further fusion of sternal segments from unidentified/unknown adult subjects of confirmed sex (100 males and 100 females) were chosen for the study. Sterna showing any pathology, fracture, gross deformity or unfused mesosternum (after maceration process) were excluded from the study.

The measurements were taken by Vernier calipers to the nearest millimeter according to Ashley technique. [10] The morphometric parameters of the sternum were measured for each sternum:

Length of manubrium ML: distance measured on the anterior surface of the sternum from the centre of suprasternal notch (jugular notch) to the centre of manubrio-mesosternal junction (sternal synchondrosis) in mid-sagittal plane, Length of mesosternum BL: distance measured from the manubrio-mesosternal junction to the xiphi-sternal junction of the sternum in the mid-sagittal plane.

After measuring these two parameters, sternal index was calculated for each sternum by using the formula:

$$\text{Sternal Index (SI)} = (\text{ML/BL}) \times 100$$

The values thus obtained were statistically analyzed using SPSS version 16.0. Univariate analysis and Fisher's linear discriminant function analysis were used to compare the values for males and females. Applicability of Hyrtl's law on these sterna was also studied along with.

The male identification point is the maximal value of a particular dimension in female bones and for the female bone identification point is the minimum value of a particular dimension in male bones.

The area lying between these points was called overlapping zone. The values of bones lying in this zone were said to have overlapped values. A variable having more overlapping area was not thought to be a good estimator. Demarking points are obtained by

calculating the maximum and minimum limits i.e. the range of a particular dimension. Addition of 3 standard deviations to the mean gives the maximum value and subtraction of 3 standard deviations from the mean gives the minimum value. Thus demarking points were obtained above which no female bone could be found and this was the upper calculated range of female bone. Any bone having values more than this was bound to be male.

Similarly from the calculated range of male bones, a demarking point was obtained below which no male bone could be found. Thus, any bone having value less than this was bound to be female. The number of sterna beyond "demarking point" i.e. having value more than the demarking points for males was obtained and the number of bones less than "demarking points" for females was obtained and their percentage was calculated.

Although identification and demarking points can identify sex accurately, but only a small proportion of sterna can be sexed based on these methods as most of the remaining sterna show the measurements in the overlapping zone. Therefore, a limiting point was calculated from the average of male and female identification points. Vast number of male sterna showed value greater than limiting point and the bulk of female sterna showed values lesser than this. In univariate analysis, the mean measurements were compared using unpaired t-test and p values less than or equal to 0.05 were considered to be statistically significant while those less than or equal to 0.001 were highly statistically significant.

### Results and Discussion:

#### 1. Manubrio-corporis index/Sternal index:

##### • Univariate Analysis:

The mean value of sternal index was found to be  $53.69 \pm 9.88$  SD for males and  $61.56 \pm 9.62$  SD for females with a statistical highly significant mean difference ( $p < 0.001$ ) of -7.87. (Table 1) The values were found to be much higher for females than males similar to observed by various workers previous studies. [11-14] The range was found to be varying between 35.74 to 84.37 in males and 43.65 to 88.20 in females. The lesser value of sternal index in males can be attributed to greater length of mesosternum in males.

Results of further analysis on the basis of identification point, demarking point, limiting point and sectioning point analysis showed that not even a single sternum could be correctly classified on the basis of identification point (Male-88.20, Female-35.74) and demarking

point (Male-90.43, Female-24.09) analysis with 100% sterna of each sex falling in overlapping zone of other sex. (Table 2)

With the calculated limiting point of 61.97, 12% of the males and 60% of the females were correctly classified. By "trial and error" method, limiting point of 60 was able to differentiate 20% of the males and 50% of the females which also could not be taken as criteria for differentiation of sex due to poor yield. (Graph 1) Sectioning point of 57.57 was able to differentiate 30% male and 32% female sterna which was very limited and could not be made a basis for sexual dimorphism.

• **Discriminant Function Analysis:**

Discriminant function analysis was used to make study more comprehensive. Fisher's linear discriminant function analysis could classify 70% male and 68% female sterna with an overall yield of 69%. The results of discriminant function analysis were found to be of limited value. (Table 3)

• **Comparative Analysis With Previous Studies:**

The comparison of sternal index with previous studies showed that the present study closely follows the findings of Jit et al and Singh et al study who found statistically highly significant mean difference ( $p < 0.001$ ) with overlapping values of nearly 100% for each sex. [11, 13] This similarity may be attributed to the similar demographic, ethnic and population distribution in North Indian subjects.

With a calculated limiting point of 61.97, 12% of male and 60% of female sterna could be classified from which it may be inferred that more of the female sterna could be correctly classified which is also similar to the results of previous North Indian studies. [11, 13]

**2. Application of Hyrtl's Law:**

A number of workers have applied Hyrtl's law in their studies to find out its reliability in sexual dimorphism from sternum. In the present study 42% of male and 92% of female sterna were found obeying this law. The male sterna obeying the Hyrtl's law were less as compare to American, European and African studies while for female sterna the percentage was much higher.

Thus the results were similar to other Indian studies. (Table 5) When compared to Indian studies, the percentages of male sterna following Hyrtl's law were much higher than most other previous studies while the results were comparable to for female sterna. These all variations and similarities are the result of racial,

ethnic and geographic factors that require further exploration and researches.

**Conclusion:**

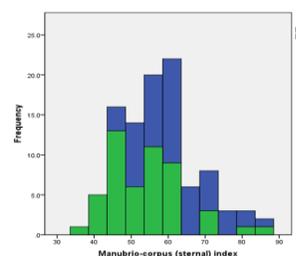
After thorough morphometric and statistical analysis and comparison with other studies, it was concluded that although statistical highly significant sex differences exist in sternal index, it cannot be taken as reliable indicator for sex determination on account of large overlapping values (100%) that limits its applicability for individual subject.

Discriminant functional analysis is of limited value and Hyrtl's law is not applicable to the sterna of Haryanvi population. The variations in the sternal index are on account of different geography, ethnic and racial distribution. Further elaborative morphometric studies are required to make sternal index a valuable parameter in sexual dimorphism.

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**Graph 1: Cent Percent Overlapping Values of Both Sexes**



**Table 1**  
**Descriptive Statistics: Results of Sternal Measurements and Sternal Index**

S. N.	Variables	Male			Female			Mean Diff.	P
		Mean	SD	Range	Mean	SD	Range		
1.	Length of manubrium	48.94	4.70	41.0-61.0	45.42	5.00	36.6-62.0	3.51	<0.001
2.	Length of mesosternum	93.07	13.40	65.1-126.7	74.71	9.00	60.1-100.8	18.36	<0.001
3.	Sternal Index	53.69	9.88	35.74-84.37	61.56	9.62	43.65-88.20	-7.87	<0.001

**Table 2**  
**Sternal index: Identification Point, Demarking Point, Limiting Point and Sectioning Point**

	Identification Point		Demarking point		Limiting Point		Sectioning Point	
	Value	Overlapping Values (%)	Value	Overlapping Values (%)	Value	Classified (%)	Value	Classified (%)
M	88.20	100	90.43	100	61.97	12 (n=12)	57.57	30 (n=30)
F	35.74	100	24.09	100		60 (n=60)		32 (n=32)

**Table 3**  
**Sternal index: Results of Discriminant Function Analysis**

Wilk's Lambda	F	t	Coefficient		Constant		Percentage Classified		
			M	F	M	F	M	F	Overall
0.85	16.27	-4.03	0.56	0.64	-15.83	-20.60	70	68	69

**Table 4**  
**Comparison of Sternal Index with Other Studies**

Study	Sex	Bones	Range	Mean	SD	Overlapping Values (%)
Narayan et al	M	126	31.72-85.33	54.76	9.94	-
	F	27	44.33-80.00	58.98	9.61	-
Jit et al	M	312	35.00-94.00	55.53**	9.57	99.68
	F	88	32.00-88.00	61.80**	10.62	98.86
Dahiphale et al	M	96	36.00-77.00	51.99**	8.34	44.79
	F	47	51.00-91.00	63.01**	8.50	95.74
Hunnargi et al	M	75	36.13-93.06	59.21*	9.85	97.33
	F	40	36.26-88.10	63.31*	9.41	100.00
Atal et al	M	56	38.00-58.00	46.09**	3.750	60.71
	F	44	45.00-62.00	56.70**	3.98	90.91
Singh et al	M	252	39.70-111.76	56.13**	9.39	99.21
	F	91	43.30-88.85	61.23**	11.37	100
Present study	M	100	35.74-84.37	53.69**	4.70	100
	F	100	43.65-88.20	61.56**	5.00	100

SD: Standard Deviation, \* p < 0.05, \*\* p < 0.001

**Table 5**  
**Applicability of Hyrtl's Law as Recorded by Various Workers**

Observer	Sex	Subjects	% Obeying the Law
Dwight, 1881 (United States)	M	30	60.00
	F	26	46.20
Dwight, 1890 (United States)	M	142	59.10
	F	86	60.40
Ashley, 1956 (East Africa)	M	85	64.70
	F	13	69.20
1956 (Europe)	M	378	52.90
	F	171	69.30
Narayan & Verma, 1958 (U.P.)	M	127	34.12
	F	27	81.48
Jit et al, 1980 (North West Chandigarh)	M	312	31.08
	F	88	88.64
Dahiphale et al, 2002 (Gujarat)	M	96	52.20
	F	47	100.00
Hunnargi et al, 2008 (Maharashtra)	M	75	18.70
	F	40	95.00
Present study, 2013 (Haryana)	M	100	42.00
	F	100	92.00

## Original Research Paper

# Diagnosis of Electric Injuries: Histopathological Examination

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### Abstract

The biggest challenge for a Forensic Pathologist is in the diagnosis of electrocution. This study consists eleven cases of electrical shock, which were brought to Mamata General Hospital Khammam, Andhra Pradesh; from Sept 2007 to Oct 2008. The characteristic feature of electrocution being electric contact mark over the body was not present in all mostall cases. Some time it is difficult for Forensic Pathologist to obtain electric mark by histopathological examination. The diagnosis of electrocution is confirmed by histopathological changes in skin. In all cases identified as dead due to electrocution samples were collected, preserved and undertaken for histopathological examination. The main objective is histopathological examination could be an important aid in diagnosis of Electrocution, where the findings were suggestive of electrical injuries. Considering the histopathological changes, nuclear steaming, dermo-epidermal separation and coagulative necrosis were the commonest features in skin with electric contact mark.

**Key Words:** Electric current, Joule Burn, Streaming of Nuclei, Histopathological changes

### Introduction:

The diagnosis of electrocution is poses great difficulty in front of Forensic specialist in most of the cases. Findings such as joule burns were present in many cases of electrocution but in some cases no gross pathological findings can be seen, and at that time, Forensic Pathologist must rely on history and circumstantial evidence. The Forensic Pathologists sometimes try to diagnose electrical deaths by histopathological findings in the skin and viscera. The microscopical changes depend upon electric current which are mainly due to the burns produced by heat and the proof of the electrical burns could produce its own specific microscopic changes.

The streaming of the nuclei is the most characteristic and consistent microscopic feature found in the skin of electricalburns. [1] This palisading appearance of nuclei alone is not evidence of electrocution because these changes are also seen in other cases; they are valuable and useful from the forensic stand point when the circumstantial evidence and other corroborative evidencesare coupled. [2]

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DOR: 09.09.2012 DOA: 15.04.2014

The site of entry of an electric current into the body may lack any visible marks or in some cases may show extensive charring with heat coagulation of the muscles .Most of fatalities are a result from the passage of current. The shape and size of the mark will correspond with the shape and size of the source of the current. The pathognomic features of electrocution are electric marks and joule burns.They are seen when low or medium voltage current is involved. [3]

Electrical marks are not always obvious especially on the hands of manual workers. The electric mark is specific for contact with electricity as a proof of electrocution, when the electric mark is present; there is strong presumption of death due to electrocution.

Most of the times, the forensic pathologist is able to diagnose the electrical injuries with pathognomic marks; however in absence of typical mark he may face problems. In such conditions circumstantial and laboratory evidences aid in the diagnosis. [4]

In electric burnsacroreaction is positive but in thermal burns it is negative. In electrocution the cause of death is ventricular fibrillation, which is confirmed by autopsy findings. [5]The primary concern of this study is histopathological findings could be an important aid in the diagnosis of deaths by electrocution.

### Effects of Electro Trauma on Body:

The extent of electricalburns depends upon the voltage involved, amount of current flow, the area contacted, and the duration of

contact with the electrical source. The contact mark or joule burn indicates entry point of current into the body and depends on the body resistance as well as the current pathway.

Cooking effect of current occurs at points of the poor insulation; the ion mobilization of cellular fluids takes place, resulting in damage to cell membranes. When the resistance of skin is diminished, penetration of current into the skin allows. [6] The current passes through the skin producing heat, which causes boiling and electrolysis of tissue fluids.

The skin explodes and rolls back from the surface. The skin offers high resistance whereas blood offers low resistance and as such within the body, electricity tends to be conducted along the blood vessels. [7]

### 1. Electric Injuries due to Low Voltage:

**Electric mark:** The characteristic electric burn mark is the diagnostic feature when body contact with electricity. At times it may be absent, but when present, raises a strong presumption of death by electrocution. [8]

**Joule burn:** It is specific and diagnostic feature of contact with electricity and is found at the point of entry of current. When the contact is prolonged, the skin mark becomes brown and with further contact, there may be charring. This is known as Joule burn. [9]

If the conductor contains copper, the electric mark shows bright green color. The electrical mark may have a distinctive pattern that of the conductor, especially there is a linear wire or a shaped metal object. When the tip of the wire or rod is at right angle to the skin, the mark may be present as a circular hole penetrating skin, muscle, and even bone simulate a bullet hole.

Joule burn is commonly found on exposed parts of the body, especially on the palmar aspects of hands. [10] Joule burn is endogenous thermal burn due to the heat generated in the body from electric current. Presence of a current mark gives important information how the current path taken place and have a characteristic greyish white parchment like appearance.

In some cases, there may not only be wound of entry but also wound of exit. These exit wounds are variable in appearance but have some features of wound of entry. The tissue in and around exit wound get split and more damage is seen in the form of punctured or lacerated wounds instead of formation of craters, as in entry wounds specially. Exit wound is mostly found on soles of feet. [11]

### 2. Electric injuries due to High Tension:

Injuries by high tension current are by direct contact, or an indirect which is due to arcing or flash-over.

Flash burns result from poor contact with live wire and resistance of dry skin. When a very high voltage current passes by and not through the body, the intense heat resulting from flash-over may produce burns resembling thermal burns. [12]

Very high voltage currents may produce massive destruction of tissue with loss of extremities, rupture of organs, charring of bones, and fusion into pearl like bodies. [13]

Metallization is a specific feature of electrical injury and lightning stroke, the particles of the conductor may have entered the skin, where they may be identified by specific stains; likely to be seen in full development only in the latter circumstance. The face of the victim may become darkened, The color is varied by the composition of the conductor i.e., brown or black if of iron, or yellow-brown if of copper, although copper salts may leave a blue mark on the skin.

This feature is due to the volatilization of the metal particles which are driven in to the skin. It can occur when medium voltage current is passed through the skin. [14]

Small grey-green areas may be present in the floor of the electric mark. Metallization in most of the marks produced by low or medium voltage may be detected only under low magnification or by histo-chemical examination. A positive test is a proof of electrocution.

**The Acroreaction Test:** applied for the identification of electric marks by demonstrating metal particles on the skin surfaces by simple color reactions. The test is based primarily on the solubility of the metal present e.g., iron, copper, aluminum, nickel or zinc, in either hydrochloric or nitric acid.

### Microscopic Features in Electrocution:

Electrical burns usually represent very high temperature burns, and produce characteristic findings of severe thermal denaturation of the collagen causing it to stain blue in the ordinary Hematoxylin and eosin staining. The epidermis is elevated with micro blisters developing within the squamous epithelium as well as in the external horny layer.

These blisters are due to cooking effect on the tissue and represent defects through which the steam exited. [15] Large vacuoles produced by the heat also appear within the epidermal cells. In addition, the nuclei of the

epidermal cells at the site of an electrical burn shows a peculiar distortion with stretching and narrowing of the contour to produce a palisade like appearance, this change is called streaming of the nuclei. These flattened cells usually stain darker than the normal cells with Hematoxylin and eosin. [16]

When contact is prolonged, the skin in the electrical mark acquires a brown tint and gets charred. These changes are called joule burn, a term which distinguishes flash burns.

Electric marks are produced by the conversion of electricity into the heat within the tissues, hence termed "endogenous burns" to distinguish them from "flash" or "exogenous" burns. Heat generated in the skin and more especially in the corium and subcutaneous tissues causes the fluid to boil to produce blisters. When the process is prolonged, the steam thus generated bursts through the skin.

The skin mark turns brown and becomes a joule burn. The characteristic of electrocution being electric contact mark over the body, is absent in many cases.

Sometimes it is very difficult for the forensic pathologist to find proof of an electrical mark, in those circumstances helps histopathological examination. From Forensic stand point, the diagnosis of electrocution is confirmed by histopathological changes in skin and presence of electric injuries.

In our study, it was found that histopathological examination could be an important aid in diagnosis, where the findings were suggestive of electrical injuries. Of these changes, the most common findings were streaming of nuclei, dermo-epidermal junction separation, and coagulation necrosis.

Repeated examination of the clothes and body of the victim, description of all external injuries and specific features of electrical burn marks by electric current, confirmation by histopathological findings, performing a full autopsy and exclusion of other causes for death will help for diagnosis of electrocution.

### **Material and Methods:**

Present study was carried out at Mamata General Hospital attached to Mamata Medical College, Khammam during one year period from Oct 2007 to Sept 2008. All the cases of electric shock reported have been evaluated. Data was collected in a Proforma, samples preserved, and histopathological examination was done analyzed and compared with previous studies and conclusions were drawn.

### **Observations:**

In present study, 11 cases were died due to electrocution, histopathology samples were preserved, histopathological examination was performed on 11 cases, and 10 of the cases were suggestive of electrical injury. The proof for cause of death due to electrocution is confirmed by histopathological findings and specific electric marks, circumstantial evidences.

Demonstration of the skin changes at the point of contact, the epidermis on microscopical examination shows evidence of apparent flattening with some distortion of the shape of cells along the direction of the current.

The epidermis is often separated and elevated with micro blisters within the squamous epithelium as well as in the horny layer. Nuclei of epidermal cell at the site of an electrical burn frequently show stretching and narrowing of the contour to produce a palisading appearance.

These features are often referred as streaming of the nuclei. Proof of an electric mark is obtained by histopathological examination, which is very difficult for forensic pathologist.

It is observed that the histopathological examination could be an important aid in diagnosis. Out of these 11 cases, nuclear streaming was reported in 10 cases (90.90%).

This is most important and consistent microscopic appearance of the nuclei of the stratum basalis and also seen in deep layers of skin with nuclear elongation. These elongated nuclei are pyknotic and mostly seen in peripheral areas of electrical injuries.

Histologically dermo-epidermal separation with vacuolization, the forming of spaces or cavities within cells was reported (90.90%) Microscopically the coagulative necrosis of cells in the epidermis and dermis was found in 10 cases. [90.90%] The depth of the necrosis is useful for whether the burns produced are due to electricity or not.

In case of electricity, borders are indistinct whereas in thermal necrosis they are well demarcated. Blister formation was noted positively in (81.81%) Metallization of skin with trace evidence, deposit of metallic electrode on the skin surface was reported in 8 cases (72.72%). The presence of dark stained metal particles at the entry wounds are characteristic of electrical injury which is due to deposition of conductor metal onto the skin.

We observed that ventricular fibrillation was cause of death. In present study almost all scientific enquiries related to electrical injuries were focused on the changes at the point of contact of the skin with electric current. These

specific changes noted and proved with histopathological methods.

**Discussion:**

In all cases of suspected electrocution, the investigation of electrical burns should involve an attempt to discover the point of contact with the energized source and the point of contact with the ground. In each case, one must appreciate how the electrical circuit was completed from the source, through to the victim and to the ground.

In low voltage electrocution, examination of the device should be done rather than examining the body which will often provide the cause of death because burns may not be present. Thus one can make a diagnosis of electrocution without an electrical burn based on the circumstances of the death, negative autopsy findings and the examination of the electrical device used at the time of death.

In high-voltage electrocution, tissue from the victim may be adherent at the point of contact with the source of the current. The clothing should be examined carefully for burns, melting, or other evidence of thermal damage that represents points of contact with electrically charged object.

Electric mark and joule burn are the pathognomic features of electric shock when low or medium voltage current is involved. High-tension currents cause gross electrical injuries, which are a result of direct contact, flash-over or thermal burns. Electric marks are not always obvious especially on the hands of manual workers. Proof of an electric mark is obtained by histological and histochemical examination or electro-microscopic methods which are useful for a forensic pathologist to rule out the cause of death due to electrocution.

Circumstantial findings are corroborative in cases of electrocution. The present study observed that the histo-pathological examination could be an important aid in diagnosis of electric injuries. The skin changes at electrocution site; basically it is an electrical burn. These local lesions are usually found in the hands or fingers at points of entry and exit of electric current, which are more severe and observed mostly over feet or opposite hands.

In present study, in ten cases findings were suggestive of electrical injuries at these sites histopathologically. Nuclei of epidermal cell at the site of an electrical burn frequently show stretching of and narrowing of the contour to produce a palisading fashion of appearance. This change is often referred as to streaming of the nuclei. Of these changes, the most common findings are streaming of nuclei in 10 cases, and

dermo-epidermal junction separation in 10 cases and coagulative necrosis in 10 cases. These findings are similar to studies carried by authors. [1, 4, 11, 15]

Presence of associated features may be useful for diagnosis of electric injuries such as elongation of the cells in the skin layers. Blister formation was noted positively in 9 cases [81.81%]. These are consistent with authors. [4, 6] Death due to electrocution was confirmed by supportive histopathological changes in organs and skin. Histopathological changes were seen in the entire skin specimen, who had contact mark. The histopathological changes as vacuolization and honey comb appearance in the deep layers of epidermis and dermis of skin formed by gas spaces from heated tissue fluids splitting the cells apart was less significant.

In India the domestic voltage supply is higher [220 v] than western countries [110v]. This may be cause for separation of epithelial cells and absence of honey comb appearance. Break or breach in epidermis along with separation of epithelial cells adjacent to breach is seen with vertical orientation of nuclei. [8, 13]

When cases present with electric contact marks which are evident, histopathological findings were used as supportive evidence for cause of death.

However in where electric contact mark was absent, positive histopathological findings were used to give the cause of death as electrocution. [5, 6] Tissue from the victim may be adherent at the point of contact with the source of the current. This explains that the low voltage electric accidents were present with contact mark and high voltage electric accidents invariably present as flash burns. These are consistent with authors. [14]

The causes for the electric injuries are thoroughly investigated on grounds of safety and compensation. Human negligence was mainly responsible for electrical accidents.

Autopsy reveals petechial hemorrhages present in white matter of brain, pleura, and pericardium with dilated heart and visceral congestion. No specific gross internal findings of organs were observed at autopsy. Similar findings were made by authors. [15]

In present study the most common histopathological lesions were nuclear streaming, dermo-epidermal separation with vacuolation, and coagulation necrosis. Similar findings are noted by authors. [4, 6, 15]

Electrical accidents involving low voltage constitutes (83.87%) while high voltage constitutes (16.12%). These are consistent with authors. [8, 14] This could be explained that the

low or medium voltage current are mainly responsible for the electrical injuries while home appliance and equipment handling at work place which are increases the electrical accidents. In low or medium voltage accidents, the electrical injuries are present as contact mark. These are consistent with authors. [11, 14, 15]

Determination of the histological appearances of the electrical wounds are rather controversial, as some changes formerly claimed to be specific for electrical lesions have been shown to be thermal in nature. There is little that is absolutely pathognomic of electrical, as opposed to purely thermal, burns.

**Conclusions:**

Most of low voltage electric injuries were present with contact wounds.

- Electric contact mark is pathognomic of electrocution.
- Histopathological changes were used as supportive evidence in giving cause of death in presence of contact mark.
- Histopathological changes were used to give cause of death where no electric contact marks were found.
- Histopathological changes are present in 10 specimens of skin with contact mark.
- Heart specimens were observed for specific features of electrocution.
- Kidney specimens were nonspecific. Petechial hemorrhages found in white matter of brain.

At present the diagnosis of death from electrical injury quite often is based on histopathological findings and electric contact marks.

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**Table 1: Histopathological Changes**

S.N.	Pathological features	Cases (%)
1	Streaming of nuclei	10(90.90)
2	Dermo-epidermal separation	10(90.90)
3	Degeneration of collagen in dermis with Coagulative necrosis	10(90.90)
4	Pyknoses of nuclei	6
5	Hyperkeratosis	5
6	Micro blister formation	9
7	Degeneration of collagen in Keratin layer	4
8	Metallization	9

## Original Research Paper

# Trends of Poisoning in Western Utter Pradesh A Clinico-pathological Study

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### Abstract

Drugs and chemicals are a great danger to human lives but most of the poisoning in our country is due to pesticides and insecticides. In this paper the cases of poisoning admitted in Subharti Hospital Meerut were studied for epidemiological, clinico-pathological and medico-legal aspects. Majority of the poisoning victims are young adults, Hindus between 16-35 years of age with preponderance of Male (61.11%) over female (38.88%). Most of the victims belonged to lower or lower-middle class. Pesticides especially Aluminium phosphide (31.74%) and organophosphates (20.63%) are responsible for more than two-third (72.22%) of the casualties. Nausea & vomiting was the most common symptom seen in 41.26% patients followed by altered consciousness (39.68%) and burning pain in abdomen (21.42%). Majority of poisoning cases (82.53%) were suggestive of suicide, of which family quarrel (36.54%) and unemployment or loss in business (14.42%) were more common in male and ill treatment by husband/in-laws (13.46%) in female.

**Key Words:** Poison, Pesticide & insecticide, Nausea & vomiting, Constricted pupil, Suicidal

### Introduction:

Poison is a substance which has deleterious effect on living organisms produces ill health or death by direct contact or by absorption in the body. With advancement in science and technology large number of harmful chemicals especially insecticides and pesticides are invented to protect farming. But now they become a serious threat to human lives. [1]

The cases of poisoning by Corrosives, Sedatives & hypnotics, Alcohol, Dhatura, Oleanders, Snake bite etc. are also frequently reported in adults and by Kerosene and cleaning agents in children. [9]

Meerut though an agriculture dominant belt of western Utter Pradesh, its geographical proximity to National Capital Region Delhi exposes youths to higher living standards and western culture including consumption of alcohol and other intoxicating drugs. This all forces them sometimes to take hasty decision to end their lives.

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DOR: 20.02.2014 DOA: 15.04.2014

So this study was undertaken to find out the trend of poisoning and effect of modern treatment on its morbidity and mortality.

### Material and Methods:

All the cases of poisoning including alcohol intoxication admitted in the Chatrapati Shivaji Subharti Hospital Meerut from 1<sup>st</sup> September 2011 to 31<sup>st</sup> May 2013 were studied for their epidemiological, clinico-pathological and medico-legal aspects.

Various epidemiological details including age, sex, religion, education, socioeconomic status etc. and data regarding mental status, personal habit, type & amount of poison consumed, early symptoms, duration of their appearance and reason behind intake etc. were collected from the patient, relatives, friends and other accompanying persons.

The general condition of patient including pulse, blood pressure, respiration, level of consciousness, pupillary condition, cyanosis, gait, speech, coordination etc. were noted after examination in collaboration with the residents of Department of Medicine and investigations & treatment from the hospital records. Attempt is also made to collect information from police records and news items from reputed news papers.

All the information of every case was recorded carefully on format and analyzed & presented in tables, bar and pie diagrams in result.

## Observation and Results:

### Epidemiological Profile

The present study was carried out in 126 patients of poisoning admitted in C.S.S. Hospital Meerut from 1<sup>st</sup> September 2011 to 30<sup>th</sup> May 2013. Two-third (65.86%) of the poisoning patients in this study were between 10-30 yrs of age, equally distributed between 11-20 (32.53%) and 21-30 (33.33 %) years of age group, followed by 31-40(15.87 %) and 41-50 (8.73&) years. (Table 1)

Gender-wise males (61.11%) were more in comparison to female (38.88%). Preponderance of male over female was observed in almost all the age groups except in 11-20 and above 50 years of age where proportion of female was little higher. Majority of the poisoning victims were not only young but unmarried (57.14 %) too. 41.26% of the cases were married and one (0.70%) was divorcee.

As to the religious faith, Hindus were more frequent (91.26%) victims of the poisoning as per their share in population. Poisoning cases were comparatively less in Muslims (7.93%) and Sikhs (0.79%) communities.

Most of the cases (88.89%) of poisoning were literate, educated up to higher secondary in 45.23% and graduate in 19.84% of the total cases but this education was not sufficient to get desired employment.

The only professionally qualified case in this study was an engineer, who has committed suicide due to unemployment by taking Ketamine, an anaesthetic drug used in rave parties. Majority of poisoning cases were from lower socio-economic status, of which 46.82% from lower middle and 40.47% from lower income group.

They were also from a joint (58.73%) or from a nuclear (36.5%) family and dependent on their parents/in-laws in majority (60.30%) of the cases, of which 20.63% of the patients were either unemployed or school/college going and 19.04% were housewives. Only 13.49% were farmer, 12.69% in service and 7.93% running small business shop. (Table 2)

Pesticides and insecticides was the most common (72.22%) source of poisoning, of which Aluminium phosphide (AIP- 31.74%) and Organophosphates (OP- 20.63%) were the commonest. The cases of other pesticides such as Cypermethrin, a mosquito repellent (5.55%) Organo-chlorines (4.76%) & Rat poisons (5.55%) Endosulphan, Ethylene Di Bromide Paraquat, Thiocarbamate etc. were also reported in few cases. (Fig.1)

Poisoning by Caustic Soda, Benzodiazepine, Oleander (*Cerbera thevetia*) etc. were also seen but exact nature of poison could not be ascertained in 17.46% cases.

All most all (99.2%) the poisons were taken orally in this study except in one case where the dead body was found in a tanker; probably the victim inhaled petroleum vapour during cleaning.

### Clinico-Pathological Features:

Though nausea and vomiting, burning pain in abdomen and uneasiness was the first symptom complained by the patients in 41.26%, 21.42% & 18.25% cases respectively but the common presentation in hospital was altered consciousness in 39.68%, dilated pupil in 35.71%, constricted pupil in 30.15%, flushed skin in 17.46% and slurred speech in 13.49% cases of poisoning. (Table 3)

Though dilated pupils were observed in more than one-third of the cases but most of them were treated with atropine as antidote by first attending physician irrespective of knowing the nature of the poison.

Signs & symptoms and treatment depend more or less on individual poisoning. In a comparative study of two most common poisonings i.e. Organo-phosphate & Aluminium phosphide, though nausea & vomiting are common in both the cases, Kerosene like smell (53.84%), constricted pupil (88.46%), abdominal cramps (46.15%) and increased salivation (34.61%) was more common in OP.

While garlicky odour (30%), breathlessness (80%), palpitation (72.5%), burning epigastric pain (67.5%) and diarrhoea (47.5%) are common in AIP poisoning. (Table 4)

Gastric lavage (93.65%) and activated charcoal (84.12%) was administered in almost all the cases irrespective of the nature and type of poison. The management differs in terms of antidotes as Atropine alone or with Pralidoxime was used in 96.15% cases of OP poisoning and MgSO<sub>4</sub>, though not an antidote, was given in 87.5% cases of AIP and the life of 88.09% of the patients were saved. The Mortality rate was higher (25%) in AIP poisoning as compared to OP (15.38%). (Table 5)

### Medico-legal Aspects:

Majority of the poisoning cases (82.53%) were suicidal in nature, of which Family quarrel & unhappiness (36.54%) and Unemployment or loss in business (14.42%) in male and Ill treatment by husband/in laws (13.46%) in female are the prime motives behind committing suicide. (Fig. 2)

Accidental cases were 12.69% where poison was taken mainly by mistake. Homicidal

intention was observed in six (4.76%) cases; all were children below 6 years, killed by their parents those have committed suicide after giving poison (altruistic filicide).

### Discussion:

Most of the cases of poisoning in this study were young adult males between 16-35 yrs of age and majority of them were unmarried dependant on their families. It was also observed that most of the poisonings cases were suicidal in nature. This indicates that young men those had just encountered with the hardships of life and if they failed to achieve the goal, take poison to commit suicide.

Similar results were also seen other parts of the county. [4, 6] The poisonings in children below 12 years were either accidental or forced to drink poison by their parents in love because they had decided to end their lives and did not want to leave their children as orphan.

In this study only 13.49% were farmers, as against higher number reported in other parts of country. [3, 5] However, in a study in rural areas of Punjab, farmers were only 12.82% of all poisoning cases, supporting the hypothesis that where farmers are in better financial condition, incidence of suicidal poisoning is less. [10] This is also true with Meerut.

Pesticides were the main source of poisoning in majority (69%) of the cases because these are easily available, cheap and highly toxic. Aluminium phosphide and organophosphate are the two commonest pesticides whose poisonings are prevalent throughout the country. In some regions Aluminium phosphide is the commonest [2] while organophosphate in other places. [3, 11]

Mosquito repellents such as All-out, Mortein, Good-Night etc. are commonly used in urban regions, ingested impulsively by younger students for the same region. Nausea and vomiting was the most common symptom seen in 41.26% cases just after taking meal/drink by a healthy person.

Apart from nausea, vomiting & burning pain in abdomen, altered consciousness, constricted pupil, flushed skin & slurred speech were also seen in large number of cases. But these features vary in individual poisoning.

In comparison of the symptoms of poisoning due to Aluminium Phosphide & Organophosphates, though gastrointestinal symptoms were seen in both; restlessness, burning pain in abdomen & diarrhoea were more common with AIP poisoning and constricted pupil, increased salivation & kerosene like smell in OP poisoning.

Gastric lavage, activated charcoal and atropine with/without Oximes were given in OP & OC poisoning. Only 15% of the patients died probably they brought to the hospital late in low condition. Though there is no specific antidote of AIP, MgSO<sub>4</sub> was given and most of them responded well. About 25% of the cases died in this study, mostly due to cardiac complications.

Majority (82.53%) of the poisoning cases are suicidal. Similar results were also observed in a study in Saurashtra Region of Gujarat, in which suicidal cases were as high as 92.8% of the total poisonings. [7]

Such type of scenario was also observed in other parts of country. [3, 10] Family quarrel and marital unhappiness was the most common reason behind committing suicide in married person, probably due to unemployment or inability to bear the responsibility of family which forces them to end their lives.

Ill treatment by husband &/or in-laws was one of the main reason in females. It indicates that in spite of widespread efforts to reduce domestic violence against women, problems related to dowry & child marriage are still exist in the society. Similar results were also observed by Patel in Jagdalpur. [8]

Poverty especially indebtedness is also an important reason behind committing suicide seen in 9.62% cases. In two tragic incidents all the members of family tried to end their lives by taking poison.

### Conclusion:

In our study majority of the cases of poisoning (72.22%) were young adults between 16-35 years of age and males (61.11%) predominated over females (38.89%).

Male female ratio was 1.57:1. Most of the patients belonged to poor socioeconomic status and lived in a joint/nuclear family structure. More than half of the cases (57.14%) were unmarried either school going or unemployed. Pesticides were the main source of poisoning (69%) of which Aluminium Phosphide and Organophosphates are the commonest.

Most of the poisoning cases are suicidal (82.55%) and family quarrel & unhappiness (34.54%) & unemployment or loss in business (14.42%) were the prime motives in males and ill treatment by husband &/or in laws (13.46%) in females.

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**Table 1: Age & Gender Wise Distribution of Poisoning Cases**

Age group (yrs)	Male (%)	Female (%)	Total (%)
<10	05 (3.96)	05 (3.96)	10 (7.93)
11-20	20 (15.87)	21 (16.66)	41 (32.53)
21-30	31 (24.6)	11 (8.73)	42 (33.33)
31-40	11 (8.73)	09 (7.14)	20 (15.87)
41-50	10 (7.93)	01 (0.79)	11 (8.73)
>50	0 (0)	02 (1.58)	02 (1.58)
Total	77 (61.11)	49 (38.88)	126 (100)

**Table 2: Occupation of Poisoning Cases**

Occupation	Cases (%)
Agriculture	17 (13.49)
Businessman	10 (7.93)
Housewife	24 (19.04)
Labourer	02 (1.58)
School/College going	26 (20.63)
Service	16 (12.69)
Unemployed	26 (20.63)
Professional	01 (0.79)
Any other	04 (3.17)
Total	126 (100)

**Table 3: Common Symptoms on Hospital Admission (n=126)**

Symptom	Cases (%)
Altered consciousness	50 (39.68)
Slurred speech	17 (13.49)
Altered gait	12 (9.52)
Constricted pupil	38 (30.15)
Dilated pupil	45 (35.71)
Flushed skin	22 (17.46)

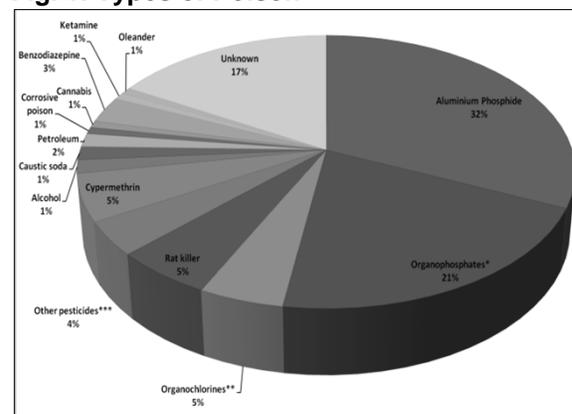
**Table 4: Comparison between Clinical Features of OP & AIP Poisoning**

Clinical Features	AIP cases (%) (n=40)	OP cases (%) (n=26)
Garlicky odour	12 (30)	0 (0)
Kerosene Like odour	0 (0)	14 (53.84)
Nausea and Vomiting	38 (95)	22 (85.02)
Diarrhoea	19 (47.5)	06 (23.07)
Pain in Abdomen	27 (68.5)	12 (46.15)
Increased secretion	04 (10)	09 (34.61)
Breathlessness	32 (80)	09 (34.61)
Palpitation	29 (72.5)	02 (7.69)
Convulsions & Fasciculation	0 (0)	02 (7.69)
Restlessness	38 (95)	12 (46.15)

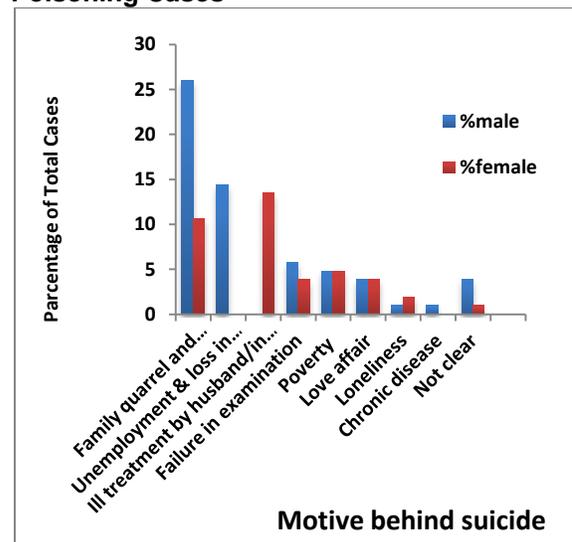
**Table 5: Comparison between Treatment and Prognosis of OP & AIP Poisonings**

Treatment & Prognosis	AIP (40) Cases (%)	OP (26) Cases (%)
Gastric lavage	38 (95)	22 (84.61)
Activated charcoal	37 (92.5)	23 (88.46)
MgSO <sub>4</sub>	34 (87.5)	00 (0)
Atropine	00 (0)	05 (19.23)
Atropine+ Pralidoxime	00 (0)	20 (76.92)
Death	10 (25)	04 (15.38)

**Fig. 1: Types of Poison**



**Fig. 2: Apparent Motive of Suicide in Poisoning Cases**



## Original Research Paper

# A Study of Sacral Index and Its Interpretation in Sex Determination in Madhya Pradesh

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### Abstract

Various parameters and indices are available based on which the sex can be determined using sacrum. These parameters and indices vary region wise also. Therefore we undertook the study in Madhya Pradesh region. Total 126 dry human adult sacra of known sex (76 male & 50 female) were obtained from various Medical Colleges of Madhya Pradesh. Maximum length and maximum width of sacrum were studied. Sacral index (SI) arrived from the measured parameters. Demarking Point (DP) helps in sexing the sacrum with certainty. Maximum length of sacrum is found statistically significant ( $p < 0.0001$ ,  $t = 8.67$ ), DP for maximum length for male sacrum is  $> 124.40$  mm and for female is  $< 81.92$  mm. Maximum width of sacrum is found statistically not significant ( $p = 0.99$ ,  $t = 0.018$ ). The SI is found statistically significant ( $p < 0.0001$ ,  $t = 9.63$ ) for sexing the sacrum in the present study. DP of SI for male is  $< 84.20$  and for female is  $> 123.06$  and 6.57% male and 12% female sacra fall beyond DP.

**Key Words:** Sacrum, Sex determination, Sacral Index, Demarking point

### Introduction:

Establishing the Identity of human remains is one of the most important aspect in which a Forensic Medicine expert has to give his opinion for an unknown and mutilated dead body. Especially when an unknown skeleton is been supplied for its opinion regarding the identification, sacral bone carries much of the importance for sex determination.

The exact establishment of identity of sex in archaeological and medico legal samples of bone depends on the number of bones sent for examination. It was observed by Taylor in his book of Medical jurisprudence, that:

a	Skull + Femur	97.35%
b	Coccyx + sacrum	97.18%
c	Pelvis alone	95.00%
d	Skull alone	91.38%
e	Femur alone	39.84%
f	Atlas vertebra	31.18%

Krogman gave the opinion that the accuracy of sex identification based on the study of complete skeleton was 100% and skull with pelvis 98%, pelvis alone 95%, skull alone 90% and long bones alone 80%.

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DOR: 25.02.2014 DOA: 17.04.2014

He subsequently made an estimate to reduce the above figures by 5-10% depending upon completeness of the material to be sexed.

Both the above authors have worked on the sexing of the bones using the various statistical analysis. However identification of sex using observations on multiple bones using different parameter is recommended than using a single bone. [1-3]

The geometry of sacra (length and breadth) also varies among different populations leading to variations in average sacral index (SI) among different population. [4, 5]

Calculation of Demarcating Point (DP) for the parameters used in sex identification increases the accuracy by 100% [6] and DP was calculated for each and every population to get accurate results in the process of identifying the sex. [7]

### Materials and Methods:

In present study 126 sacra of known sexes (76 male and 50 female sacra) were collected from Sri Aurobindo Medical College, Indore M.P, MGM Medical College, Indore, M.P, R. D. Gardi Medical College, Ujjain, M.P and N.S.C.B. Medical College, Jabalpur, M.P.

#### Instruments used were:

1. Sliding digital Vernier calliper.
2. Standardized flexible ribbon tape.

In order to avoid manual errors, sufficient care was taken and all parameters were measured accurately. From each sacrum, following metrical data was recorded as in the

manner described below:

a. **Maximum length of Sacrum (Wilders mid-ventral Straight length):**

It was measured along the mid-line of sacrum with the Vernier calliper from middle of antero-superior margin of promontory to middle of antero-inferior margin of the last sacral vertebra. (Fig. 1)

b. **Maximum breadth of sacrum:**

It was measured with the Vernier calliper by taking two points at the upper part of auricular surface anteriorly (or lateral most part of ala of sacrum), thus maximum breadth was measured on anterior aspect of sacrum. (Fig. 2)

By using the above measurements, the sacral index was calculated:

**Sacral index:** Widthx100/Straight Length

The Demarking Points [D.P.] suggested by Jit and Singh [6] were used for identification of sex of sacrum with 100% accuracy.

For identification of male sacrum, the D.P. of a particular measurement was more than 3 S.D of the female mean value. Similarly, for identification of female sacrum, the D.P. of the same measurement was less than 3 S.D. of the male mean value.

**Demarking Point and Calculated Range:**

Mean and standard deviation were calculated for the ranges of each parameter of both the sexes. Using these values calculated range was arrived at by the formula '**Mean +/- 3SD**'.

Generally parameters are higher in males in comparison to females, in such parameters, for a given male, calculated range of 'a to b' and female calculated 'x to y'.

Values of 'a' (min. in male range) and 'y' (max. in female range) were chosen as 'demarking points'. But parameters which are less in males in comparison to females, in such parameters, for a given male, calculated range of 'a to b' and female calculated 'x to y'. Values of 'a' (max. in male range) and 'y' (min. in female range) were chosen as 'demarking points'.

**Fig. 1: Maximum length of Sacrum is being measured**



**Fig. 2: Maximum Width of Sacrum is being measured**



**Result:**

In this study the Mean value, Calculated range, 'P' value for statistical significance, Demarking point and % of bones identified with the help of demarking point for maximum length, maximum width and Sacral index (SI) for both the sex was analyzed and tabulated. (Table 1)

Maximum length of sacrum is found statistically significant ( $p < 0.0001$ ,  $t = 8.67$ ), demarking point for maximum length for male sacrum is  $>124.40$  mm and for female is  $<81.92$  mm. Maximum width of sacrum is found statistically not significant ( $p = 0.99$ ,  $t = 0.018$ ).

The Sacral Index is found statistically significant ( $p < 0.0001$ ,  $t = 9.63$ ) for sexing the sacrum in the present study. Demarking point for sacral index for male is  $<84.20$  mm and for female is  $>123.06$  mm. Maximum samples for maximum length of sacra of male fall in the range of 100-110 and 110-120 i.e. 31 and 30 respectively and samples of female fall in the range of 90- 100 i.e. 19 sacrum. (Fig. 3)

Our study showed that the maximum samples for maximum width of male and female sacra fall in the range of 100-110 i.e. 48 and 19 respectively. (Fig.4) while the maximum samples for sacral index of male sacra fall in the range of 90-100 i.e. 31 and samples of female fall in the range of 100-110 i.e. 19 sacrum. (Fig. 5)

**Discussion:**

In present study average value for sacral index in males was 97.61 and that for females was 113.40. Mean value of female was significantly higher than male. 6.57% male and 12% female bones fall beyond Demarking Point. Difference between male and female mean was statistically highly significant.

The mean value of Sacral index for male sacra (97.61) in this study was higher than that of Kolkata region (94.9) studied by Mazumdar et al [11], Amritsar region (93.69) studied by Arora et al [9], Gulbarga region (94.24) studied by Math Sailaja C [8], Dhapate SS (94.58) [13],

Singh et al (94.32) [7], Jana et al [14] (91.27) and Bagde (94.75). [15]

It was lesser than that of Amritsar region (100.24) studied by Sachdeva K et al [10], Shreekrishna HK et al [12], Tamilnadu (99.21), Varanasi region (100.85) studied by Raju et al [19], Flander white (106.49) Black (106.17) [17], Davivongs (104.16) [4], Charnalia (105.1) [16], Grays Anatomy (105.1) [20] and it was very close to that of Patel et al [1] Jamnagar (96.25), Agra region (98.21) studied by Mishra et al. [2]

The mean value of Sacral index for female sacra (113.40) in present study was higher than that of Kolkata region (109.8) studied by Mazumdar et al [11], Amritsar region (111.74) studied by Sachdeva K et al, Dhapate SS (104.27) [13], Singh et al (104.81) [7], Jana et al (103.89) [14], Varanasi region (111.39) studied by Raju et al [19] and Flander white (108.69). [17]

It was lesser than that of Shreekrishna HK et al [12] in Tamilnadu (119.94), Amritsar region (125.35) studied by Arora et al [9], Agra region (117.84) studied by Mishra et al [2] and Davivongs (115.49) [4] and it was very close to Gulbarga region (113.19) studied by Math Sailaja C [8], Patel et al [1] Jamnagar (113.25), Bagde(112.05) [15], Flander Black (112.35) [17] and Charnalia (112). [16] All studies including present study found sacral index for sex determination statistically significant except Flander [17] study for Black population.

### Conclusion:

Since sacrum is a component of pelvic girdle with functional differences between the two sexes, it itself becomes important for identification of sex in the human skeletal system. Sacral index (SI) is the best parameter for identification of sex. Maximum length of sacrum is found statistically significant.

Maximum width of sacrum is found statistically not significant. The Sacral Index is found statistically significant for sexing the sacrum in the present study. However, not a single parameter could identify sex in 100% of the bones. Hence, it can be concluded that sex determination of the sacrum with 100% accuracy is possible only when maximum number of parameters are taken into consideration.

Continuance of such studies in a defined geographic area over a period of time will definitely help in establishing the anthropometric standards. Such studies will also be useful to observe the changing trends if any, in the metric measurements which is influenced by environmental, socioeconomic factors, physical stress and genetic factors.

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**Fig. 3: Maximum Length of Sacrum (wilders mid – ventral straight length) in mm**

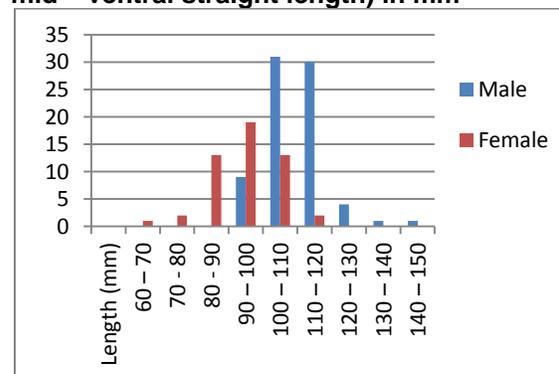


Fig. 4: Maximum Breadth of Sacrum in mm

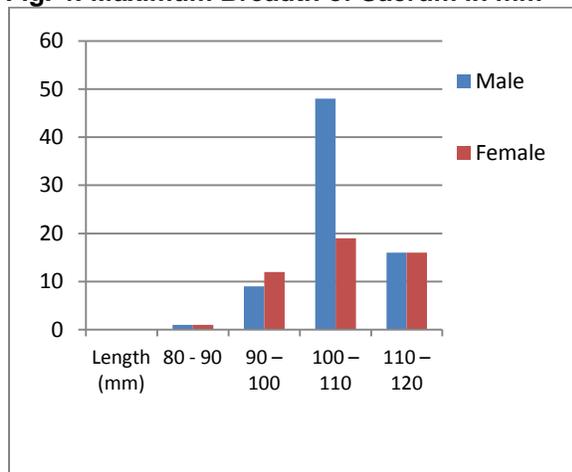


Fig. 5: Sacral Index

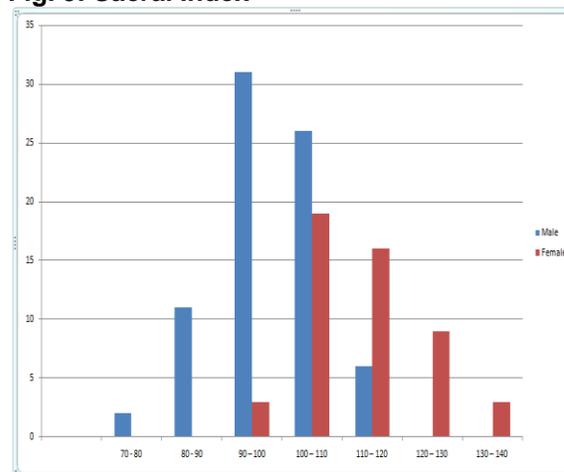


Table 1  
Various Parameters of Sacrum and their Statistical Analysis

S. N.	Parameters	Sex	Range	Mean	S.D.	t' value	p' value	Calculated range Mean+ S.D.	D.P.	% of bone identified by D.P.
1	Length of sacrum (mm)	M (76)	94.54-145.95	109.47	9.18	8.67	<0.0001	81.92 - 137.02	>124.4	5/76
		F (50)	68.84-118.18	94.46	9.98			64.52 - 124.4	<81.92	4/50
2	Width of sacrum (mm)	M (76)	88.0-125.02	106.42	6.64	0.018	0.99	86.49 - 126.36	<81.64	0/76
		F (50)	88.5-128.66	106.45	8.27			81.64 - 131.26	>126.36	1/50
3	Sacral index	M (76)	72.02-112.71	97.61	8.48	9.63	<0.0001	72.16 - 123.06	<84.20	5/76
		F (50)	93.01-139.34	113.4	9.73			84.20 - 142.60	>123.06	6/50

Table 2  
Comparative Number & Percentage of Bones in which Sex could be Identified using Demarking Points as the Parameter

S.N.	Parameters	Sex	Present study	Mishra et al	Raju et al	Arora et al	Patel et al	Shreekrishna et al	Mazumdar et al	Shailja et al
1	Length of Sacrum	M	6.57	71.60	42.40	60	-	-	7.90	14.43
		F	8	23.08	-	0	-	-	-	15.39
2	Width of Sacrum	M	0	0	9.10	0	-	-	0	0.57
		F	2	0	-	0	-	-	-	0
3	Sacral index	M	6.57	39.20	0	45	62.50	56	9.40	0
		F	12	80	0	40	68.75	78	44.70	0

## Original Research Paper

# Awareness about Consumer Protection Act and Medical Negligence among Private and Government Medical College & Hospital Faculty Members

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### Abstract

The Consumer Protection Act 1986 provides protection to the rights of consumers and redressal of consumer disputes. Medical profession was included within its ambit in 1995. Since then large number of patients and consumer organizations are approaching the consumer courts for the redressal of their grievances against doctors and hospitals. The current study was conducted to know awareness about CPA and medical negligence among medical and surgical specialists working in Private and Govt. Medical Colleges. It was found that the awareness about CPA and medical negligence among the medical as well as surgical specialists was unsatisfactory.

A total of 75% of medical specialists working in Private Medical College scored very poor to poor and 25% scored moderate to good. 80% of medical specialists working in Govt. Medical College scored very poor to poor and 20% scored moderate. 60% of surgical specialists working in Private Medical College scored very poor to poor and 25% scored moderate to good and 50% of surgical specialists working in Govt. Medical College scored very poor to poor and 50% scored moderate to excellent.

**Key Words:** CPA, Medical Negligence, Awareness among Practitioners

### Introduction:

In the history of Indian legislation, enactment of Consumer Protection Act (CPA) 1986 clearly reveals the recognition and growth of consumer jurisprudence. The Consumer Protection Act is a compassionate social legislation that provides for protection of rights of the consumers and redressal of consumer disputes. CPA has provided for three tier quasi-judicial consumer dispute redressal mechanism at district, state and national level.

The Act applies to all goods and services, excluding goods for resale or for commercial purpose, services rendered free of charge and under a contract for personal service. After about a decade of its enactment, in 1995, medical profession was also included within the ambit of CPA by the Supreme Court of India in a landmark case of Indian Medical Association vs. VP Shantha. [1]

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DOR: 10.03.2014 DOA: 12.04.2014

Initially there was a hue and cry amongst the medical fraternity. But now plenty of water has passed under the bridge. Willingly or unwillingly, the medical fraternity has accepted the truth. Large number of patients and consumer organizations are approaching the consumer courts for the redressal of their grievances against doctors and hospitals. It is essential on the part of medical professionals to have adequate knowledge and awareness about CPA and its implication on their profession.

### Aims and Objectives:

1. To study an awareness about Consumer Protection Act (CPA) and medical negligence among the faculty of medical and surgical specialties of Dayanand Medical College & Hospital, Ludhiana and Govt. Medical College & Hospital, Patiala.
2. To compare the awareness about CPA and medical negligence among the faculty members of medical and surgical specialties of Govt. and Private institution.

### Material and Methods:

The present study was conducted on 80 faculty members of Dayanand Medical College & Hospital, Ludhiana, and Govt. Medical College & Hospital, Patiala (20 faculty members from medical specialties and 20 faculty members from surgical specialties each from Dayanand

Medical College and Hospital and Govt. Medical College and Hospital, Patiala).

Written informed consent was obtained from the participants after providing them the information sheet that explained the purpose of the study. A self-administered questionnaire having 15 questions related to various aspects of Consumer Protection Act (CPA) and medical negligence will be provided to the participants.

Each question had four options; out of which participant had to mark the most appropriate one. The participants were asked to respond to these 15 questions in half an hour and once the participants replied the queries the questionnaires were taken back.

Confidentiality was maintained throughout the whole process of collection of data and its analysis. Those who refused to participate or were not available on third visit were excluded from the study.

For the purpose of analysis each correct answer is given score 'one' and wrong answer/un-attempted question is given score 'zero'. The individual scores were summed up to yield a total score. Scores were converted into percentage.

**Scope of Consumer Protection Act:**

CPA has provided for three tier quasi-judicial consumer dispute redressal mechanism:

1. **District Consumer Dispute Redressal Forum**
  - Pecuniary jurisdiction: up to Rs. 20 Lakhs
  - Appeal lies to the State commission within 30 days of receipt of the order.
2. **State Consumer Dispute Redressal Commission**
  - Pecuniary jurisdiction: Rs. 20 Lakhs to 1 Crores.
  - Appeal lies to the National commission within 30 days of receipt of the order.
3. **National Consumer Dispute Redressal Commission**
  - Pecuniary jurisdiction: Rs.20 Lakhs to 1 Crores.
  - Appeal lies to the Supreme Court within 30 days of receipt of the order.

**Important Definitions, Relevant to Medical Profession: [2]**

• **Who is a Consumer?**

Consumer is a person who buys any goods for a consideration .....Sec 2(1) (d) (i) or hires or avails of any services for a consideration which has been paid or promised or partly paid and part by promised, or under any system of deferred payment and includes any beneficiary of such services other than the

person who hires or avails of the services for consideration paid or promised, or partly paid and partly promised, or under any system of deferred payment, when such services are availed of with the approval of the first mentioned person. Sec 2(1) (d) (ii)

**What is a Defect?**

Any fault, imperfection or shortcoming in the quality, quantity, potency, purity or standard which is required to be maintained by or under any law for the time being in force under any contract, express or implied or as is claimed by the trader in any manner whatsoever in relation to any goods. Sec 2(1) (f)

**What is Deficiency?**

Any fault, imperfection, shortcoming or inadequacy in the quality, nature and manner of performance which is required to be maintained by or under any law for the time being in force or has been undertaken to be performed by a person in pursuance of a contract or otherwise in relation to any service. [Sec 2(1) (g)]

**What is Service?**

Service of any description which is made available to potential users and includes the provision of facilities in connection with banking, financing, insurance, transport, processing, supply of electrical or other energy, board or lodging or both, housing construction, entertainment, amusement or the purveying of news or other information, but does not include the rendering of any service free of charge or under a contract of personal service. [Sec 2 (1) (O)]

**Medical Services Covered by Sec 2(1) (o) of the Act:**

In IMA v. V.P. Shantha [1] and others, the Supreme Court of India observed that the medical services rendered by the medical practitioners are covered by Sec. 2 (1) (o) of the Act. It excludes free services or services under a contract of personal service.

While construing the words 'free of charge' the Apex Court observed that the medical practitioners, govt. hospitals/nursing homes and private doctors/nursing homes (hereinafter called doctors and hospitals) broadly fall in three categories namely,

1. Where services are rendered free of charge to everybody availing of said services;
2. Where the charges are required to be paid by everybody availing the services; and
3. Where charges are required to be paid by persons availing services but certain category of persons who cannot afford to pay are rendered services free of charge.

- In case of first category where medical services are rendered free of charge whatsoever to every person availing the service would not come within the ambit of 'service' as defined under Sec. 2 (1) (o) of the Act. Payment of token amount for registration purposes would not alter the position in respect of such doctors or hospitals.
- In case of second category where services are rendered on payment basis to all persons will clearly come within the ambit of Sec. 2 (1) (o) of the Act.
- So far the third category is concerned, where free services are rendered to poor patients by doctors/hospitals whether private or Govt., but fee is charged for services rendered to other patients would come within the purview of Sec. 2 (1) (o) of the Act, even in cases where services are rendered free of charge.

**Contract of Personal Service and Contract for Personal Service—Distinction: [3]**

Sec. 2 (1) (o) of the Act excludes a 'contract of personal service' from the ambit of the term 'service'. The expression 'contract of personal service' means services rendered by an employee to his employer under the contract of personal service.

It is true that the relationship between a medical practitioner and a patient carries within it certain degree of mutual confidence and trust and, therefore services rendered by the medical practitioner can be regarded as services of personal nature but since there is no relationship of master and servant between the doctor and the patient, the contract between the medical practitioner and his patient cannot be treated as a contract of personal service but is a contract for services.

A 'contract for service' means a contract, in which one party undertake to render services e.g. professional or technical services to or for another party. In performance of such service he is not subject to detailed direction and control, but exercise professional or technical skill and uses his own knowledge and discretion.

A 'contract of service' implies relationship of master and servant and involves obligation to obey orders in the work to be performed and to its mode and manner of performance.

**What is Medical Negligence?**

Medical Negligence may be defined as the "act of omission which a reasonably competent medical practitioner, guided by such

medical knowledge and practice as is commonly known at the time and at the place where he practices and further guided by such other considerations which ordinarily regulate the conduct of a reasonably competent medical practitioners, would do, or doing something which a reasonably competent medical practitioners would not do".

It is the failure on the part of a doctor to exercise his skill and diligence, which are required of a medical professional resulting in harm to the patient. However deviation from common practice is not necessarily an evidence of negligence. Similarly a mere accident or error of judgment is also not evidence of negligence. To label any act or omission by the doctor as negligence, all the essential ingredients of medical negligence must be present.

The essential constituents of negligence include four "D"s namely:

1. Duty of Care towards Patient (Doctor Patient Relationship)
2. Dereliction or Breach in Duty of Care
3. Damage that results to the patient must be Reasonably Foreseeable
4. Direct Causation (Direct relation between the Breach in Duty of Care and the Damage)

**Observation and Discussion:**

In the present study total 80 faculty members of DMC & Hospital, Ludhiana and GMC & Hospital, Patiala participated.

Data related to distribution of study subjects according to their specialty and institute and the questions related to Consumer Protection Act and their replies given by the faculty members were depicted in tabular forms. (Table 1 & 2) The correct replies are shaded grey and marked with asterisk.

Similarly the questions related to Medical Negligence and their replies given by the faculty members and the awareness scores achieved by each faculty were also produced in tabular form. (Table 3 & 4)

One mark was awarded for each correct answer and wrong answer/un-attempted question was given score 'zero'. The individual scores were summed up to yield a total score.

Scores were converted into percentage and based on the marks secured grading of faculty members was done as very poor (<35%), poor (35-50%), moderate (51-60%), good (61-75%), excellent (>75%). (Table 5)

Out of total faculties, 75% of medical specialists working in Private Medical College scored very poor to poor and 25 % scored moderate to good. 80% of medical specialists

working in Govt. Medical College scored very poor to poor and 20% scored moderate.

Whereas 60% of surgical specialists working in Private Medical College scored very poor to poor and 25% scored moderate to good. 50% of surgical specialists working in Govt. Medical College scored very poor to poor and 50% scored moderate to excellent.

Present study showed that there is no significant difference in the marks scored by the faculty members of the medical specialties of the Private and Government Medical College. (Table 5) Similarly, the scores of the faculty members of the surgical specialties of the Government and Private Medical College were also not significantly different.

However, the awareness score of the faculty members of the surgical specialties was significantly higher than the members of the medical specialties of both Private and Government Medical College.

This difference could be due to the fact that surgical specialists encounter more medical negligence cases as compared to medical specialists. In a study carried out on 464 dental and medical specialists showed that awareness about CPA was higher among the medical professionals than dental professionals. [4]

In a survey carried out on 120 faculty members from clinical departments of KIMS, Bhubaneswar, Orissa it was found that in spite of an increasing trend of litigations and compensation suits against the practitioners, only 35% of the participants had insured themselves and 16% of them were ignorant about the self-insurance in practice. [5]

**Conclusion:**

Public awareness about CPA and medical negligence has increased in the last decade. Malpractice lawsuits have become a major concern in patient care. The current study

is an effort to present information about CPA and medical negligence among medical and surgical specialists working in Private Medical and Govt. Medical Colleges.

Awareness about CPA and medical negligence among the medical as well as surgical specialists is unsatisfactory.

Lack of updating knowledge by professionals (medical and surgical), there is increased risk of litigation especially in cases with poor outcomes.

It is recommended that doctors must update their understanding on Consumer Protection Act and medical negligence so as to be legally safe.

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**Table 1: Distribution of Study Subjects According to their Specialty and Institute**

Faculty Specialty	No. of Faculty members participated	
	DMCH, Ludhiana	GMCH, Patiala
<b>SURGICAL</b>	<b>(20)</b>	<b>(20)</b>
General Surgery	8	7
Orthopedics	7	7
Obs & Gynae	3	4
Plastic Surgery	1	1
Urology	1	1
<b>MEDICAL</b>	<b>(20)</b>	<b>(20)</b>
General Medicine	10	9
Pediatrics	5	5
Neurology	2	2
Endocrinology	1	1
Dermatology	2	3

**Table 5  
Grading of Faculty Members as per Marks Secured**

Specialty	Marks Secured				
	<35 % (Very poor)	35-50% (Poor)	51-60% (Moderate)	61-75% (Good)	>75% (Excellent)
Medical (Pvt.)	10(50%)	5(25%)	4(20%)	1(5%)	--
Medical (Govt.)	9(45%)	7(35%)	4(20%)	--	--
Surgical (Pvt.)	8(40%)	4(20%)	2(10%)	3(15%)	3(15%)
Surgical (Govt.)	7(35%)	3(15%)	9(45%)	1(5%)	--

**Table 2: Responses to the Queries on CPA, by Faculty Members of DMC&H, Ludhiana (Pvt.) and Clinicians of GMC&H, Patiala (Govt.)**

Questions	Reply	M-Pvt.(20)	S-Pvt.(20)	M-Govt. (20)	S-Govt. (20)
1. Supreme Court of India included medical services under the ambit of CPA in	a. 1986	10	10	10	03
	b. 1988	03	01	03	01
	c. 1995*	05	07	03	08
	d. 2002	02	02	04	08
2. In CPA a complaint is to be filled within _ yrs from date on which a case of action has arisen.	a. 01 yrs.	13	02	04	02
	b. 02 yrs. *	03	16	11	14
	c. 04 yrs	00	01	02	02
	d. Any time.	04	01	03	02
3. The time limit for appeal at various levels is	a. 30 Days*	11	06	06	12
	b. 45 Days	02	00	06	02
	c. 60 Days	02	01	02	04
	d. 90 Days	05	13	06	04
4. For false complaint under CPA the complainant shall pay as penalty to opposite party, not exceeding--	a. Rs, 10,000/- *	08	12	06	11
	b. Rs, 25,000/-	07	00	07	02
	c. Rs, 50,000/-	03	07	02	01
	d. Not liable to pay	02	01	05	06
5. In a compensation case, if the party is not satisfied with the decision of National Commission, appeal may lie at	a. No appeal possible	03	00	04	10
	b. Session Court	05	02	09	00
	c. High Court	06	05	01	00
	d. Supreme Court*	06	13	06	10
6. If a doctor fails to comply in a compensation case under CPA then punishment is	a. Imprisonment	05	00	02	08
	b. Fine up to 10,000/-	02	01	08	00
	c. Both a & b.	13	19	10	09
	d. None of above	00	00	00	03
7. The power of Consumer Courts is like	a. Civil Court*	07	08	09	09
	b. Criminal Court	03	00	04	00
	c. Both Civil & Criminal	08	04	03	03
	d. Special power	02	08	04	08
8. Which is not correct about Consumer Court?	a. No advocate required	07	03	04	05
	b. Court fees to be paid	05	12	07	05
	c. Accused has to be present*	05	02	03	05
	d. Decision given within 90 days	03	03	06	05
9. State Commission has pecuniary jurisdiction of	a. up to 20 lakh	06	10	04	06
	b. 20 lakh – 1 Crore*	09	08	13	09
	c. More than 1 Crore	02	01	02	01
	d. No Limit	03	01	01	04
10. District Forum has same power as are vested in a Civil Court by	a. I - Class Magistrate*	08	18	07	09
	b. II-Class Magistrate	08	01	08	08
	c. Tehsildar	02	00	04	02
	d. Collector	02	01	01	02

**Table 3: Responses to the Queries on Medical Negligence by Faculty Members of DMCH, Ludhiana (Pvt.) and Clinicians of GMCH, Patiala (Govt.)**

Questions	Reply	M-Pvt.(20)	S-Pvt. (20)	M-Govt.(20)	S-Govt. (20)
A patient got treatment from a Govt. hospital where no fee is charged. There is allegation of negligence against the treating doctor. The complainant can approach the :	a. Civil Court only	03	02	08	08
	b. Civil & Criminal Court*	07	14	04	04
	c. Civil Court and Consumer Court	08	02	05	03
	d. Civil, Consumer and Criminal Court	02	02	03	04
In a Civil negligence case against the doctor, onus of proof lies on	a. Doctor	09	08	02	01
	b. Patient*	08	09	13	19
	c. Public Prosecutor	01	01	03	00
	d. Judicial Magistrate	02	02	02	00
Contributory Negligence is a defense in:	a. Civil Negligence*	05	10	11	06
	b. Criminal Negligence	05	05	04	01
	c. Civil & Criminal Negligence Both	09	04	02	06
	d. None of the above	01	01	03	07
Which of the following is not a defense available to a doctor against allegation of negligence?	a. Limitation Period	05	02	05	03
	b. No fees accepted*	13	12	10	03
	c. Therapeutic Misadventure	00	03	02	02
	d. Res Judicata	02	03	03	12
A doctor while treating the patient without consent in an emergency is protected under	a. Sec. 87 IPC	04	01	02	03
	b. Sec. 89 IPC	10	05	09	06
	c. Sec. 92 IPC*	03	06	06	05
	d. Sec. 90 IPC	03	08	03	06

**Table 4**  
**Awareness Scores Achieved by Each Faculty (1 mark for correct answer; Max score 15)**

Medical Specialty (Pvt.)		Surgical Specialty (Pvt.)		Medical Specialty (Govt.)		Surgical Specialty (Govt.)	
Faculty No.	Score	Faculty No.	Score	Faculty No.	Score	Faculty No.	Score
1.	05	1.	05	1.	06	1.	09
2	08	2	00	2	06	2	09
3	04	3	07	3	08	3	09
4	04	4	10	4	04	4	08
5	05	5	08	5	08	5	09
6	08	6	12	6	07	6	08
7	05	7	11	7	07	7	08
8	06	8	12	8	08	8	03
9	04	9	12	9	08	9	06
10	11	10	10	10	07	10	03
11	03	11	05	11	07	11	04
12	07	12	08	12	04	12	03
13	08	13	06	13	05	13	05
14	08	14	05	14	03	14	09
15	05	15	06	15	04	15	10
16	06	16	03	16	05	16	04
17	07	17	05	17	04	17	06
18	03	18	05	18	04	18	05
19	04	19	06	19	03	19	06
20	07	20	05	20	02	20	08

## Original Research Paper

# Psychological Autopsy Study of Suicides among Elderly

<sup>1</sup>Adamali Nadaf, <sup>2</sup>Anand Mugadlimath, <sup>3</sup>Chidananda P.S. <sup>4</sup>K. H. Manjunath

### Abstract

A great deal of research has been focused on the suicide in young, but surprisingly limited research has been under taken in the area of suicide in elderly accomplished by under reporting. Since the proportion of older people in population is rising worldwide, indeed the increase in developing countries like India is even greater than the developed countries. This prospective and descriptive study among elder people has been carried out in the Department of Forensic Medicine, Victoria Hospital, Bangalore Medical College and Research Institute, Bangalore during the period November 2005 to April 2007 (18 months). All the cases aged 60 years and above brought to the department for medico-legal autopsy with alleged history of suicide and or detected as suicide by the circumstantial evidences and autopsy findings were selected. A sum total of 70 cases were studied during the study period.

**Key Words:** Elderly suicide, Reasons for suicide, Depression, Psychological autopsy

### Introduction:

The term "suicide" comes from two words-sui (of oneself) and cide (killing of) and is used to denote self-planned and deliberate termination of one's life. It is distinctly a human affair. The phenomenon of suicide is old as mankind, but still remains an unsolved giant puzzle. From the time immemorial, suicidal feelings and hopelessness have been considered part of ageing and understandable in the context of being elderly and having physical disabilities.

The ancient Greeks tolerated these attitudes in extreme and gave elderly people the option of 'assisted suicide'; if they could plead convincingly that they had no useful role in the society. Although the number of young people who commit suicide is larger, suicide among elderly also forms a significant group.

It is even more crucial to take seriously, any threats of suicide on the part of older individuals, because of their efforts to take their own lives so often to have a fatal outcome- older people tend to be more "successful" when they try to kill themselves.

### Materials and Methods:

The present psychological autopsy study among elder people has been carried out in the Department of Forensic Medicine over a period of 18 months. All the cases aged 60 years and above brought to the department for medico-legal autopsy with alleged history of suicide and or detected as suicide by the circumstantial evidences and autopsy findings were selected. A sum total of 70 cases were studied for this prospective and descriptive study during above mentioned period.

Detailed information regarding the deceased particulars including suicidal Intent scale [1], presumptive stressful life events [2] and the circumstances of death were collected from the relatives and police. In some cases this information was supplemented by either visit to the scene of crime, the photographs of scene of crime and also by suicide notes, if any. The Suicide Intent Scale [1] applied to assess seriousness of the intent to commit suicide.

The Gurmeet Singh PSLE Scale [2] was used to estimate the effect of various psychosocial stressful events and Socioeconomic status used was Modified B G Prasad and Kumar classification of socioeconomic status [3], based on AICPI (All India Consumer Price Index), March 2005 was used. [4]

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DOR: 27.11.2013 DOA: 29.05.2014

## Result and Discussion:

During the study period 5565 autopsies were conducted in the Department of Forensic Medicine. Among 5566 cases, 93% (5165 cases) were aged less than 60 years and 7% (404 cases) were aged more than 60 years.

Of these 404 cases of elderly deaths which were brought to the mortuary as unnatural deaths after autopsy, 39% were diagnosed as natural deaths, 41% accidents, 18% suicides, and 2% homicides. Suicide was the third leading cause of unnatural deaths among elderly.

It is in contrast with the collaborative study by SAMHSA, CDC, NIH, HRSA, and HIS [5], in which suicide was the 16<sup>th</sup> leading cause of death among elderly.

In this study suicide among elderly constitutes 4% (70 cases) of all the suicides (1801 cases) and suicide rate was higher among those aged 15-29 years and 30-44 years. [Table 1] This is in contrast to the WHO estimation in 2002, [6] in which elderly suicides accounted for 8.043% of all the suicides and a study by Nambudri VMD [7] found that 18.46% of elderly suicides. It has been found that suicide among elderly was common among individuals aged 60-64 years (40%) followed by 65-69 years (27%), 70-79 years (20%) and was least among those is 80+ years (13%).

The similar findings were observed by Vikram Palimar [8], who found suicide among aged 61-65 years, was 48.4%. This is possibly due to beginning of dependency and stressful life following their retirements. In contrast to this in a collaborative study [5] suicide rates increased with increasing age.

It was observed in the present study that the elderly males (73%) were more prone for suicide than their counterparts (27%), with a male: female ratio 2.7:1. The similar high rate of suicide among males was reported by others. [9-12, 5] and very high rate of 9.3:1 was reported by Vikram Palimar. [8]

This high rate among males may be due to declining health, depleting wealth and depending tendency on alcohol and drugs. Even though more than 70% of the informants were first degree relatives, most of them were unaware of their parent's suicidal intentions.

It was in disagree with Chiu et al [13] who found 70% of the informants had noted some form of suicidal communication in the year preceding death. In the current study it has been observed that more than half of the victims were from urban area, this is in contrast to the study by Hude Quan et al [12] who reported highest rate of suicide in rural population (46.7%).

Since the study was conducted in Bangalore, an urban area, the high rate of suicide in urban residents is expected, owing to the urbanization, industrialization and increase in size of population. Nearly half of the study cases were widow/widower, one female was unmarried, one male was remarried, and another three were separated. Similar findings of loss of spouse (35%) were reported by other authors. [9, 5]

An opposite findings were observed by Chiu et al [13] who reported married women had higher risk than single and widowed women. The high rate of suicide among widow/widower in present study could be due to loss of partner, loneliness and stressful life.

In this study 67% of the individuals were not educated and another 17% had less than mandatory education. Similar findings of high level of low educational status (75%) among elderly suicides were reported by Rubelowitz et al. [14] It was also found that 90% of the elderly individuals belonged to the Hindu religion, 7% Muslims and 3% Christians. [8] In this part of the world majority of the population follows Hinduism as religion and there is no strong injunction against suicide in the same religion.

The study showed that more than half (52%) of our study population were unemployed /households and were dependent (male 29% and females 23%), 20% of the males were agriculturist and 28% were non-agriculturists.

Nearly half of the study group belonged to lower middle (47%) and quarter of the population belonged to upper lower class (26%) of the socioeconomic groups. Only 6% belonged to upper class. The high rate of suicide among lower class could be due to financial and health problems which are more prevalent in them. More than half of the individuals were dependent on their children and spouse.

In this study 60% of the individuals were from joint family, 24% from nuclear and 16% were living alone. [9, 12] The reason for high rate of suicide in joint family in this study could be due to social and cultural differences in this part of the world, where majority of the families are joint families, in contrast to living alone and nuclear families which are common in western countries.

In present study death due to poisoning (50%) predominated in both males (36%) and females (14%). [Table 2] Hanging was common among males (19%) compared to females (3%).

Burns was used as method of suicide by 11% of the males and 7% of females. Other methods included drowning (4% males, 3% females), one of the male was jumped from 2<sup>nd</sup>

floor and another male consumed sleeping pills and then drowned in a tank of water.

Similar findings were observed in the study by Vikram Palimar [8] in which poisoning accounted for 84% and hanging 16%. But it is in disagreement with Abraham VJ [10], who found hanging (52%) as the common method and poisoning as the second most common.

In many of the studies [5, 11, 12, 14, 15, 16] gunshot injuries were common. Fall from the height (86.3%) was the most predominant in the study by Abrams RC [17] and suicide by over dose of drugs was common in study by Rubenowitz et al. [14] Poisoning as common suicidal method used by victims in this study could be due to lack rules and regulations regarding use of pesticides and easy accessibility. Hanging was common among males and poisoning was common among females indicating that males used violent method and females used painless method to end their lives. Fire arms were not reported due to strict legislation regarding their use.

Among the poisons Organophosphorus compounds formed the majority group (86%). (Table 3) [8] Other poisons were sulphuric acid, cyanide, and drug over dose, the later was common in their study. [16] In our study 61% individuals committed suicide in their home and the bed room was the most common place (24%). [11] Another 39% committed suicide outside the home. [Table 4]

The reason may be that they did not want to give trouble to their family members or fear of being noticed by the family members. More than 1/3<sup>rd</sup> of study population committed suicide during 4-8 pm and another 3<sup>rd</sup> ended their lives during late night and morning hours.

This is in contrast to Vikram Palimar [8] who observed maximum rate of suicide between 6 am -6 pm. The increased rate of suicide after later part of the day was due to increased stresses as the day advances and reaching the peak in evening.

Previous suicidal attempt was present in only 11% of the victims and one in every 8 victims had attempted suicide in the past. This is in contrast with the findings of others. 10-12]

This could be due to the reason that when elderly attempt suicide, most of the time they were successful, because of strong suicidal intention. Family history of suicide was present in only 3% of the suicide victims [11] and it is in contrast with Rubenowitz et al [14] which may be because of lack of knowledge about family history of suicide in the informants.

It has been observed in this study that the elderly suicide has got multi-factorial

causation. [Table 5] Among them family conflicts (57%), chronic physical pain (51%), chronic illness (51%), psychiatric disorders (46%), financial problems (33%) and addiction to the substance of abuse (34%) were the common factors. In 20% of the cases the individuals experienced social isolation/loneliness and only 3% had personality disorders.

These findings were supported by other workers also. [11, 12, 15] It is in contrast with Rubenowitz et al study [14] in which psychiatric illness and mental illness were common, while in other study financial problem as a main precipitating factor for suicide. [10]

The elderly suicide phenomenon is a social problem that is not going to cure by itself; it is a challenge to raise our collective consciousness, to develop innovative interventions to address the needs of our senior citizens.

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**Table 1: Age wise Distribution of Suicides during Study Period**

Age Group (Yrs)	Male (%)	Female (%)	Total (%)
0-14 years	10(1)	18(1)	28(2)
15-29 years	413(23)	564(31)	977(54)
30-44 years	369(20)	171(9)	540(30)
45-59 years	155(9)	31(2)	186(10)
>60 years	51(3)	19(1)	70(4)
Total	998(55)	803(45)	1801(100)

**Table 2: Method of Suicide employed to End their Lives**

Method used	Male	%	Female	%	Total
O.P Poisoning	20	29	9	13	29
Burns	8	11	5	7	13
Hanging	13	19	2	3	15
Drowning	3	4	2	3	5
Other poisons*	5	7	1	1	6
Fall	1	1	0	0	1
Total	51	73	19	27	70

\*Other poisons include sulphuric acid, cyanide, sleeping pills and over dose drugs

**Table 3: Type of Poison used**

Type of Poison	Cases	%
Organophosphorus	29	86
Sulphuric acid	2	6
Cyanide	1	3
Drug over dose	1	3
Unknown poison	1	3
Total	35	100

**Table 4: Place of Incidence**

Place	Cases	%	
In Home	Bed room	17	24
	Kitchen	7	10
	Bath room	2	3
	Toilet	3	4
	Hall	11	16
Outside Home	Terrace	3	4
	Road	3	4
	Field/Park	6	9
	Hotel/Lodge	2	3
	Inside compound	3	4
	Water tank	5	7
	Hospital	1	1
	Others*	7	10
Total	70	100	

\*Include Bus stand (2cases), Shed (1case), Garage (1case), Ashram (1 case), Music house (1case) and office compound (1 case)

**Table 5: Causative Factors for Suicide**

Causes	Cases	%
Chronic physical pain	36	51
Psychiatric disorder	32	46
Financial problem	23	33
Chronic illness	36	51
Isolation/Loneliness	14	20
Personality disorder	2	3
Addiction to substance of abuse	24	34
Family conflicts	40	57

## Original Research Paper

# Compensation Issue in Clinical Trials Recent Indian Scenario

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### Abstract

Hon'ble Supreme Court has shown its concern for protection of human rights of those who were the research participants for clinical trials and suffered either death or serious adverse events. These research participants had not given adequate compensation or no compensation at all. A Public Interest Litigation (PIL) has been filed in the Supreme Court of India in the year 2012 by a NGO, consequently a committee has been constituted by the Ministry of Health and family Welfare, government of India to look into the matter of compensation.

Recently a formula to determine the quantum of compensation in the cases of clinical trial related Serious Adverse Events (SAEs) including deaths occurring during clinical trials have been evolved by a committee formed under the Drugs and Cosmetics Rules.

This research paper deals with critical issue of compensation in clinical trial related SEAs including deaths of the research participants and initiative taken by the concern authorities including the directions given by the Supreme Court of India from time to time and provisions in the Drugs and Cosmetics (Amendment) Bill, 2013.

**Key Words:** Serious Adverse Events, Clinical Trial, Compensation, Drug and Cosmetic Act

### Introduction:

As per the information provided by the Union Government of India in the Supreme Court as many as 2644 research participants, died during the clinical trials. [1]

Out of which 80 deaths were found to be attributable to the clinical trials. Clinical trials of 475 new drugs were conducted and only 17 drugs were approved for marketing in India from January 1, 2005 to June 30, 2012.

Clinical trial of two drugs-Bayer's Rivaroxaban and Novartis's Aliskiren vs. Enalapril accounted for maximum number of deaths. Bayer's Rivaroxaban was first used for human trials in 2008 resulting in death of 21 of which it claimed that only five were related to clinical trial but it has till date paid compensation to kin of only two.

Two years later, the same drug was again put on clinical trial and this time 125 deaths were reported, of which it was stated that five were related to clinical trial.

The Union Health Secretary stressed the importance of clinical trials of new drugs on humans. It was claimed that during the last 40 years, about 900 drug molecules of different therapeutic categories have been approved for marketing in India. Out of these 900, only seven drug molecules have been discovered and approved in India.

Rest of them are discovered and developed in other countries like US, EU, Japan after going through complex process of research and drug development including clinical trial in human beings.

Novartis used the investigational product listed as Aliskiren vs. Enalapril last year and it resulted in death of 47 of which only one has been attributed to clinical trial of the new drug.

Only another clinical trial of new drug on humans, Sun Pharma's Paclitaxel injection concentrate for nano-dispersion, registered a double-digit death figure (12) during the last seven years.

Majority of the pharmaceutical companies, whose drugs were permitted for clinical trial on human beings, were of foreign origin. Allegations have been made by NGO,

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DOR: 12.02.2014 DOA: 24.04.2014

Swasthya Adhikar Manch, in its PIL that Indians were used as guinea pigs by foreign pharmaceutical majors for human trial of their new drugs, it claims that of the 57303 enrolled subjects, and 39022 completed the clinical trials. [1] SC in its order dated 6<sup>th</sup> March 2013 observed that it transpires from the record produced before the court that for these subjects neither any compensation has been provided nor paid. [2]

### **Historical Background:**

The first International Statement on the ethics of medical research using human subjects namely, the Nuremberg Code was formulated in 1947. In 1948, Universal Declaration of Human Rights (adopted by the General Assembly of the United Nations on 10<sup>th</sup> December) expressed concern about rights of human beings being subjected to involuntary maltreatment.

In 1964 at Helsinki, the World Medical Association formulated general principles and specific guidelines on use of human subjects in medical research, known as the Helsinki Declaration which was recently amended in 2008 Sixth revision, 59th Meeting at Seoul.

In 1966, the International Covenant on Civil and Political Rights specifically stated, 'No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment. In particular, no one shall be subjected without his consent to medical or scientific treatment.

In February 1980, the Indian Council of Medical Research released a 'Policy Statement on Ethical Considerations involved in Research on Human Subjects' for the benefit of all those involved in clinical research in India, which were amended in 2000 and recently in 2006. [3]

### **Recent Developments related to clinical trials:**

The Union Secretary for Health & Family Welfare promised to the Supreme Court for stringent regime on clinical trials on the recommendations of the Parliamentary Standing Committee, which faulted the Drugs and Cosmetics (Amendment) Bill, 2007.

On the advice of the Ministry of Law, the Health Ministry had withdrawn the 2007 Bill and introduce a new the Drugs and Cosmetic (Amendment) Bill, 2013 in the Parliament on 29.8.2013.

The Bill has a separate chapter containing penal provisions for violation and non-compliance of the provisions relating to the conduct of the clinical trials and strict penal provisions relating to payment of compensation, Ethics Committee etc. [Para 5, 6; Order dated 26.07.2013] [2]

### **Provisions regarding Compensation for Clinical Trials in the New Bill, 2013: [4]**

Chapter IIB has been inserted to cover the provisions related to mechanism for award of compensation in clinical trials if, serious adverse events happens. The important provisions related to following aspects:

- No clinical trial without permission
- Medical treatment and compensation for injury due to clinical trial
- Deferment of clinical data requirements by the Central Licensing Authority
- Registration of Ethics Committee
- Composition of Ethics Committee
- Functions and responsibilities of Ethics Committee
- Penalty for conducting clinical trial of cosmetics without permission
- Penalty for violation of conditions of permission
- Penalty for repeat offences
- Penalty for failure to provide compensation
- Penalty for contravention of any provision of this chapter
- Confiscation of stock, etc
- Cognizance of offences
- Powers of Central Government to make rules

### **Research Ethics and Professional Misconduct:**

Clinical drug trials or other research involving patients or volunteers as per the guidelines of ICMR can be undertaken, provided ethical considerations are borne in mind.

Violation of existing ICMR guidelines in this regard shall constitute misconduct. Consent taken from the patient for trial of drug or therapy which is not as per the guidelines shall also be construed as misconduct. [5]

### **Role of MCI in Preventing Clinical Trial Related Professional Misconduct:**

A complaint has been filed against Indore Clinical Trials conducted by doctors violating minimum ethical standards by Swasthya Adhikar Manch, Indore (M.P) and Smt.Brinda Karat, Member, Polit Bureau, CPI (M), Former Member, Rajya Sabha. [6]

### **Illustration 1: [6]**

The Ethics Committee of MCI at its meeting held on 14.2.2012 noted and directed the Council to enquire from Drug Controller of India (DCG (I), Indian Council of Medical Research (ICMR), & Madhya Pradesh Medical

Council to know the action taken on the outcome of their enquiries.

In this regard, as per the report dated: 7.3.2012 received from Dr.V.M. Katoch, Director General, ICMR, New Delhi, he stated that the Role of ICMR is in capacity building, setting up various guidelines and standards for conducting Clinical Trials properly.

The DCG (I) and Medical Council of India may initiate action for proper enquiry. Accordingly, a letter was sent to DCG (I) with a request to inform the status of the enquiry, if any, initiated. The DCG (I) in its letter dt.15.5.2012 informed that CDSCO team constituted has carried out inquiry of various trials and the report is as under:

"I) 11 trials from January, 2008 to October, 2010 sponsored by:

1. M/s Cadila Healthcare Ltd., Ahmedabad;
2. M/s Emcure Pharmaceuticals, Pune &
3. M/s Intas Pharmaceuticals, Ahmedabad conducted by Psychiatrist of MGM Medical College at their private clinics with necessary permission DCG (I), involved 241 patients participation under following five Principal investigators:

#### **Allegations:**

1. The said department did not inform the concerned college authorities and did not submit ethical clearance from competent authorities attached to the college.
2. Dr.Raghulam Razdan & Dr.Pali Rastogi did not maintain any source data for trials conducted for Intas Pharmaceuticals and Cadila Healthcare which is contrary to **Drugs & Cosmetics Acts & Rules under Appendix VII of Schedule Y.**
3. Emcure Pharmaceutical did not monitor trial properly (for instance the Lab. finding value for the test on screening day & the last visit were exactly identical for 4 subjects of DAPOXITINE trial conducted by Dr.Abey Paliwal & transcription error of data from source by Dr.Ujjwal Sardesai.
4. The investigator site of Dr.Raghulam Razdan sponsored by Cadila Healthcare (subject code 011 male 39 years) shows 1st site visit on 7.3.2009 whereas the consent form of the subject patient is dt.9.3.2009. In another subject code No.34 female 42 years shows 1st site visit on 7.4.2009 and the **informed consent** is on 30.6.2009.
5. Dr.Raghulam Razdan in his study of efficacy/safety of fixed dose of PARAXETINE Hcl and CLONAZEPAM in comparison PARAXETINE reported adverse

event as erectile dysfunction in subject No.27 female 45 which is not practical.

6. The report examined by CDSCO (HQ) observed that there were many discrepancies in respect of the clinical trials conducted by Dr.Raghulam Razdan for Cadila & Dr.Abhey Paliwal and Dr.Ujjwal Sardesai for Emcure.

#### **Show Cause and Warning Notices Issued by the CDSCO:**

Show cause notices were issued to the alleged doctors by CDSCO. CDSCO observed that there had been certain irregularities in conduct of clinical trials which were not in accordance with the Good Clinical Practices (GCP) guidelines for clinical research in India.

In view of the above, the said pharmaceutical firms and the investigating doctors have been issued warning by CDSCO vide letter dated: 2.5.2012 to be careful while conducting trials so as to ensure strict compliance of GCP guidelines and applicable regulations.

#### **Illustration II: [6] Regulatory Authorities stopped clinical trial:**

News report quoting use of drug TADALAFIL in Pulmonary Arterial Hypertension (PAH) trial conducted by Dr.Anil Bharani & Dr.Ashish Patel was investigated by the M.P. State Drug Controller Authority & CDSCO (WZ) on 10.8.2011. They found that the said trial was conducted without permission from DCG (I) and also the drug was not approved by DCG (I) for the said indication at the time of initiation of the trial (18.9.2005).

The said Regulatory Authorities directed the investigators to stop the trial and also restrict them to conduct any clinical trial for a period of six months. [Para II of Report] [6]

#### **Illustration III: [6]**

Report on Clinical Trial conducted by Dr.Hemant Jain at Chacha Nehru Hospital, Indore by the investigating team comprising DDC(I), West Zone, Drug Inspector & Experts constituted by CDSCO on 16-20 April revealed that out of the 26 clinical trials conducted after due permission of DCG(I), between 2006-2010, there were some irregularities in 23 trials.

The main findings in all the said 23 trials were **that the quorum of the Ethics Committee (MGM Medical College and M Y Hospital that reviewed & accorded approvals of the trials protocols) were not as per requirement of schedule 'Y' to Drugs & Cosmetic Rule as no lay person/legal expert were present in the meetings of the Ethics Committee.** [Para III of Report] [6]

### **MCI Observations:**

The Ethics Committee observed that **ethical irregularities** have been **observed in the conduct of the clinical trials done by the concerned doctors** on the basis of the investigation report with supportive documents from the **Drug Controller of India** and action taken report from the **Madhya Pradesh State Medical Council** and **State Health Authorities** in the above cases. [6]

Therefore, the eight doctors were called for hearing with all supporting documents in the meeting scheduled subsequently. The committee also decided that the concerned doctors be sent all relevant papers so that they can attend the meeting with a written reply.

### **Media Highlighted the Issue of Clinical Trial: [7-12]**

One of the media news highlighted the role played by politicians and different stakeholders in following words: "Brajesh Pathak, BSP's Rajya Sabha Member and Congress MP from Rajasthan, Jyoti Mirdha Gehlawat, daughter-in-law of former Haryana Minister Krishna Gehlawat are remembered for exposing corrupt and malpractices in medical profession."

It further reported that Jyoti Mirdha has taken up the issue of freebies to doctors by pharmacy companies for promoting their medicines. Her complaint to Prime Minister Dr. Manmohan Singh has forced the government to frame rules and regulations to prohibit Pharma companies from giving gifts to the doctors. She raised the issue concerning medical profession in Lok Sabha receiving appreciation from the Chair and Health Minister.

This unethical practice is costing patients dearly as doctors prescribes unwanted costly medicines just to promote sale of medicines of those particular companies that give them costly gifts and sponsor their foreign jaunts.

Brajesh Pathak has created history in his capacity as Chairman of Parliamentary Standing Committee for Ministry of Health and Family Welfare. He grilled officials of Drug Controller General of India, Indian Council of Medical Research and Health Ministry during review meetings.

Pathak has exposed as how the Central Drugs Standard Control Organisation, which is supposed to ensure that licences for manufacturing of medicines are given after proper clinical trial of its use, has given licences to a number of Pharma firms including one owned by the relatives of the then Union

Railways Minister Pawan Kumar Bansal without clearing clinical trials.

Pathak was shocked to find that the mission of CDSCO has become to meet the aspirations, demands and requirements of the pharmaceutical industry rather than protecting the public health by assuring the safety, efficacy and security of human and veterinary drugs.

He also exposed the nexus of officials of CDSCO, Indian Council of Medical Research and Health Ministry for giving permission for clinical trials to NGO PATH run by the former US President Bill Clinton in utter violation of rules which resulted into death of half a dozen tribals. Pathak has accused CDSCO of saving the interests of Pharma giants instead of people. [7]

### **Case before the Supreme Court of India in a PIL:**

SC noted that this matter alleges **malpractices in clinical trials by Government and non-Government as well as by independent investigators**. SC was of the view that for proper consideration of the matter it shall be appropriate if the Secretary, Ministry of Health and Family Welfare, Government of India and/or Central Drugs Standard Control Organisation through Director General of Health Services, Government of India, give information on the following points:

- i. The number of experimental **New Clinical Entities (NCEs)** approved for clinical trials by the **Drug Controller General of India (DCGI)** from **January 1, 2005 to June 30, 2012**.
- ii. Whether deaths were suffered by subjects of clinical trials. If yes, the number of deaths.
- iii. Whether serious side effects were suffered by the subjects of clinical trials. If yes, the number of such subjects and the nature of side effects, and
- iv. The details of compensation paid to the subjects who suffered side effects or paid to the family of the subjects who suffered death. [Order dated: 08.10.2012, R.M. Lodha, J., Anil R. Dave, J.] [2]

SC Bench **directed the Chief Secretaries of the States other than State of Madhya Pradesh, Manipur, Union Territories of Dadar & Nagar Haveli and Daman & Diu** to file their written responses related to clinical trials in their respective States and UTs.

### **Meeting Convened by the Ministry of Health & Family Welfare:**

On 26.7.2013, it was submitted that the Secretary, Ministry of Health would convene the meeting of the Chief Secretaries/Health Secretaries of the State Governments and the

Administrators of the Union Territories to discuss all the facets and aspects concerning the legal framework for strengthening the regulation of clinical trials and other incidental matters. [2]

It was stated that on 13.8.2013, the meeting of the Chief Secretaries/Health Secretaries of the State Governments and the Administrators of the Union Territories was convened. In that meeting, diverse issues were deliberated. [Para 4] [2]

### **Summary of Suggestions from States & UTs:**

The views expressed by the States of Madhya Pradesh, Rajasthan, West Bengal, Punjab, Andhra Pradesh, Karnataka and Gujarat, have been particularly mentioned. Based on the deliberations, the Secretary, Ministry of Health and Family Welfare summed up and made the **following observations:**

1. Even though the concerns have been raised about the conduct of clinical trials in the country, clinical trials are necessary for the development of new drugs in the country.

India has the capacity and knowhow for drug discovery research. However, there should be a robust system for conducting clinical trials in the country to ensure that trials are conducted in a scientific and ethical manner and in compliance to the regulatory provisions.

2. Restricting clinical trials to Government Hospitals alone would not provide a solution.

3. The amount of money paid by the sponsor/companies to the investigator for conduct of clinical trial may act as an inducement to the investigator for conducting clinical trials. Sometimes such inducement may lead to bias in enrolment of subjects in the trials.

4. Regulatory provisions may be made so that information relating to the amount of money paid by the companies to investigators for conduct of clinical trials is in the knowledge of the regulatory authorities.

5. There are some concerns on certain clauses of the amendment of Drugs & Cosmetics Rules made on 30.1.2013 regarding compensation in clinical trials. Some amendments in these clauses may be required.

6. A Committee constituted under the chairmanship of Dr. Ranjit Roy Chaudhury for formulating guidelines on clinical trials and new drugs has submitted its report. The report will be helpful in further strengthening of the regulation of clinical trials in the country.

7. States' suggestions and views would be considered for further strengthening of the regulation of clinical trial.

### **Suggestions Received from Various Stakeholders:**

The SC received suggestions by the Central Government and from various stakeholders namely;

(i) National Human Rights Commission;

(ii) Mr. Sanjay Parikh, advocate for the petitioners;

(iii) SAMA Resource Group for Women and Health & Locost Standard Therapeutics and

(iv) Indian Society for Clinical Research [2]

### **Constituting Apex Committee and Technical Committee:**

In light of the order passed by the Supreme Court on 3.1.2013 that until further orders the clinical trials of new chemical entity shall be conducted strictly in accord with the procedure prescribed in Schedule 'Y' of Drugs & Cosmetics Act, 1940 under the direct supervision of the Secretary, Ministry of Health & Family Welfare, Government of India.

It was further stated that a system of supervision of clinical trials of new chemical entities by constituting Apex Committee and Technical Committee has been put in place. [Para 10] [2]

### **Appointment of Expert Committee:**

The Expert Committee under the Chairmanship of Prof. Ranjit Roy Chaudhury to prepare guidelines for approval of clinical trials and new drugs in the country was constituted which has submitted its report on 8.8.2013. It is stated that the said report is under consideration. [Para 7] [2]

### **Current Scenario on Status of Clinical Trials in India:**

It was further stated that 577 clinical trial sites have been inspected and notices have been issued to the investigators/sponsors/ethics committees seeking clarifications in 235 cases. [Para 9] [2]

Giving factual details, it is stated that till 31.8.2013, [12] New Drugs Advisory Committees (NDACs) have met 78 times wherein a total number of 1122 applications for approval of clinical trials, new drugs and fixed dose combinations were evaluated.

Out of these 1122 applications, 331 were related to approval of Global Clinical Trial (GCT) including clinical trials of new chemical entities. Of these 331 GCT applications, NDACs

after deliberations have recommended for approval of 285 applications.

For 46 applications, no recommendation has been made. Out of above 285 applications so far, DCG (I) has given approval to conduct clinical trials in 162 cases. [Para 11] [2]

PIL raised the grievance that three parameters, namely,

- Assessment of risk versus benefit to the patients,
- Innovation vis-a-vis existing therapeutic option and
- Unmet medical need in the country, indicated by this **Court in the order dated 21.10.2013**, have not been followed in letter and spirit in granting approval to 157 NCEs. [2] [SC Order dated: 10.03.2013, Division Bench of R.M. Lodha, J., Kurian Joseph, J.]

**Report submitted by Prof. Ranjit Roy Chaudhury & Existing Safety measures:**

With regard to conduct of clinical trials in respect of 162 cases for which approval has been given by DCG (I), we keep the matter for consideration after two weeks to enable the Additional Solicitor General to place on record the report of Prof. Ranjit Roy Chaudhury and also the details of the existing regime which ensures the safety to the subjects of clinical trials and avoid any serious adverse event by such clinical trials. [Para 12] [2]

**Procedures for Payment of Compensation Specified:**

Pursuant to the order dated October 8, 2012, the Secretary, Ministry of Health and Family Welfare, Government of India has taken certain measures to strength regulation of clinical trials that included three amendments in G.S.R.s [13, 14, 15] as follows:

**Procedures for Clinical Trials:**

G.S.R. 53(E) [13] specifies:

- Procedure to analyse the reports of serious adverse events including deaths occurring during clinical trials and
- Procedures for payment of compensation in case of trial related injury or death. [Para 2]

**Conditions for Conducting Clinical Trials Specified:**

G.S.R. 63(E) [14] specifies:

- Various conditions for conduct of clinical trials,
- Authority for conducting clinical trial inspections and
- Actions in case of noncompliance.

**Registration of Ethics Committee:**

Similarly, G.S.R.72 (E) [15] provides for:

- **Requirements and guidelines for registration of Ethics Committee.**
- By amendment, it was proposed that no Ethics Committee can review and approve any clinical trial protocol unless it is registered with the Central Drugs Standard Control Organization and that in case of noncompliance, the registration can be suspended/ cancelled. [Para 4-6] [2] [Order dated: 26.7.2013], Bench of R.M. Lodha, J., Madan B. Lokur, J.]

**Constitution of Three Independent Expert Committees:**

Drugs Controller General (India) constituted three Independent Expert Committees [18] under the Chairmanship of **Dr. A K Agarwal, Maulana Azad Medical College.**

**New Mechanism for Compensation:**

- This **Independent Expert Committee** shall examine the report of serious adverse event of death and give its recommendation to the Licensing Authority within 30 days of receiving the report from the **concerned Ethics Committee.**
- The **DCG(I)** shall, then decide the **Quantum of Compensation** to be paid by the Sponsor or his representative and shall pass order as deemed necessary within three months of receiving the report on the Serious Adverse Event of death.
- **In case of clinical trial related injury or death, the Sponsor or his representative shall pay the compensation** as per the order of the DCG (I) within thirty days of the receipt of such order.

**Formula for Calculation of Compensation in Clinical Trials:**

The Committee after deliberation prepared formula to be followed for the determination of Quantum of Compensation in case of Clinical Trial related death. The following factors emerged for discussion:

- F1: Age of the Subject,
- F2: Risk of death,
- F3: Income of the Subject,
- F4: Co- morbidity of the subject at the time of SAE (Death),
- F5: Expected Survival,
- F6: Dependency on the deceased
- F7: Concomitant medication ,
- F8: Gender of the subject
- F9: Negligence during the conduct of Clinical Trial
- F10: Duration of the disease

- F11: Industry vs. Academia vs. Institute v/s Sponsor,
- F12: Expectedness of drug to cause death.

**Basis for Selection of Criteria:**

1. The criteria should not be discriminative in nature due to socio-economic conditions e.g. (a) income, (b) education
2. The criteria should not discriminate gender/sex
3. The criteria should not be such which may have minimal impact but may create large variability.
4. The formula should be such that the inter group variability of compensation value so arrived at, has little scope of discretion, thus avoid possible bias.

**Factors Finalised for Calculation of Quantum of Compensation:**

Thus, the **following criteria** were finally decided to be incorporated in the compensation formula.

- Age of the subject
- Risk factor depending on the seriousness and severity of the disease, presence of co-morbidity and duration of disease of the subject at the time of enrolment in the clinical trial.

**Consideration of the Age of the Subjects:**

The committee noted that **the Workmen Compensation Act (WCA)** [16] prescribes the factors (based on age) for calculation of the lump sum amount of compensation to be paid by the employer in case of permanent disablement and death depending upon age of the injured.

The factor ranges from 99.37 (for age of 65 or more) to 228.54 (of age not more than 16) depending upon the age of the injured. [Table 1]

After deliberating the above, it was suggested that the same factor may be applied for considering the age of the subject while calculating the amount of compensation in case of clinical trial related death.

The rationale for taking the age factor as per WCA [16] is that both are in general **“No Fault Compensation”** and the committee felt that both the situations are comparable so far as age factor is concerned.

**Risk Factor:**

After detailed discussion it was decided that the risk factor shall be divided in five grades of a scale. [Table 2]

**Need and Criteria to have a Base Amount**

The Committee deliberated and agreed that a constant base factor (amount) based on

logic should be there, on which the variables (age & risk) should be applied upon to determine the quantum of compensation on case to case basis.

Several rounds of discussion were held to decide a base amount. A figure of 4 lacs was considered. [17] A figure of 6 lacs was also deliberated on the logic of making the nominee of the deceased a reasonable amount available.

However, the committee finally decided to a base amount that is more logical and which remains contemporary / dynamic.

After detailed discussion the committee decided that base amount should be such that if the nominee of the subject keeps that amount of compensation in bank by way of fixed deposit, he or she will get an monthly interest amount which is at least approximately equivalent to the minimum wages (reference: Minimum wages of Delhi) of the unskilled workers.

It was considered that the minimum wages as on date is Rs.7722.00 per month and accordingly a base amount (rounded) of Rs. 8.0 Lakhs would be appropriate.

This base amount should refer to the age of 65 yrs which corresponds to the factor of 99.37 of the table of WCA [16]. It is evident that the base amount will increase /change with the revision of minimum wage.

**Final Formula for Compensation:**

Following three factors will be used for calculation of the quantum of compensation in case of SAE (Death) related to clinical trials are:

1. Age
2. Risk and
3. Base amount

<b>Compensation =</b>	<b>B x F x R</b>
	<b>99.37</b>

Where,

- B = **Base amount** (i.e. 8 lacs)
- F = **Factor depending on the age** of the subject as per **Annexure 1** (based on Workmen Compensation Act)
- R = **Risk Factor** (Table 2)

**Compensation for Healthy Volunteers or Subject of No Risk:**

However, in case of patients whose **expected mortality** is 90% or more within 30 days, a **fixed amount of Rs. 2 lacs** should be given. Thus, it will be seen that the compensation amount will vary from a **minimum of Rs.4 lacs to a maximum of Rs.73.60 lacs depending on the age of the deceased and the risk factor.**

The committee will examine cases of SAEs of deaths and decide the final quantum of compensation after due diligence and application of mind on the risk factor and recommend the same to DCG (I) on case to case basis. The committee also considered the above formula as provisionally final.

**Summary and Conclusions:**

It is hoped that provisions related to compensation for SAE including deaths as a result of clinical trials in India will be enforced in true letter and spirit in the better interest of research participants.

Medical fraternity doing research and clinical trial will also take care of ethical aspect and not to indulge in professional misconduct by violating any of the relevant provisions of the law recently enacted and those already existed.

Research work and clinical trials are need of the hour but under strict supervision and vigilance by the newly constituted bodies. NGOs are expected to keep watch on these unethical practices by all stakeholders including MNCs.

Human rights issue of these research participants will be taken care by relevant agencies including NHRC/SHRC and various High Courts. The Supreme Court of India will come up with clear cut guidelines while disposing PIL pending before it so that Research Participants will get adequate compensation for their contribution and sacrifices for greater cause of humanity.

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**Table 1: Factor (F) for calculating the amount of compensation of Appendix 1 of WCA [R]**

Age	Factors	Age	Factors
1	2	1	2
Not more than		Not more than	
16	228.54	41	181.37
17	227.49	42	178.49
18	226.38	43	175.54
19	225.22	44	172.52
20	224.00	45	169.44
21	222.71	46	166.29
22	221.37	47	163.07
23	219.95	48	159.80
24	218.47	49	156.47
25	216.91	50	153.09
26	215.28	51	149.67
27	213.57	52	146.20
28	211.79	53	142.68
29	209.92	54	139.13
30	207.98	55	135.56
31	205.95	56	131.95
32	203.85	57	128.33
33	201.66	58	124.70
34	199.40	59	121.05
35	197.06	60	117.41
36	194.64	61	113.77
37	192.14	62	110.14
38	189.56	63	106.52
39	186.90	64	102.93
40	184.17	> 65	99.37

**Table 2: Risk Grade**

S N	Grade	Description (Prognosis)	Survival
1	0.50	Terminally ill patient	Expected survival not more than (NMT) 6 months
2	1.0	Patient with high risk	Expected survival between 6 to 24 months
3	2.0	Patient with moderate risk	More than 2 years
4	3.0	Patient with mild risk	
5	4.0	Healthy Volunteers or subject of no risk	

## Original Research Paper

# Comparison of Inter-Canine and Inter-Molar Width as an Aid in Gender Determination: A Preliminary Study

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### Abstract

The dentition use in gender determination has been explored and advocated owing to its strength and resistance to various insults. Our aim was to determine and evaluate the usefulness of inter-molar arch width in gender determination. Our objective was to compare these distances in determination of gender and to validate its use as a forensic tool. Fifty subjects were selected and impressions were made for both the arches with alginate. Study models were prepared and used for analysis.

Inter-canine and inter-molar width in maxillary arch for male and female were  $35.22 \pm 1.54$  and  $33.49 \pm 1.49$ ; and  $48.74 \pm 1.89$  and  $45.44 \pm 1.92$  respectively. Inter-canine and inter-molar width in mandibular arch for male and female were  $25.58 \pm 1.37$  and  $25.29 \pm 1.50$ ; and  $42.45 \pm 2.00$  and  $39.53 \pm 1.87$  respectively. Thus, these measurements were significantly higher in males. On using the Receiver Operating Characteristic (ROC) curve to deduce values with high specificity maxillary inter-molar arch width gave high specificity of 92% to detect gender correctly, with best sensitivity i.e. 64%. Therefore, we conclude that inter-molar arch width is useful in determining the gender of dental remains accurately, of individuals with missing canine teeth.

**Key Words:** Maxillary arch, Mandibular arch, Inter-canine arch width, Inter-molar arch width, Gender determination

### Introduction:

Gender determination of skeletal remains is a part of archaeological and many medico-legal examinations. The method of the identification may vary, but the ultimate goal is to determine the gender of the remains correctly. [1, 2] The identification of remains gains utmost importance in cases of mass fatality like in earthquakes, tsunami, cyclones and flood etc., where the bodies are damaged beyond recognition. In situations, where only fragments of skeletal remains are found for e.g. fragment of the jaws, in such situations only the odontometric features will help in recognition of the individual from the remains, particularly the teeth in the fragment. [3]

Because no two mouths are alike and dentition is as individual as fingerprints, it can be used for human identification. The dentition's use in gender determination has been explored and advocated owing to its strength and resistance to various insults.

As teeth are the hardest and chemically the most stable tissue in the body, they are an excellent material in living and non-living populations for Forensic investigations. [1]

Hence, tooth size standards based on odontometric investigations can be used in determining the age and particularly the gender. [2] With such tooth size standards, whenever it is possible to predict the gender, identification is simplified because then only missing persons of one gender needs to be considered. [2]

In this sense identification of gender takes precedence over age. Sexual dimorphism refers to those differences in size, stature and appearance between male and female that can be applied for individual identification.

Canines, in particular, have the greatest degree of sexual dimorphism, rendering them highly valuable in identification. Mesio-distal width of canine, [3, 4] inter-canine width [2] and mandibular canine index (MCI) [5] have been proved highly valuable in gender identification. Recently, there has been an increased interest in using molars as an aid in gender

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determination. [1] Since, first permanent molars are the first permanent teeth to erupt in the respective arches [6] and also have less chance of being impacted; therefore, an attempt has been made to compare the accuracy of inter-molar arch width between the first permanent molars to inter-canine arch width in gender determination and to validate it as an accurate entity for gender determination in cases where canines are missing.

### Aims and Objectives:

- To determine the inter-canine and inter-molar arch width in the maxillary and mandibular arches.
- To evaluate the usefulness of inter-molar arch width in gender determination.
- To compare the inter-molar arch width to inter-canine arch width in determination of gender and to validate its use as a Forensic tool.

### Materials and Methods:

Fifty subjects consisting of 25 males and 25 females, with age ranging between 18 to 25 years as per inclusion criteria were selected for our study. The patient was evaluated clinically. (Fig. 1) Patients with normal overjet and overbite, with absent spacing in the anterior teeth and with normal molar and canine relationship were included in the study.

Patients with presence of partially erupted teeth, with deleterious oral habits and having teeth with severe attrition were excluded from the study. [1] Once a patient was selected, a written consent was obtained from the patient after explaining the procedure and the purpose of the study. After that the patient was comfortably seated on the dental chair and height adjustment done before wearing gloves.

Maxillary and mandibular impressions were made with alginate using universal precautions for infection control. [7] Study models were prepared in dental stone and used for analysis. (Fig. 2)

On study model following measurements were made for all subjects using Vernier caliper. The measurements taken included: **Maxillary inter-canine** (Fig. 3) and **inter-molar** (Fig. 4) **arch width**; and **mandibular inter-canine** (Fig. 5) and **inter-molar** (Fig. 6) **arch width**. The inter-canine arch width was calculated from the cusp tip of canine on one side to the cusp tip of the canine on the opposite side, [3, 4] while the inter-molar arch width was calculated from the central fossa of first permanent molar on either sides.

### Results:

In this Study arithmetic means were calculated for inter-canine and inter-molar arch

width in maxillary and mandibular arches for males and females. Student 't' test was used to compare the means of the inter-canine and inter-molar width in maxillary and mandibular arches for males and females.

All the comparison of means done was significant with 'p' value < 0.05. Inter-canine width in maxillary arch for male and female were  $35.22 \pm 1.54$  and  $33.49 \pm 1.49$  respectively with 't' value of 4.01. (Table 1)

Inter-molar width in maxillary arch for male and female were  $48.74 \pm 1.89$  and  $45.44 \pm 1.92$  respectively with 't' value of 6.09. (Table 1)

Inter-canine width in mandibular arch for male and female were  $25.58 \pm 1.37$  and  $25.29 \pm 1.50$  respectively with 't' value of 0.70. (Table 2) Inter-molar width in mandibular arch for male and female were  $42.45 \pm 2.00$  and  $39.53 \pm 1.87$  respectively with 't' value of 5.30. (Table 2)

Receiver Operating Characteristic (ROC) curve was used to deduce sensitivity and specificity of the measurements to determine gender correctly. (Graph 1)

On using the curve to deduce balanced sensitivity and specificity mandibular inter-molar arch width gave 92% sensitivity with satisfactory specificity of 76%; and on using the curve to deduce values with high specificity maxillary inter-molar arch width gave high specificity of 92% with best sensitivity i.e. 64%. (Table 3)

### Discussion:

With an increase in the number of natural, as well as man-made calamities like earthquakes, floods, wars, riots etc. the need to correctly identify the remains of dead individuals have increased. Individual identification depends on different parameters like age, gender and race. Gender determination is one of the important steps employed in the identification of an individual. Correctly, determined gender limits the number of missing persons to just one half of the population. [2]

In Forensic cases, it is common to recover partial remains like fragmented skull, jaws and other bones of the body. The teeth being one of the strongest human tissues are known to resist a variety of ante-mortem and post-mortem insults and are one of the most commonly recovered remains.

Mesio-distal width of canine, [3, 4] inter-canine width [2] and mandibular canine index (MCI) [5] have been used to determine gender in the past and is supported by many researchers. But recent research by Acharya et al [8, 9], Boaz et al [10] have found that these measurements do not reflect the gender difference accurately.

Also these measurements are not useful in individuals with missing canines. In such cases, width of molars or inter-molar arch width may be used in gender determination. [1]

Hence, in our study inter-molar arch width was used to determine the gender and the results were compared with inter-canine arch width to assess a better method to determine gender correctly.

In our study, the mean inter-canine width in maxilla; and the mean inter-molar width in both maxilla and mandible were significantly higher in males than females.

This observation is in agreement with the study done by other authors [11-13] wherein they stated that boys have wider teeth; and larger upper and lower inter-molar width than girls. This may be because the dental arch width reflects the size of the basal bone and since males in general are larger than females; same would reflect itself in the basal bone of the jaws and the dental arches.

There was no significant difference between the mean mandibular inter-canine width between male and female, in our study. This observation is in agreement with other studies. [12, 14] Since crowding tends to decrease the anterior dental arch width and crowding is more common in mandibular anteriors, this could be the reason for the above mentioned finding.

But this observation is in disagreement with the study done by Hussein et al, [11] as they found the mandibular inter-canine width to be greater in males.

On comparing the means the maxillary inter-canine and mandibular inter-molar arch width were found to have high't' values, and were found to be quite useful in determining the gender. This was due to significant difference in the arch width between males and females.

But in our study, the maxillary inter-molar width was found to have the highest't' value, which was due to most significant difference in the values of mandibular inter-molar arch width in males as compared to females, making it the most useful measurement to determine gender correctly.

The sensitivity to determine gender correctly was high for mandibular inter-molar arch width i.e. 92% with a satisfactory specificity of 76%. But in Forensic and medico-legal examinations high specificity is required, to eliminate inaccurate identification and to prevent prosecution of innocent individuals.

In our study; maxillary inter-molar arch width was found to have the highest specificity of 92% in determining the gender correctly along with a satisfactory sensitivity of 64%, which was

again due to most significant difference in the values of mandibular inter-molar arch width in males as compared to females.

Thus, the maxillary inter-molar width had both high specificity and high't' value and this measurement may be used to determine gender correctly.

### Conclusion:

Although the odontometric measurements based on canines are quite popular and have been substantiated from time to time for determining gender, these are rendered invaluable where canines are absent.

In such cases, where molars are present these teeth may be used to determine gender. On the basis of the results of our study, we may conclude that inter-molar arch width may be useful in determining the gender of dental remains accurately, of individuals with missing canine teeth and also it may be more accurate in gender determination than inter-canine arch width, with maxillary inter-molar arch width being more specific.

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Fig. 1: Armamentarium Used For Clinical Evaluation



Fig. 2: Armamentarium for Preparing Dental Models



Fig. 3: Maxillary Inter-Canine Arch Width



Fig. 4: Maxillary Inter-Molar Arch Width



Fig. 5: Mandibular Inter-Canine Arch Width

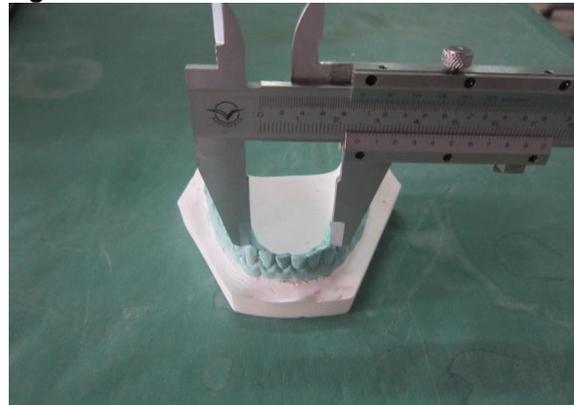
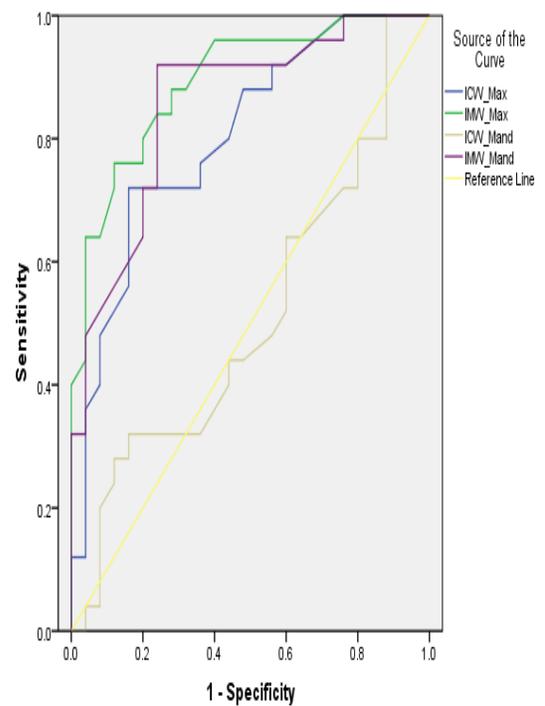


Fig. 6: Mandibular Inter-Molar Arch Width



Graph 1: Receiver Operating Characteristic Curve



**Table 1**  
**Statistical Significance of Different Parameters of Maxilla**

Parameters	Sex	Mean	±S.D	't' value	'p' value	Significance
Inter Canine Width	M	35.22	1.54	4.01	0.00	Significant
	F	33.49	1.49			
Inter Molar Width	M	48.74	1.89	6.09	0.00	Significant
	F	45.44	1.92			

**Table 2**  
**Statistical Significance of Different Parameters of Mandible**

Parameters	Sex	Mean	±S.D	't' value	'p' value	Significance
Inter Canine Width	M	25.58	1.37	0.70	0.48	Significant
	F	25.29	1.50			
Inter Molar Width	M	42.45	2.00	5.30	0.00	Significant
	F	39.53	1.87			

**Table 3**  
**Sensitivity and Specificity**

Arch	Parameter	Balanced		High Specificity	
		Sensitivity	Specificity	Sensitivity	Specificity
Maxillary	Inter Canine Width	72%	84%	48%	92%
	Inter Molar Width	80%	80%	64%	92%
Mandibular	Inter Canine Width	44%	52%	20%	92%
	Inter Molar Width	92%	76%	56%	88%

### **My Autopsy Case**

*I know, you are speechless, but I am sure now.*

*Your wounds are horrible, but pain is no more.*

*Your maggots don't dare to scare,*

*They are but to tell me, what has happened, where.*

*Your rajma rice, no more feels like butterfly in my stomach,*

*They are, but to let me feel the fun, you had much before, you are gone.*

*Your tongue out puffy face doesn't tease me anymore.*

*But it really makes me, take you up, as a challenge for sure.*

*Your severed limb with rigor, do'nt try to grab me anymore.*

*But it seems to me, as if it is asking a help for.*

*Your stillness doesn't burrow in my ears any more.*

*But it helps me concentrate on my own.*

*Your story of being scorned off, upsets me no more.*

*But the silent cry desperately makes me, open the door.*

*Off course, you are not able to speak now.*

*But, your voice would not be unheard any more.*

*Someone may say, you are of no use any more.*

*But here, with due regard, I acknowledge,*

*That day by day, my autopsy case teaches me more and more.*

*Dr Arvind Kumar,  
Associate Professor, Forensic Medicine,  
Lady Hardinge Medical College, New Delhi*

## An Epidemiological Study of Acute Head Injury and It's Evaluation by CT scan

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### Abstract

Head injury is a morbid state resulting from gross subtle structural changes in the scalp. Skull and/or the contents of the skull produce by mechanical forces. The application of blunt force to the head may result injury to the contents of the skull either alone or with a fracture skull. In six month study period total 64 cases of head Injuries were admitted in B.C. Roy Hospital. Total number of Male patients admitted in Hospital due to head Injuries were 46(71.87 %) and female were (28.12%). 32.81% the victims aged between 21 to 30 years. In present series of study R.T.A. was most common cause of Head Injury 85.95%. Most common CT finding was Skull fracture 34.37% followed by cerebral contusion 32.81%, extradural hematoma 25% and 21.87 % subarachnoid hemorrhage. CT scan was the main tool for the imaging the Skull and its contents.

**Key Words:** CT scan, Head Injury, Extradural Hematoma, Fracture skull

### Introduction:

The incidences of Head injuries are increasing with great mechanization in industry and increase in high velocity transport. [1]

The Injuries could be caused by direct violence or indirectly and by blunt force trauma or penetrating Injury. [2] Patient with severe head injury has a mortality rate of more than 50% and those who survive are often left with severe neurological deficits. Haldia is a petrochemical city and is well connected with National highway.

Mostly the victims' succumbed to fatal head Injuries in road traffic accidents are common in all kinds of accidental injuries. Any kind of craniocerebral injury can be caused by any kind of blow or any sort of head. [3]

Till now, CT scan remains the investigation of choice of head injuries. CT scan is performed without Intravenous contrast administration on both brain and bone without setting. It distinguishes between extracerebral and intracerebral lesions and can separate those patients with compressing hematomas that require immediate surgery from those in whom craniotomy might be of no benefit or even be harmful.

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DOR: 10.02.2014      DOA: 25.05.2014

So this study has been taken to determine the various epidemiological factors of

head injury like Age, Sex, occupation, area wise distribution and various aspects of CT finding.

### Material and Method:

This study was conducted in Emergency and surgical I.C.U. of B.C. Roy Hospital from July 2013 to Dec 2013. During this period 64 head injuries cases were admitted to B.C. Roy hospital Haldia. The Patients were studied from at the time of admission to the ward and followed up in the hospital until recovery or death. The head injuries were evaluated by CT scan of Head.

Plain (Non contrast) CT was done in all patients taking 10 axial sections from base of Skull to the vertex. The information was collected from the Interviews from relatives, patient case sheet and interrogation from police.

The information was collected into a Performa including age, sex, marital status, occupation, factors responsible for head injury and CT finding of each case and was analyzed.

### Results and Observations:

In 6 months study total 64 cases of head injuries were admitted in B.C. Roy Hospital Haldia. Total no of male patients admitted in hospital due to head injury were 46 (71.87%) and female were 18 (28.12%). (Fig. 1)

In this study Twenty one victims were the aged between 21 to 30 years (32.81%). (Table 1) In our study Forty one cases (64.06%) belongs to urban population and rest rural (35.93%). (Fig. 2)

Students were the most common victim 18.75% followed by Businessman, agriculture and housewives respectively. (Table 2) Most common factors responsible for the head Injury

was R.T.A. 85.93% followed by physical assault 9.37% and fall from height 4.68%. (Table 3)

Present study showed that most common CT finding was skull fracture (34.37%) followed by cerebral contusion 32.81%, extradural hematoma 25%, subarachnoid hemorrhage 13.06% and subdural hematoma 4.06 % respectively. (Fig. 1 & 2)

**Discussion:**

In the present study male are more affected than female similar to the other studies. The reasons are that male is more involve in outdoors visits, more active involve in occupation and sustaining more stress and strain. The similar study was conducted by Mebratu et al. [5] In our study most of the victims belong in the age group of 21-30 yrs and 31-40 years and is consistent with studies available from India and other countries.

The age around 20-40 years is the most active phase of life during which there is tendency to take risk. The lower proportion of victims above 60 years could be due to generally less mobility. Present study showed that most common victims were businessmen followed by students and least was retired person and unknown.

Business occupations are most active phase of life and are most involved in outdoor visit. Retired person are continued to their home and less movable. The most common CT finding in our studies was skull fractures (34.37%) similar to study done by Asaleue et al [4] in which skull fractures was 42%. [4]

In this study other CT findings were cerebral contusion (32.81%) followed by extradural hematoma (25%), subarachnoid Hemorrhage (21.8%) and intracerebral Hemorrhage (21.87%). In 10.93% cases CT scan finding was normal.

**Conclusion:**

The present study revealed that male aged 21-30 years and occupation by Business were more involved. Most common cause of head injury was road traffic accident.

CT scan is the main tool for the evaluation of acute head injury which categorized the mild. Moderate and severe head injuries and it is essential for rapid surgical intervention in moderate and severe head injuries. To decrease the incidence, mortality and morbidity following precaution and measures should be taken by government and local authorities:

- Government should equip law, enforcement agents involved in regulating and monitoring

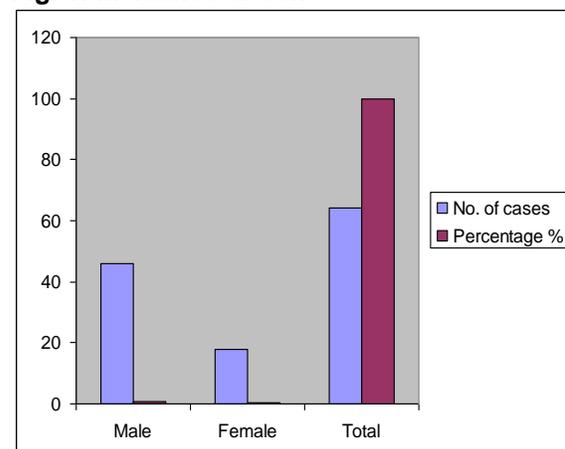
road users to ensure and enforce safe driving.

- Motorcycle Helmet campaign, anti drunken driving campaign road traffic injury Prevention School, safe communities and establishment of trauma centre and pre hospital care system which are proven way of tackling R.T.A.
- The hospitals even the P.H.C. should be facilitated with CT scan for the rapid triage of acute head injury and its management.

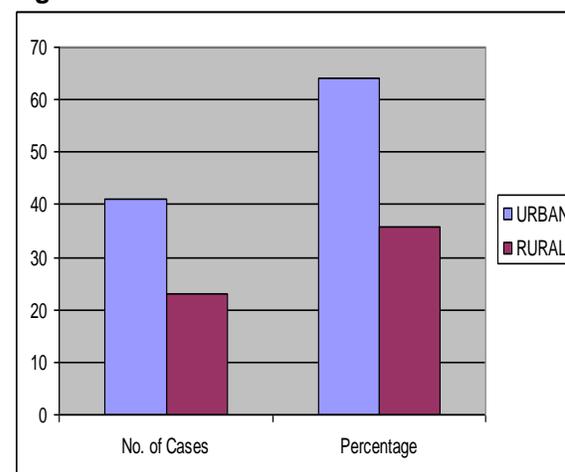
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**Fig. 1: Incidence of Sex**



**Fig. 2: Area Wise Distribution**



**Table 1: Incidence of Age**

Age group (Yrs)	Male	Female	Total	Percentage
0-10	2	1	3	4.68
11-20	6	1	7	10.93
21-30	15	6	21	32.81
31-40	11	4	15	32.81
41-50	5	3	8	12.5
51-60	4	2	6	2.37
>60	3	1	4	6.25
	46	18	64	100

**Table 2: Victim's Occupation**

Occupation	Cases N=64	Percentage
Business	21	32.81
Student	12	18.75
Hose wives	09	14.06
Agriculture	08	12.50
Labourer	03	4.68
Unemployed	08	12.50
Retire servicemen	02	3.12
Unknown	01	1.56
Total	64	99.98

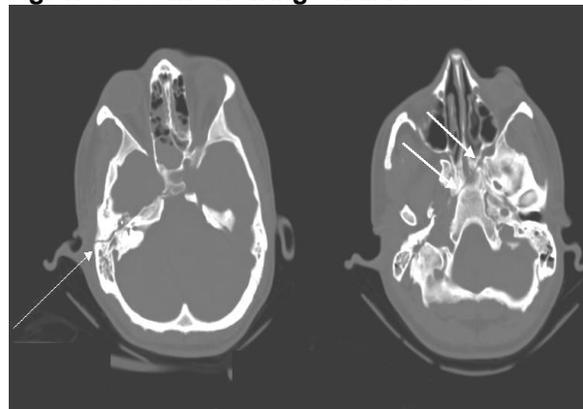
**Table 3: Causes of Head Injury**

Causes	Cases , N=64	Percentage
R.T.A.	55	85.93
Physical assault	06	09.37
Fall from height	03	04.68
Total	64	99.98

**Table 4: CT finding in Head Injuries**

CT Scan	Cases	Percentage
Normal Brain	7	10.93
Skull Fracture	22	34.37
Extra Dural Hematoma	16	25
Subarachnoid Hemorrhage	14	21.87
Intracerebral Hemorrhage	14	21.87
Cerebral contusion	21	32.81
Subdural Hematoma	09	14.06

**Fig. 1: CT scan showing Skull Fracture**



**Fig. 2: CT scan Showing Epidural Hematoma**



## Original Research Paper

# Significance of Costochondral Junction of the Fourth Rib In Age Determination in North Kerala Population

<sup>1</sup>Abraham Jobby, <sup>2</sup>Angela A Viswasom

### Abstract

Determination of age of an individual is one of the most important factors in establishment of identity. The present study was conducted on post-mortem specimens obtained from 100 males and 50 females above the age of 16 years in the population of North Kerala. The study used the phase evaluation chart to establish the age of an individual. In the male rib specimens, correct age could be predicted in 68% cases with evaluation of articular facet, firmness and texture combination. In the female rib specimen, it age could be estimated in 73% cases using firmness and shape of the rim combination. The results of the present study showed that it was a good method of assessment of age in a high percentage of cases even when only ribs are available. The method was very relevant at an application level when scattered bony remnants are obtained, to establish the identity in cases of mass disasters.

**Key Words:** Age determination, Fourth rib, Costochondral junction, North Kerala population

### Introduction:

The estimation of age is an essential part of all Forensic scientific investigations involving skeletal remains of unknown individuals. Assessment of gross morphologic changes in bones is a more rapid method of age estimation and its accuracy is enhanced when more than one criterion is chosen.

Krogman [1] gives a comprehensive study of the ageing of persons from bones including cranial sutures, pubic symphysis, vertebral bodies, sacrum, sternii and ribs amongst others. Kerley ER [2] in an osteological study noticed that the sternal extremity of the rib is billowy in adolescence; cup shaped with sharp margins in middle age and irregular in later years. Loth et al [3] worked on age estimation from the study of ribs and confirmed the observations made earlier by Kerley. [2]

They developed a system in which each rib was analyzed on the basis of changes noted in articular facet – Pit depth, Pit shape and Rim & Wall configuration, each of which was divided into six stages. Results indicated that the age at death could be estimated from a rib within about two years in the second decade to about seven years in the 5<sup>th</sup> and 6<sup>th</sup> decades.

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Pit shape and Rim & Wall configurations yielded better results than about pit depth alone.

Iscan M Y [5] introduced the sternal end of the right fourth rib as a site for age estimation. The sample consisted of 118 white males of verified age, sex and race and the ribs were assigned to one of the nine phases (0 to 8).

It was observed that metamorphosis was most rapid and uniform from the mean age of 17-28yrs (phases 1 to 4). The rib morphology was more varied after age 39 (phases 5 to 8), resulting in wider range of predicted age.

Iscan M Y et al [5] carried out a study of the right fourth ribs of 86 white females. He found that the female ribs showed both earlier initial pit formation and a different morphologic pattern of ageing as compared with males.

The most rapid metamorphoses occurred in mean ages 14-28 (phases 1 to 4) with changes noticeable at 3-4 years intervals. After mean age 28, this process slowed, expanding the interval between phases to 10-15yrs. Loth S R et al [6] studied changes in the ribs 3 and 5 along with those that were seen on the fourth rib.

The results of this analysis indicated that in >79% of cases, all three ribs (3, 4 & 5) fell into the same phase and intercostal differences were within one phase for 98% of the sample and so it was concluded that the age could be assessed from these adjacent ribs also using the phase method.

Yavuz M F et al [7] applied the rib phase standards to a Turkish sample of 150 males and 144 females of known age and each rib was

phased according to the standards developed by Iscan M Y. The phase estimations were subjected to an analysis of variance and the results indicated that Turkish ribs did not show racial variation.

Variation as measured by standard deviation increased from phase 5 on in both sexes. Russell K F et al [8] applied the phase method to the fourth rib. Measures of race differences in 4<sup>th</sup> rib morphology were included and the result was that Americans of African origin showed a non-significant trend for the rib changes to be delayed compared to Americans of European descent

Oettle A C et al [ 9] studied 395 sternal ends of fourth ribs (265 male, 74 female of South African Black population) collected during the period 1994 – 96 and found the phase method employed by Iscan M Y et al acceptable, although it was less accurate to predict age in this population.

**Materials and Methods:**

The present study was carried out on 117 males and 53 female post-mortem specimens. The specimens were obtained from consecutive cases of known identity and age.

Decomposition changes or cause of death was not considered as exclusion criteria.

In the selected cases general examination followed by examination of sternum and its union and other abnormalities was done.

**Methodology:**

The method of preparation of the specimen was based on the technique described by Iscan M Y et al. [3] each of the rib samples was individually examined under natural lighting with the aid of a hand lens.

The phase evaluation method devised by Iscan M Y [3] was used to classify the ribs.

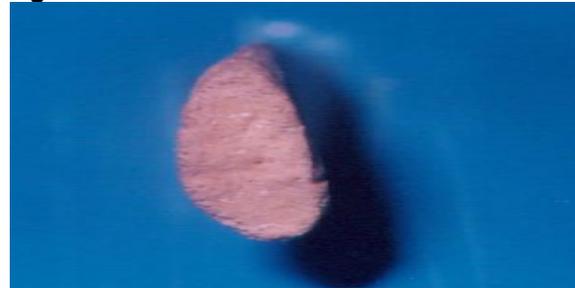
Each of the seven morphological changes was graded and the most suitable coding was given for each. Viewing and smooth running of fingertips on the bone assessed the texture (T) of the bone.

The weight (H) of the bone and its firmness (F) has reference to density and was assessed by pressing them in between the thumb and index finger. Gross examination of the articular surface (A), walls of the pit (W), edges (E) and the shape of the rim (S) was done. The specimen belonged to that phase where five or more of the parameters tallied.

When only four or less tallied, the articular facet changes, Walls and Edges were selected as the inclusion criteria for selecting the phase in their order since they were the primary changes assessed.

The data obtained from the study was statistically analyzed using ANOVA and regression analysis for the relationship between the actual age of the person and the phase evaluated.

**Fig. 1: SL 39 Phase 0**



**Fig. 2: SL 124 Phase 1**



**Fig. 3: SL 25 Phase 2**



**Fig. 4: SL 5 Phase 3**



**Fig. 5: SL 48 Phase 4**



**Fig. 6: SL 70 Phase 5**



**Fig. 7: SL 169 Phase 6**



**Fig. 8: SL 22 Phase 7**



**Fig. 9: SL 14 Phase 8**



**Fig. 10: SL 14 Phase 8**



**Observations:**

Out of the 170 specimens studied 117 were from male and 53 from female persons.

The age ranges of the persons at death ranged from 18- 85 years in the male and from 16-78 years in the females.

**Males:**

The data obtained from male specimens were statistically analysed by linear regression method applied to individual parameters i.e. Articular surface (A), Calcification (C), Walls (W), Shape of Rim (S), Edges (E), Texture (T), Weight of bone (H) and Firmness (F) collectively and excluding the parameters one by one for their efficiency to indicate the correct age and to find out which one /more of these parameters indicate age better with P value less than 0.01.

When all the parameters were evaluated using linear regression and it was found that the parameters walls, weight and calcification and very high P values and was found to decrease the predictability of age. It was possible to predict age in 69% of male rib specimens.

The parameters (A, E, F, S, T and W) were regressed and it was found that the predictability of age was still accurate in 69% of male rib specimens. Using the 5 parameters (A, E, F, S and T) it was possible to predict age accurately in 69% of male rib specimens.

Using parameters articular facet, firmness and texture, it was possible to predict age accurately in 68% of specimens and precisely in 66% of male rib specimens.

The maximum correlation with age was obtained with the evaluation of articular facet, Firmness and Texture combination and was found to predict the correct age in 68% of cases. Inclusion of other parameters was found to decrease the predictability.

**Females:**

The female specimens were grouped in decades of age to know the frequency of distribution. When all the parameters were evaluated using linear regression it was seen that calcification and edges had the highest P value and hence decreased the predictability of age. Excluding edges, the other parameters were subjected to linear regression and it was found that calcification had the highest P value and was excluded in the next step.

Excluding calcification, the other parameters were regressed and it was found that texture and walls had high P values.

These parameters in combination had a 75% chance of predicting age. Texture and walls were excluded and other parameters were regressed using linear regression and in 74% of

female rib specimens there could be an accurate analysed age.

Linear regression method was applied to firmness and shape of rim. This combination was found to be able to predict age accurately in 73% of female rib specimens. Firmness was regressed using linear regression method and it was found to predict age in 71% of female rib specimens with P values less than 0.01.

The maximum correlation with age was obtained with the evaluation of Firmness and Shape of the Rim combination and was found to predict the correct age in 73% of cases. The evaluation of Firmness alone was found to predict age accurately in 71% of cases. Inclusion of other parameters was found to decrease the predictability.

### Discussion:

Changes in the articular facet of the sternal end of the rib (Phase Method) were studied and the process was started by Kerley E R [2], improved by Loth et al [3] and popularized by Iscan M Y et al. [4] Yavuz M F et al [7] applied the phase analysis to Turkish samples, Russell K F et al [8] conducted the study on Americans of European and African descent, Oettle A C et al [9] used it on the South African Black population, and Pillai G K [10] on the South Kerala population.

All of them approved the repeatability of the method popularized by Iscan M Y et al [4] even though they were not able to get very similar results. They believed that the articular facet underwent metamorphic changes throughout life, which were useful age indicators. The question of racial variation was answered by Iscan M Y et al [11], in their studies, which stated that while the degree of interracial variation did not require new standards but specific modification of the standard for their own population.

The present study was undertaken to develop the specific modifications that are applicable to our population to determine age from the sternal end of fourth rib. The results of present study of the male fourth rib specimen can be compared with the result of the studies of Iscan M Y et al and Pillai G K. [4, 10]

In the male rib specimens of the present study, it was found that the maximum correlation with age was obtained with evaluation of articular facet, firmness and Texture combination and was found to predict the correct age in 68% of cases. (Table 1)

In our study 53 right-sided female rib specimens were studied and phase analyzed.

The results were compared with the results of Pillai G K. [10] In the female rib specimen of the present study, it was found that maximum correlation with age was obtained with evaluation of firmness and shape of the Rim combination and was found to predict correct age in 73% of cases. The evaluation of firmness alone was found to predict age accurately in 71% of cases. (Table 2)

Statistical analysis of the results of the present study confirmed that the sternal ends of the fourth rib showed continuous metamorphosis as a normal regressive change of the ageing process, and its assessment could be used to determine age of the deceased to some extent.

### Summary & Conclusion:

The present study was done on 117 males and 53 female postmortem specimens collected from North Kerala population. The study attempts to reevaluate the results of Iscan M Y et al [3] with a view to correlate them with known age in both male and female specimens collected during autopsy, and proposes to utilize it in future in the particular ethnic subgroup from where they were collected.

The sternal end of the fourth rib showed sequential changes of a pit formation when its billowy nature was lost and then it changed into a cup shaped one with anterior and posterior walls with smooth interior surfaces.

The surfaces then lost their smoothness and the rim which was originally smooth and even, oval in shape, became sharp and irregular, scalloped and with window formations.

The overall firmness and texture of the bone also changed from dense, smooth and solid in youth to thin, brittle and porous in the elderly. The present study is a similar one done in an exclusive ethnic subgroup of North Kerala population with the same view.

A similar study had been conducted in South Kerala by Pillai G K. [10] The results of the present study showed that it was a good method of assessment of age in a high percentage of cases even when only ribs are available, mostly like those of previous workers world over, but differed in certain aspects from the South Kerala population.

The results were very relevant at an application level when scattered bony remnants are obtained, to establish the identity in cases of mass disasters.

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**Table 1: Comparison of Statistics of Male Rib Specimens**

Phase	Age range			Cases in current study	Mean age		
	Pillai G K	Iscan M Y	Present study		Pillai G K	Iscan M Y	Present study
1	16-25	17-18	18-28	7	18.8	17.3	23.5
2	20-29	18-25	20-23	6	24.2	21.9	22.0
3	30-38	19-33	21-28	9	33.5	25.9	24.7
4	34-45	22-35	22-38	13	38.7	28.2	24.7
5	34-56	28-52	28-58	22	47.2	38.8	41.0
6	36-80	32-71	30-80	30	50.6	50.0	51.7
7	60-90	44-85	40-75	17	73.3	59.2	54.9
8	65	44-85	40-85	14	65	71.5	63.0

**Table 2: Comparison of Statistics of Female Rib Specimens**

Phase	Age range		Cases in current study	Mean age	
	Pillai G K	Present study		Pillai G K	Present study
1	16-23	16-27	3	19.3	20
2	17-25	20-24	4	20.4	21.3
3	20-36	20-40	10	26.6	28.2
4	26-45	25-52	3	40.2	38.3
5	32-60	28-70	13	51.1	46.5
6	60-62	31-78	9	61	54.4
7	65	43-75	7	65	59.9
8	70	60-78	4	70	69.5

## Original Research Paper

# Pattern of Fatal Cranio-Cerebral Injuries in Mumbai Region

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### Abstract

Head injury is a leading cause of death and disability around the globe and presents a major worldwide social, economic, and health problem. With increasing civilization there is increase in road surface transport to fulfil the need of population, due to this the most common cause of head injury is vehicular accidents. Cases for present study were selected from the medico-legal autopsies, conducted at the Grant Medical College, Sir J. J. Hospital, Mumbai, during the period of 18 months, from January 2009 to August 2010. Cases (100) having a definite history of head injuries irrespective of predisposing factors, were selected for the purpose of scrutiny. From the head injury cases so scrutinized, fatal cases were isolated where the cranio-cerebral injuries alone occurred. In this study Road traffic accident is the most common cause of head injury, linear type of parietal and temporal bone fracture is mostly seen. Incidence of subarachnoid hemorrhage is most common.

**Key Words:** Craniocerebral injuries, Intracranial hemorrhage, Road traffic accident, Autopsy

### Introduction:

The Head injuries, sustained from vehicular accident is an ever increasing trend, due to increase in population, vehicles on the road, speed, ignorance of traffic rules, avoidance of protective equipments and poor road conditions. The present work dedicated in analyzing and evaluating of head injuries because the factors responsible for it were multiple and variable.

Comprehensive study and analysis of injuries to the head in respect to situation, number, size, severity, extent and pattern, by the autopsy surgeon depicts ideas about the manner of infliction. After vehicular accidents, head injury due to fall is the 2<sup>nd</sup> most common cause of cranio-cerebral trauma leading to death.

### Material and Method:

The present prospective study includes total 100 autopsy cases of head injury admitted in Grant Medical College, Sir J.J. Hospital Mumbai during the period of 18 months from January 2009 to August 2010.

Mainly the cases having fatal type of craniocerebral injuries were selected. General information of each case & autopsy findings entered in Performa & then tabulated to retrieve the relevant data for observation & compare with various previous studies. In this study main considered parameters included are the injury pattern of scalp, skull, meninges i.e. intracranial spaces and brain substance.

### Observations and Result:

The present study of 100 cases of cranio-cerebral injuries in Sir J.J. Hospital reveals that head injury is the commonest cause of death in road traffic accident. (Fig. 1)

Most common location of external injury to scalp in cranio-cerebral injury was temporal region (29%). (Table 1) In this study, highest incidence of cranio-cerebral injury seen during the 3<sup>rd</sup> and 4<sup>th</sup> decade followed by 5<sup>th</sup> and 6<sup>th</sup> decade of life. (Fig. 2) Incidences of fatal cranio-cerebral injuries are more common in males than females. (Fig. 3)

Most of the cases (48%) of cranio-cerebral injury came to hospital within 30 minutes of incidence. Out of 100 cases, 39% cases were brought dead and survival period of 31% cases were more than 4 days. (Fig. 4)

Incidence of subarachnoid hemorrhage (50.90%) is most common followed by subdural hemorrhage (28.50%) and least common is Intraventricular hemorrhage (1.8%). (Table 3)

C.T. Scan was done in 38 admitted cases, out of which subarachnoid hemorrhage was detected in 45.80% of cases and subdural hemorrhage in 30.50% of cases. (Fig. 5) Vault

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(39%) is most commonly fractured in cranio-cerebral injury cases followed by base of skull (5%). However no fracture was detected in 52% cases. Linear type of vault fracture (74.50%) is most common, depressed fracture (14.30%) comes next in order. (Table 2)

### Discussion:

Present study showed that the most common cause of cranio-cerebral injuries is road traffic accident. Similar findings were seen in Kalyanraman et al [1] and Sambasivan et al studies. [2] This is possible due to marked expansion of the city, ignorance of traffic rules, over-crowding, rapid increase in the number of vehicles playing on congested roads and avoidance of helmets resulting in frequent traffic accidents.

In this study higher incidence of cranio-cerebral injuries has been noted in 3<sup>rd</sup> and 4<sup>th</sup> decades (41%), which correlates with Lalwani S et al. [3] This is because of adult population lives an active life which predisposes them to accidents causing cranio-cerebral injury.

In general cranio-cerebral injury is more common in males (84%). The rate of accidents is related to driving and activities outside the house. [3] In our study most common location of external injury to scalp in cranio-cerebral injury was temporal region (29%), this result is similar to the ones made by Panigrahi et al. [4]

The scalp laceration may give a clue as to how the wound occurred or was inflicted. Scalp contusion colour gives idea about time since injury. The maximum cases were of simple linear fracture of vault in this study. Parietal bone fracture is seen in 25% cases, temporal in 21% of cases. Linear fracture (81.25%) is the commonest kind of skull fracture as revealed in our study that correlates closely with Yakamin et al [5] as 89% and Nicol et al. [6]

These facts are explained on the basis of the temporal bone involvement mostly due to its thin structure and maximum exposure. Parietal bone involvement in fall can be explained mainly due to the prominences and elevations of parietal bone of skull and also the mode of fall occurring in different circumstances.

Our findings of maximum involvement of parietal bone are similar with the findings of other authors. [6, 7] The observations of the present study of (9.70%) cases of extradural hemorrhage are quite comparable with the study of Galbraith et al (14.6%). [8] The finding of subdural hemorrhage (28.50%) in present study is similar with the findings of Das and Ray et al (SDH-28.01%). [9] The dating of the subdural hemorrhage has great medico-legal importance.

There may have been one or more episodes of trauma on record, any of which may have criminal or civil connotations. Our findings are similar with the findings of Pathak et al [10] i.e. Subdural and subarachnoid hemorrhages are found in maximum number of cases and extradural hemorrhages are found in minimal number of cases.

The finding of subarachnoid hemorrhage (50.90%) in the present study is correlates with other studies. [11] i.e. subarachnoid hemorrhage is the commonest type of intracranial hemorrhage.

Traumatic subarachnoid hemorrhage contrasts with effusions of other etiology (ruptured aneurism, secondary effusions from hemorrhage into the ventricles) which are characteristically found at the base of brain.

Out of 100 cases of cranio-cerebral injury, in 64 cases cause of death was found to be Head injury in our study. The result is similar to the study of Harnam Singh and Agarwal AD. [12]

### Conclusion:

Commonest cause of cranio-cerebral injury is road traffic accident. Fall from height, railway accidents, assaults came next in order. Incidences of cranio-cerebral injuries are more common in younger age groups and mostly in males. Right temporal is the most common region involved in external injury to scalp.

Parietal and Temporal bone fractures are more common. Linear fracture of skull is the commonest, depressed fracture comes next in order. Incidence of Subarachnoid hemorrhage is highest. Most of the head injury cases are accidental, the reason being the overcrowding narrow roads, non existence of separate footpath, lack of traffic knowledge and the careless driving often in intoxicated state.

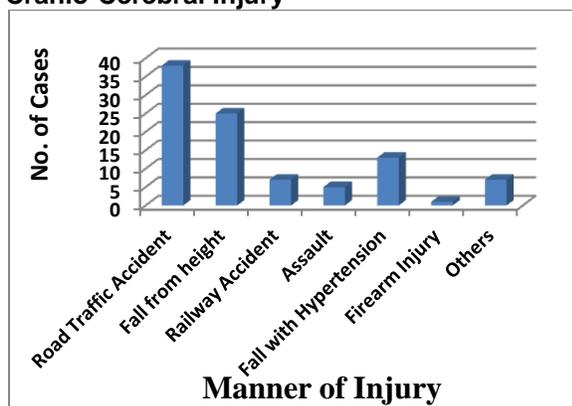
Prevention of fatal head injuries can only be done by taking stringent measures in implementing traffic rules among the various categories of road users, improvement of road surface infrastructure, rapid emergency services & establishment of trauma care centers are major factors to reduce this hazard.

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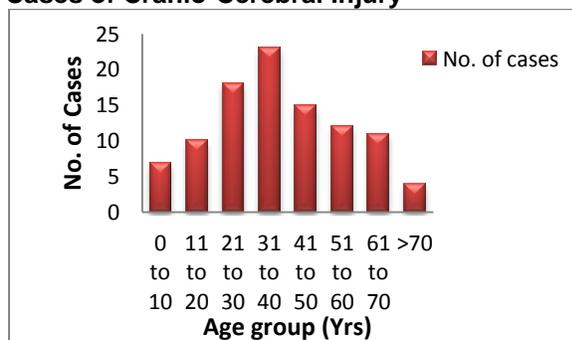
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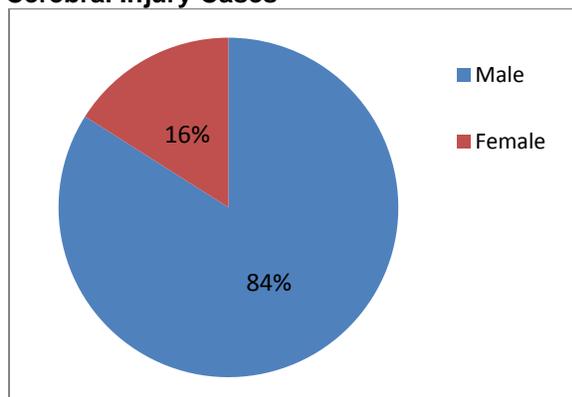
**Fig. 1: Manner of Injury among Cases of Cranio-Cerebral Injury**



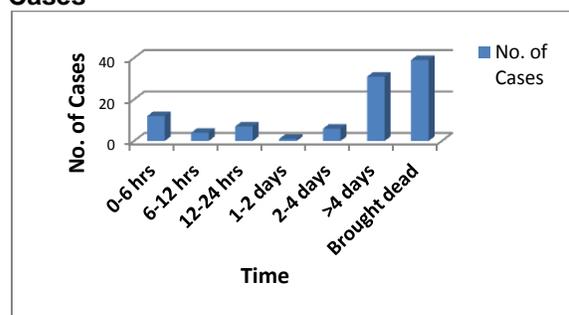
**Fig. 2: Cause of Death on Autopsy among Cases of Cranio-Cerebral Injury**



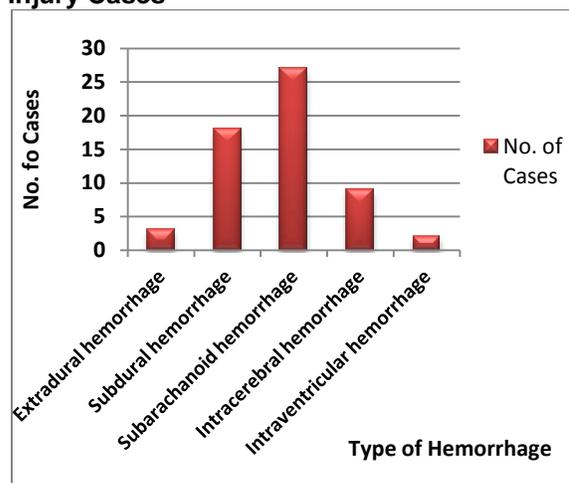
**Fig. 3: Gender Wise Distribution of Cranio-Cerebral Injury Cases**



**Fig. 4: Survival Period Cranio-Cerebral Injury Cases**



**Fig. 5: CT scan Report of Cranio-Cerebral Injury Cases**



**Table 1: Site of External Injury to Scalp among Cranio-Cerebral Injury Cases**

Scalp Area	Side		Total
	Right	Left	
Frontal	6	2	8
Parietal	8	2	10
Temporal	18	11	29
Occipital	8	2	10
<b>Total</b>	<b>40</b>	<b>17</b>	<b>57</b>

**Table 2: Skull Fracture Distribution among Fatal Cranio-Cerebral Injury Cases**

Type of skull fracture	Cases	Percentage
Vault	39	39
Base	5	5
Combination	4	4
No fracture	52	52
<b>Total</b>	<b>100</b>	<b>100</b>

**Table 3: Incidence of Various Types of Intracranial Hemorrhage**

Type of Hemorrhage	Cases	Percentage
Extradural	16	9.70
Sub dural	47	28.50
Subarachnoid	84	50.90
Intracerebral	15	9.10
Intraventricular	3	1.80
<b>Total</b>	<b>*165</b>	<b>100</b>

## Original Research Paper

# Determination of Time since Death from Changes in Morphology of White Blood Cells in Ranchi, Jharkhand

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### Abstract

Determination of 'time elapsed since death' (TSD) is one of the important content of the post-mortem report. Irreversible changes occur in the WBCs in the internal environment due to non-availability of oxygen, accumulation of carbon dioxide, pH change and accumulation of toxic products. Although the changes in morphology of white blood cells are also variable, depending on different factors like other parameters used for the purpose of determination of time since death, but it is less variable as compared to others. The study sample comprised of 150 medico-legal autopsies conducted in the department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, during June 2006 to September 2007. Blood samples were collected from heart chambers and slides were prepared on spot at the time of autopsy. Slides were stained by Leishman's stain and examined under light microscope. In present study neutrophils were recognized up to 30 Hrs Lymphocytes up to 36 hrs, Eosinophils up to 20.30 hrs and monocytes up to 19.20 Hrs. In no case basophil was observed.

**Key Words:** WBC, Neutrophils, Lymphocyte, Eosinophils, Monocytes, Lysed, Time Since Death (TSD)

### Introduction:

Determination of 'time elapsed since death' (TSD) helps in the investigation of complex and mysterious cases to unearth the truth for the administration of justice in many ways. In general, determination of the time of death is extremely difficult, and accuracy is almost impossible.

Although by careful study of different macroscopic, microscopic, chemical and biological parameters, the TSD can be determined in considerably narrow range.

Irreversible changes occur in the WBCs in the internal environment due to non-availability of oxygen, accumulation of carbon dioxide, pH change and accumulation of toxic products. [1]

The changes in morphology of White blood cells (WBC) are also variable depending on different factors, like other parameters used for the purpose of determination of TSD but it is less variable as compared to others.

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DOR: 20.02.2014 DOA: 29.05.2014

### Materials and Methods:

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

Only those cases in which TSD were known by relatives, police or doctors and verified by other post-mortem changes were included in this study. Cases in which bodies grossly affected with septicemia, anemia, and nutritional deficiency, Malignancy of blood, blood disorders, and charred bodies were not included in this study.

Blood samples were collected from heart chambers and slides were prepared on spot at the time of autopsy. Slides were stained by Leishman's stain and examined under light microscope. The study was based upon variation in White Blood Cells.

Morphology of all types of white blood cells (WBC) i.e. neutrophils; lymphocytes, Eosinophils and monocytes were noted in following manner:

**Normal, slightly dysmorphic, grossly dysmorphic, mixture of dysmorphic & Lysed and Lysed.**

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

**Table A: Groups of Dead Bodies**

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

**Observations:****1. Neutrophils:**

In our study among the cases examined during the first 6 hours after death in 91% cases morphology of neutrophils were found to be normal and in 9% cases they were slightly dysmorphic. In 6 to 12 hours after death they were normal in 60.7% and slightly dysmorphic in 39.2% cases.

Where as in 12 to 18 hours after death they were normal in 12.55% cases, slightly dysmorphic in 25% and were grossly dysmorphic in 62.5% cases. (Table 1)

In between 18 to 24 hours neutrophils were slightly dysmorphic in 2.9% cases, grossly dysmorphic in 79.5% cases, mixture of dysmorphic and lysed in 14.7% and were completely lysed in 2.9% cases.

They were found to be grossly dysmorphic in 22.2% cases, mixture of dysmorphic and lysed in 22.2% and in 55.6% cases found to be completely lysed in 24 to 36 Hrs. In all cases examined after 36 hours of death neutrophils were found to be lysed.

Neutrophils were found to be recognizable latest by 30 hours in present study.

**2. Lymphocytes:**

Out of all the cases examined during the first 6 hours after death lymphocytes were found to be normal in 95.5% of cases and cells were slightly dysmorphic in 4.5% where as they were normal in 82.1% cases and slightly dysmorphic in 17.9% cases during 6 hours to 12 hours after death. In 12 to 18 hours after death cells were normal in 35% cases, slightly dysmorphic in 20% cases and grossly dysmorphic in 45%.

Whereas lymphocytes were normal in 2.9% cases, slightly dysmorphic in 5.9% cases and grossly dysmorphic in 91.2% cases during 18 to 24 hours of death.

Out of cases examined during 24 to 36 hrs after death neutrophils were found normal in 11.1% cases, dysmorphic in 22.2% cases, mixture of dysmorphic and lysed in 22.2% and were lysed in 44.5% cases.

They were found lysed in all the cases examined beyond 36 hours after death. (Table 2) Lymphocytes were found recognizable latest by 36 hours after death in present study.

**3. Eosinophils:**

During first 6 hours after death the eosinophils were found to be normal in 50% cases, slightly dysmorphic in 45.45% cases, grossly dysmorphic in 4.5% cases where as the cells were found normal in 3.6% cases, slightly dysmorphic in 28.6 % cases grossly dysmorphic in 60.7% cases and were lysed in 7.1% cases in 06-12 Hrs. (Table 3)

Present study showed that in between 12-18 hrs after death the eosinophils were found dysmorphic in 45%, mixture of dysmorphic and lysed in 5.1% cases and were completely lysed in 50% of the cases where as they were found to be dysmorphic in 5.9% of the cases, mixture of dysmorphic in 2.9% and were found lysed in 91.2% of case examined during the period of 18 to 24 hours.

In all cases eosinophils examined beyond 24 hours after death were found to be lysed. Eosinophils were found to be recognizable in latest by 20.30 hours after death in present series of cases.

**4. Monocytes:**

In this study out of the total cases examined, in first 6 hours after death in 45.5% cases morphology of the monocytes were found to be normal, in 50.1% cases they were recognizable but slightly dysmorphic, and in 4.5% cases lysed. Where as they were normal in 7.1% case, slightly dysmorphic in 28.6%, and grossly dysmorphic in 64.3% of cases examined during 6-12 hours after death. (Table 4)

Among the cases examined during the 12-18 hrs after death the monocytes were found to be slightly dysmorphic in 5%, grossly dysmorphic in 37.5%, mixture of dysmorphic and lysed in 12 .5% and lysed in 45% cases.

They were found dysmorphic in 2.9% cases and lysed in 97.1% of cases examined during 18 to 24 hours after death. In all cases examined beyond 24 hours after death the monocytes were found to be absent. In the present study monocytes were found to be recognizable latest up to 19.20 hours.

**Discussion:**

Rajesh Bardale in his study observed that neutrophils up to 20-24 hrs, lymphocytes up to 30 hrs eosinophils up to 21 hrs and monocytes are identifiable up to 18 Hrs after death. [2] Penttila A, Lahio K. stated that when corpses were kept at +4°C the lymphocytes seemed to be most resistant and basophils the least resistant to the effects of autolysis. [3]

H Dokgoz et al found that eosinophils and monocytes were identifiable up to 72 hrs, neutrophils up to 96 hrs and lymphocytes up to

120 Hrs after death in non-refrigerated cadavers. [4] Rajesh Bardale had not found morphology of any cell identifiable beyond 30 hrs contrary to other studies. [1, 2, 4]

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

Platt et al in their study of cerebrospinal fluid cells found that if the post-mortem duration is greater than 12 hour, the cells become vacuolated and cannot be identified. [6]

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

**Conclusion:**

The present study proves that changes in the morphology of white blood cells can be helpful as supplementary procedure for estimating time since death. It is also a very simple procedure and interpretation of above mentioned findings is easy.

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**Table 5: Change in Morphology of WBC V/S TSD**

Time since death	Changes in Morphology of White Blood Cells
0—06 hrs	Neutrophils - normal
	Lymphocyte - normal
	Eosinophils - normal
	Monocytes - normal
06—12 Hrs	Neutrophils - Slightly dysmorphic
	Lymphocyte - Slightly dysmorphic
	Eosinophils - grossly dysmorphic
	Monocytes - grossly dysmorphic
12—18 Hrs	Neutrophils - Grossly dysmorphic
	Lymphocyte- Slightly and Grossly dysmorphic mixed.
	Eosinophils - Lysed
	Monocytes - Lysed
18—24 Hrs	Neutrophils - Grossly dysmorphic
	Lymphocyte - Grossly dysmorphic
	Eosinophils - Lysed
	Monocytes - Lysed
24—36 Hrs	Neutrophils - mixture of lysed and dysmorphic cells
	Lymphocyte - Lysed
	Eosinophils - All Lysed
	Monocytes - All Lysed
36-48 Hrs	Neutrophils - All Lysed
	Lymphocyte - Lysed
	Eosinophils - All Lysed
	Monocytes - All Lysed
> 48 Hrs	In case of lymphocyte also all Lysed

**Table1**

**Morphological Changes in Neutrophils in Different Time Intervals**

TSD (Hrs.)	Normal	Recognizable but slightly dysmorphic	Recognizable but grossly dysmorphic	Mixture of dysmorphic and Lysed	Lysed	Total
0—6	20 (91%)	2 (9%)	0	0	0	22
6—12	17 (60.7%)	11 (39.2%)	0	0	0	28
12—18	5 (12.5%)	10 (25%)	25 (62.5%)	0	0	40
18—24	0	1 (2.9%)	27 (79.5%)	5 (14.7%)	1 (2.9%)	34
24—36	0	0	2 (22.2%)	2 (22.2%)	5 (55.6%)	9
>36	0	0	0	0	17 (100%)	17

**Table 2**

**Morphological Changes in Lymphocytes in Different Post- mortem Interval**

TSD (Hrs)	Normal	Recognizable but slightly dysmorphic	Grossly dysmorphic	Mixture of dysmorphic and Lysed	Lysed	Total
0—6	21 (95.5%)	1 (4.5%)	0	0	0	22
6—12	23 (82.1%)	5 (17.9%)	0	0	0	28
12—18	14 (35%)	8 (20%)	18 (45%)	0	0	40
18—24	1 (2.9%)	2 (5.9%)	31 (91.2%)	0	0	34
24—36	1 (11.1%)	0	2 (22.2%)	2 (22.2%)	4 (44.5%)	9
>36	0	0	0	0	17	17

**Table 3**  
**Morphological Changes in Eosinophils in Different Post-mortem Interval**

TSD (Hrs)	Normal	Recognizable but slightly dysmorphic	Grossly dysmorphic	Mixture of dysmorphic and Lysed	Lysed	Total
0—6	11 (50%)	10(45.45%)	1(4.5%)	0		22
6—12	1 (3.6%)	8 (28.6%)	17 (60.7%)	0	2 (7%)	28
12—18	0	0	18 (45%)	2(5%)	20 (50%)	40
18—24	0	0	2 (5.9%)	1 (2.9%)	31(91.2%)	34
>24	0	0	0	0	26 (100%)	26

**Table 4**  
**Morphological Changes in Monocytes in Different Post-mortem Interval**

TSD (Hrs)	Normal	Recognizable but slightly Dysmorphic	Grossly dysmorphic	Mixture of dysmorphic and Lysed	Lysed	Total
0—6	11 (50%)	11 (50%)	0	0	0	22
6—12	2 (7.1%)	8 (28.6%)	18 (64.3%)	0	0	28
12—18	0	2 (5%)	15 (37.5%)	5 (12.5%)	18 (45%)	40
18—24	0	0	1 (2.9%)	0	33 (97.1%)	34
>24	0	0	0	0	26 (100%)	26

## Review Research Paper

# Embryonic Stem Cell Research Ethical and Legal Controversies

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### Abstract

The discovery of stem cells particularly embryonic stem cells with its possible clinical application has generated great curiosity amongst medical professionals and general public. Embryonic stem cell research has become a challenging issue for biomedical scientists, policy makers and regulatory bodies.

The key controversial issue is the determination of moral and legal status of the embryo as embryo stem cell research involves retrieving embryonic tissue from spare embryos leading to their destruction. This embryo that has the full capacity to develop into a human being is sacrificed for the benefit of others. Global regulations monitoring stem cell research are also troubled with similar ethical and moral issues associated with it. The main source of embryonic tissue is the spare or supernumerary embryos created during infertility treatment by artificial reproductive techniques (ART). Sadly, in absence of regulatory provisions to govern them, the field of ART is open for all forms of medical malpraxis bearing direct implications on embryonic stem cell research. This article is an attempt to seek clarity on the concept of embryonic stem cell research and contentious issues associated with it.

**Key Words:** Stem cells, embryonic stem cell research, Moral and legal status of embryo, ART, Global regulation

### Introduction:

Stem cell research has offered a new viable therapeutic option for debilitating diseases, injuries and other diseased conditions. The scope of stem cell based treatment has expanded in recent years due to advances in stem cell research and technologies. Now, stem cell based treatments have been established as standard clinical care in certain disorders like use of hematopoietic stem cells in leukemia's or use of limbal stem cells in corneal disorder.

Stem cell technology is speedily increasing within the field of regenerative medicine, granting DE novo production of functional tissue and providing for brand new diagnostic and therapeutic capabilities that will surpass the risk benefit ratio of typical existing reparative treatment modalities e.g. organ transplantation, rejuvenation of tissues. [1] The hype created by this discovery and so claimed by many research scientists has made people believe that something significant is happening.

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Whatever promising future clinical application it holds, stem cell research especially embryonic stem cell research is associated with ethical, social and legal controversies.

What is so unethical about embryonic stem cell research? The major conflicting unethical issue identified with this research is extraction of embryonic stem cells by embryo destruction. The very embryo which has the capacity to become a human being is destroyed at the onset of its potentiality of becoming one of us. The current view about any clinical research is to look it from the view point of cardinal research principles of autonomy, justice, non-maleficance and human dignity.

Any research which stands to violate these principles is bound to suffer from moral and ethical controversies. A research that involves embryo destruction will find it difficult to accommodate itself within these cardinal principles.

### Definition and Platforms of Stem cells:

Stem cells are one of the human body's master cells with the ability to grow into any one of the body's more than 200 cell types. [2] They are unspecialized and undifferentiated cells capable of self proliferation, migration and differentiation. The distinct characteristic associated with the stem cell is their potential of

self renewal and capacity to differentiate into specialized cell. In short they are immature precursor cells with a capacity to specialize and differentiate into a mature specialized cell.

- i. **Embryonic Stem cells (ESCs):** These are the first differentiation after fertilization of cells of the embryo proper. They are derived from the inner cell mass of the blastocyst, 4–5 days after fertilization. They are not totipotent, but pluripotent and capable of forming all other cells of the body.
- ii. **Adult Stem Cells:** These are derived from bone marrow, peripheral blood, tissues, muscles, adipose tissues, cartilage etc.

The adult stem cells are broadly classified as hematopoietic, non-hematopoietic and organ specific stem cells.

Hematopoietic stem cells are blood forming cells derived from bone marrow. Non-hematopoietic stem cells are mesenchymal stem cells (MSCs) present in many tissues like bone marrow, blood, cartilage, fat, placenta, liver etc.

MSCs have unique characteristics of differentiating into several cell lineages such as cartilage, bone etc. They are pluripotent, non immunogenic, not patient specific and have tendency to migrate to the sites of inflammation.

- iii. **Umbilical Cord Blood Stem Cells and Placental Stem Cells:** Stem cells can also be isolated from the umbilical cord blood and placenta. Cord blood is found to be rich source of stem cells. They are multi potent in nature.

Further based on their capacity to divide and differentiate they may be totipotent, pluripotent or Multipotent. Totipotent stem cells give rise to all different types of stem cells in the body including a living organism e.g. fertilized egg. Pluripotent stem cells give rise to any type of cell except those required to form a foetus. Multipotent stem cell gives rise to specific different type of cells.

### **Induced Pluripotent Stem Cell (iPSC):**

These are adult cells that are engineered or reprogrammed to become pluripotent i.e., to behave like an embryonic stem cell. The scientific experience with induced pluripotent stem cells till date seems to be very promising. Yamanaka and then Thomson have discovered ways to reprogram somatic cells to a primordial state and then redifferentiate them to tissues of choice. [3]

It is important to note that though iPSC technology as enormous potential, it is still at its infancy, and certainly does not do away with the need for ESCs. [4]

### **Somatic Cell Nuclear Transplant (SCNT) – Cloning:**

Known as cloning, SCNT was first demonstrated in 1997 through the creation of Dolly the sheep. [5] As it suggest, it is simply the transfer of a somatic cell nucleus into an enucleated oocyte that can give rise to a cloned zygote from which embryonic stem cells can ultimately be derived. [6]

### **Human Embryonic Stem Cells (HESCs) Sources:**

HESCs are derived from the inner cell mass of the human blastocysts. Blastocyst is formed five days after fertilization of the egg by the sperm. It has outer shell which matures and if survives implantation becomes placental tissue and the inner cell mass becomes the tissues of the human body.

The extraction of HESCs from inner cell mass for research purpose leads to the destruction of the embryo. The major source of human embryonic stem cell tissues are the spare or supernumerary embryos created during in vitro fertilization as a part of infertility treatment. The other source is creating embryos with somatic cell nuclear transfer techniques (SCNT). The legislation of most countries including India allows use of spare or supernumerary embryos either fresh or frozen created during in-vitro fertilization.

Some countries with more liberal view have allowed creation of human embryos with SCNT as a source of embryonic tissues. The controversial issue in embryo research is concerned with which embryos are suitable and can be used for research.

There is disagreement over whether it is appropriate to create embryos solely for research purposes, and what techniques should be used to create those embryos. Many people and governments feel that an appropriate restriction on embryo research is to limit the use of embryos in research to those embryos that are surplus to infertility treatments. [7]

### **The Status of the Embryo- Moral, Legal, Personhood:**

As mentioned earlier, the extraction of embryonic tissue for research purpose involves destruction of the embryo. So what is wrong with destroying embryo? Most of these arguments about the rightness and wrongness of embryo destruction are based on the moral status of the embryo. The moral wrongness associated with embryo destruction will not only make the research impermissible but also deny the potential benefits expected from this research.

The use of human embryonic tissues for research poses a moral problem as it brings two highly valued but conflicting moral principles: the inherent duty to provide treatment to ease pain and suffering on one hand and the value of human life and dignity on the other.

Extraction of stem cells from human embryos violates the second principle as it leads to destruction of potential human life. Both principles cannot coexist together, but which principle takes precedence is a rather contentious issue. How the embryo should be considered from moral or legal point of view is the main debatable issue associated with HESC research.

### **Deciding the Moral Status of the Embryo:**

It's very difficult to ascertain the moral status of the embryo as it varies. There are different views about this moral status. The leading views deliberate that the embryo has the status of Persons, or Potential persons, or Divine creations, or Subjects of moral harm, or the beginning of human life with intrinsic value, or organic material with no moral standing than other body parts. [8] The development of human life or person is an evolving process starting from fertilization to the birth of a new born.

The early stages of development mostly compromise of cellular differentiation whereas at the end, the foetus assumes its full form both in physical and functional status.

There is no clear cut demarcation during this process of physical development as to when personhood is acquired. At one end of the spectrum of views on this issue is the belief that the embryo, from the moment of conception, is created by God and is a person in its own right with the same moral status as an adult human.

Those who hold this view, such as Catholic Bishop Richard Doerflinger, say that it is wrong to destroy embryos of any gestational age, for any purpose. [9] This absolutist view is not shared by all those with religious beliefs.

A substitute stance is that the embryo acquires full personal identity, and the ethical rights that come with this status, step by step during the process of development occurring between conception and birth.

It is so ethically acceptable, under these circumstances, to use embryo for research purpose. This view has been defended by some theologians of alternative faiths, together with Protestant, Christians, Jews, Muslims and Buddhists, and is additionally seconded by many folks who don't have a religious faith. [10]

The embryo in its early stage is a cellular structure and don't have the psychological, physiological, emotional and intellectual characteristics that we tend to attribute with individuality. [11]

It, therefore, follows that if human embryo does not fulfill the criteria for personhood; it does not have any interests to be protected and thus may be instrumentally used for the benefit of other human persons. [12]

In the discussion about embryo research, the formation of the primitive streak is considered as an important landmark point. The primitive streak, seen in the form of appearance of a surface thickening, is the first visible organization of the embryo which usually happens around fourteen days after fertilization.

The term 'pre-embryo' was introduced in 1985 to describe the early embryo up to this point. One argument that was used to justify drawing a distinction between the pre-embryo and the embryo proper was that the possibility of splitting the pre-embryo into two parts or twin parts. It appears, as per this argument, that the pre-embryo wasn't 'a person', as personhood is commonly taken to imply indivisibility or individuality. [13]

Others have argued that the concept of the pre-embryo is a rhetorical device invented to justify embryo research and that it creates an artificial division in what is, in reality, a continuous biological process of development. [14,15] Some research workers argue that the formation of central nervous system should be considered as the landmark for the definition of life, since this implies that the possibility of sensation initially exists.

Up to 14 days of embryonic period, the blastocyst has no central nervous system and therefore, cannot be considered as sentient. If we can remove organs from brain dead declared patients who are alive in some sense, then we can use two hundred-cell embryos as cell donors at the same moral status as brain dead individuals. [16]

It is argued that the early stage embryo is not sufficiently personalized to possess the ethical and moral weightage of personhood. [17]

There is another viewpoint of the "relative value" of human embryos, more than cells but less than persons. [18] This view states that embryos deserve respect but not to the same extent as a fully developed person.

In accordance with this argument, the moral status of a human embryo increases in a step wise manner through its development in the uterus, and at the point of birth it is entitled to enjoy full rights of human beings. [19] From the

entire deliberations one can conclude that the human embryo deserves respect but it cannot be considered as a person as it lacks the essential attributes of personhood.

### **Legal and Constitutional Status of the Embryo/Unborn Foetus:**

The Universal Declaration of Human Rights (UDHR) in its Article 1 says that: "All human beings are born free and equal in dignity and rights". [20] "The word "born was used to exclude the foetus and embryo from granting human rights. An amendment was proposed and rejected that would have deleted the word "born", as it was deliberated to protect the right to life from the moment of conception." [21]

Even the Convention on the Rights of the Child does not recognize the right to life until birth. [21] Thus a foetus has no rights under UDHR. The main standard for the protection of human life in general international law is Article 6 of the Covenant on Civil and Political Rights (CCPR). Article 6 of the CCPR, in its first paragraph the norm prescribes that "every human being has the inherent right to life. However, the phraseology of the norm doesn't outline the term "human being". [22] The unborn foetus has full potential to become a human being in right environment.

The liberal interpretation of the above fundamental right, one can conclude that the unborn foetus, from the conception till birth, has a right of life and it is immaterial whether the foetus is created in vitro or in vivo. Now, if this standard were transferred to all forms of unborn life, not only would research with embryonic stem cells infringe upon Art. 6 CCPR, but the legality of liberal abortion laws would also be highly debatable. [22]

The US Supreme Court has never ruled on the constitutional status of embryos outside of the body and most US states have no law on the matter. But the court has ruled that fetuses are not persons within the meaning of the 14<sup>th</sup> Amendment, and thus do not have constitutional rights as such. Presumably that ruling would also extend to embryos as well. [23]

Article 4 of the American Convention on Human Rights states: "Every person has the right to have his life respected. This right shall be protected by law and, in general, from the moment of conception. No one shall be arbitrarily deprived of his life". [24]

But the Inter-American Commission on Human Rights, one of two adjudicatory bodies that interprets and monitors compliance with the American Convention, has clarified that this protection is not absolute." [25]

Article 2(1) of the European Convention on Human Rights provides: "Everyone's right to life shall be protected by law." [26]

The European Commission on Human Rights, in *Paton v. United Kingdom*, held that the Convention language "tend[s] to support the view that [Article 2] does not include the unborn," and acknowledged that recognition of an absolute right to life before birth would "be contrary to the object and purpose of the Convention." [25]

In *Vo v. France*, the European Court of Human Rights, which interprets and monitors compliance with the European Convention, affirmed that "the unborn child is not regarded as a 'person' directly protected by Article 2 of the Convention and that if the unborn do have a 'right' to 'life,' it is implicitly limited by the mother's rights and interests, including her rights to life, health, and privacy." [25]

The above judgement brings forth another controversial issue of foetal rights versus maternal rights of autonomy. The liberalized abortion laws existing in different countries and so proposed by various organizations have clearly determined the precedence of maternal rights over foetal rights.

The basic fundamental right to life is guaranteed by Article 21 of the Constitution of India. It says that no person shall be deprived of his life or personal liberty except according to procedure established by law. Even here the term "person" is not defined.

The Indian Legal System provides for the protection of the rights of the foetus through sections 312 to 316 of the Indian Penal Code (IPC) which deals with miscarriage. [27]

Section 315 IPC deals with "Act done with intent to prevent child being born alive or to cause it to die after birth" and Section 316 IPC deals with "Causing death of a quick unborn child by act amounting to culpable homicide. In the above penal provisions, the unborn child is protected from any act which prevents it from being born and also provides punishment for causing its death which is considered equivalent to culpable homicide.

Section 416 of Code of Criminal Procedure (CrPC) Act 1973 provides for postponement of capital sentence of pregnant women and also to commutes the sentence to life imprisonment in such circumstances. [27]

This provision is made to protect the life of unborn foetus as it has nothing to do with the act committed by the pregnant woman. Here the legislation has considered the unborn foetus as a distinct and separate individual/entity with the right of protection against potential harm.

The Section 13 of the Transfer of Property Act, 1882 deals with the transfer of property for the benefit of unborn.

Here the statute has defined the unborn as legal person by fiction. From the above legal provisions it is clear that the unborn foetus is protected against potential harm in the same manner as the fundamental rights of non interference with personal life and bodily integrity guaranteed to a human person.

If embryo is granted the status of personhood then they too will have the right of not to be harmed or killed with imposed obligations of not to do so.

The lack of clarity on the status of the embryo and deliberations put forth by constitutions of various countries and decision given by competent courts it can be assumed that the foetuses are not a person and hence cannot enjoy fundamental constitutional rights meant for human beings or persons.

Though the IPC and CrPC provide protection to the foetus from potential harm the Indian Constitution is silent on this aspect of extending the fundamental rights to the unborn foetus in clear terms.

### **Value of Embryos:**

The spare embryos which are the outcome of infertility treatment are the essential source of embryonic tissue. These embryos can either be used for embryonic stem cell research or can be discarded as leftover material once the objective of infertility treatment is achieved.

In other words, should we consider them as waste material or treat them as valuable commodity. "For donor couples, the transformation of embryos from intended babies, to 'waste' or 'leftover' material and then finally a source of precious stem cells is a complex and value laden process." [28]

The transformation of discarded embryos into stem cells has been referred to by one scientist as the process of turning 'garbage into gold'. [29] The child intending couples have to make emotional, physical and financial investment to reap the benefits in terms of successful pregnancy though this beneficial outcome cannot be always guaranteed.

The so considered 'waste materials' has economic value considering the initial substantive financial and emotional/physical cost incurred by these donors.

Also the potential commercial value associated with the result of embryonic stem cell research using such embryos might be tremendous. Pharmaceutical and Biotech companies will earn substantive commercial profit that may eventually flow from this work.

This raises an important question about the right of the donor couple to seek or claim financial stake or compensation. Nevertheless it is illegal under the Human Fertilization and Embryo Act (HFEA) of the United Kingdom (UK) for them to incur any financial reward for donating their embryos and they have no financial stake in any materials or procedures developed from their donation. [13]

Most commentators support a ban on the 'sale of embryos. For example, the European Group on Ethics in Science and New Technologies has stated that 'embryos as well as cadaveric tissues and foetal tissues must not be bought or sold...Measures should be taken to prevent such commercialization.

It is illegal for gametes to be bought or sold. An increasing number of biotech and pharmaceutical companies are gathering an array of 'valuable' bodily materials including DNA samples and umbilical cord blood (also used for stem cell research) from various corners of the globe for scientific and commercial exploitation. [13]

However, the issue of making payments to gamete donors or embryo donors remains ethically controversial as it may lead to "commodification of the body".

### **Global Legislation Governing Embryonic Stem Cell Research:**

Legislation governing human embryonic stem cell research is not uniform and varies from country to country. [30,31] Most of them have allowed use of spare or supernumerary embryos created during in-vitro fertilization for this purpose but have prohibited creation of human embryos specifically for research purposes.

The use of spare or excess embryos is subjected to certain provisions like informed consent, donation of embryos without financial compensation and restrictions on the use of embryo not beyond fourteen days.

Few countries have put prohibitions on buying and selling of gametes, fertilized eggs, embryos and foetal tissues.

But some countries with more liberal view have allowed creation of human embryos for research purpose with somatic cell nuclear transfer technique as well as use of supernumerary embryos for procurement of human embryonic stem cells.

India has allowed establishment of new HESC lines with spare, supernumerary embryo with prior approval of the Institutional Committee for Stem Cell research and Therapy (IC-SCRT) and Institutional Ethics Committee (IEC)

provided appropriate consent is obtained from the donor as per the draft guidelines.

**Need of Definitive Legislation:**

Since the spare embryos created during infertility treatment are the most valuable source of embryos, India lacks in having a definite legislation regulating artificial reproductive technologies (ART). The existing guidelines directing stem cell research including embryonic stem cell are prepared by the Indian Council for Medical Research (ICMR).

These recommending guidelines have two inherent defects. One, these guidelines do not have any legal effect and second, it has no penal provisions for violating the rules/policies mentioned in these guidelines.

The absence of effective legislation will raise serious objection regarding the rights of the donor of embryos, number of spare embryos, quality of the embryos, preservation and disposal of frozen embryos etc.

The presence of definite enactment will help to regulate the activities of ART clinics by imposing strict accountability and responsibility through penal provisions. Registration of ART clinics should be made mandatory and subjected to periodic supervision to ensure high standard of norms, care, quality of treatment and facilities offered by them specifically in view of use, disposal and preservation of embryos.

The rights and autonomy of the donor couple and donor of gametes should be adequately protected. Informed consent of the donor regarding the use and destruction of the spare embryo should be taken. The question of financial compensation given to them should be adequately addressed keeping into mind the relevant existing rules and regulations of the country. Legislation similarly on the lines of the Human Fertilization and Embryo Act, as prevalent in the United Kingdom, will help to lessen the problems associated with ART.

**Conclusions:**

The possibilities offered by adult and embryonic stem cells in the treatment of various diseases have created widespread excitement globally. The clinical application of stem cells and its outcome is not yet clear and hence their potential use need to be ascertained by evidence before accepting them as safe and effective treatment.

Though stem cell based therapies are in early stage of clinical development later on they may turn out to be expensive in nature and thus affordable to only wealthy few. This might create social injustice and inequality and both are in violation of basic principles of clinical research.

The challenge is to ensure that it is available to all patients who need them.

The issues related to the source of embryonic tissues still lie unresolved and many more are likely to appear especially if non-embryonic sources of pluripotent stem cells become available. The science of medicine is always evolving and any new scientific discovery is associated with some or the other ethical or legal issue.

Ethical issues will remain, but they are the issues that arise in bringing any new discovery out of the lab into clinical research and then clinical use. The more apt and liberal use of ethical and legal principles will help to resolve them and bring these discoveries in reality for the benefit of needy patients.

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## Review Research Paper

# Digital Autopsy: Moving From Fiction to Reality

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### Abstract

With the technology ruling over each sphere of our modern lives it is no wonder that it is also proving to be a source of great help to the forensic experts who with their work make the dead talk. Technology is fast replacing the manual and mental traditional methods and with the launching of igene and autopsy suites virtual autopsy/digital autopsy / autopsy imaging is indeed moving from fiction to becoming a factual reality. Though forensic radiology has been in use since the discovery of X-rays but the technique which was used to visualize and analyze the mummified remains of people who died thousands of years ago sowed the seed of digital visualization being promoted commercially as digital autopsy. In the setting of Forensic evaluation, 3D surface scanning using multislice CT technology provides excellent visualization of the body and allows re-examination of digital images of the deceased long after the actual time of death.

**Key Words:** Autopsy, Imaging, Technology, Forensic Radiology, Digital

### Introduction:

Autopsy means "Self" (autos) and "I will see" (opsomei) in Greek "to see with one's own eyes." [1] It is the systemic and scientific examination of a dead body to determine or confirm the cause of death. They are of three types namely clinical or pathological, medico-legal and anatomical.

Clinical/ Pathological autopsy is done to determine the disease causing death and a pathologist performs it with the consent of relatives of the deceased.

Medico legal autopsy is done to solve the mysterious unnatural death and is done by a Forensic pathologist or medico-legal expert ideally. Anatomical autopsy is carried out to learn the normal structure of the human body by medical students.

Forensic pathology is a field within which physicians are mainly preoccupied with examining what initially are victims of possible, suspected or obvious violence. Clinical Forensic Medicine essentially does the same but with living victims.

As examinations are typically performed under the legal restraints of investigative authorities such as courts, prosecutors, district attorney or police, there are constraints as to cost, time, objectivity and task specification depending on local law.

Digital Autopsy or Imaging autopsy can be defined as the use of high definition CT and or MRI scan to determine the cause of death in addition to or in lieu of traditional autopsy.

CT is well suited to show foreign objects, bones and air or gas distribution throughout the body, whereas MRI sequences are strong in detaining organ and soft tissue findings. Ultrasonography helps in evaluation of various organs, pleural air, effusions, cardiac and pericardial abnormalities, haemoperitonium and even skeletal injuries.

Resulting data can be archived and reproduced without loss, analyzed elsewhere or distributed to specialists for technically demanding analysis.

### History:

In ancient Egypt and Mesopotamia, post-mortem dissections were frequently performed during the process of embalming. [2] In India, autopsy and dissection were practiced by Sushruta, an early pioneer of ayurveda in the sixth century BC. [3]

In 3<sup>rd</sup> century BC, Greek scholars used autopsy for the purpose of enhancing their understanding of anatomy and disease. [4] Similar approaches emerged in Europe during the middle ages and the Renaissance with the work of Vesalius and others.

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DOR: 04.02.2014 DOA: 24.02.2014

The first organized treatise on pathological finding of autopsy was "The seats & the uses of disease investigated by anatomy", published in 1761 by Giovanni Batista Morgagni. This book describes nearly 700 autopsies performed by the author and is the foundation of modern post-mortem science. [4-6] At the end of 19<sup>th</sup> century, Osler established the autopsy as one of the cornerstones of his approach to both medical training and the clinical method. [7, 8]

In the 1<sup>st</sup> half of the 20<sup>th</sup> century, autopsy rates steadily increased. The 2<sup>nd</sup> half of 20<sup>th</sup> century & beginning of 21<sup>st</sup> century saw continued decline in autopsy rates. [9]

The most commonly attributed factor accounting for this phenomenon included discomfort of the physician in requesting permission from family, cost containment measures and risk of blood borne pathogen transmission, religious and cultural beliefs.

### History of Imaging Autopsy:

Advanced imaging techniques have been in use for quite some time during Forensic investigations. In 1977, Wullenweber et al reported one of the earliest Forensic applications of computed tomography to describe radiographic patterns of gunshot injuries to head. [10] In 1980, Flodmark et al performed a comparison study of premortem CT findings and subsequent autopsy results in neonates who suffered perinatal asphyxia. [11]

Kalender et al in 1990, followed by developing acquisition and processing of 3D digital radiographic imaging data. [12] The 1990's saw the inception of large scale research programmes dedicated to imaging autopsy.

The most prominent programme was the Virtopsy Project headed by Prof. Michael Thali which was initiated by Prof. Richard Dirnhofer at the end of 20<sup>th</sup> century and has been operating out of the Institute of Forensic Medicine at the University of Zurich, Switzerland since 2011. [1, 13]

The aim was to improve the objectivity of findings made in forensic autopsies.

The foundation stone of the commercial concept of digital autopsy was laid during the publicity generated regarding the analysis of the "Virtual Mummy" at the British Museum in year 2004. [14] While manner of death, cause of death, time of death, identification of deceased and a range of practical and reconstructive applications are obviously related to medico-legal investigation of death, Virtopsy methods were ground breaking in that they have established a new high tech tool box into both research and practical aspects of modern Forensic pathology.

### Technology:

The technology currently used for conducting a virtual autopsy comprises of:

- Robot guided surface scanning for three dimensional documentation of the surface of the body, to scale and in colour. [15] This supplements the external post-mortem examination of the body that is done in conventional autopsy.
- Multi-slice spiral CT and MRI. This supplements the internal post-mortem examination of the body in autopsy. [16]
- Post-mortem angiography, which visualizes the cardiovascular system of the deceased with the aid of peristaltic pump and contrast medium. [17]
- Image and robot guided, contamination free sampling for a wide range of supplementary Forensic analysis such as histology, bacteriology, virology, toxicology and diatomology. [15] This procedure replaces the usual collection and storage of sample material from the body.

### Recent Advances:

By connecting a conventional CT or MRI scanner to a 3D imaging software tool developed by Malaysian company iGene, pathologists can display and examine cadavers in a much cleaner fashion than conventional scalpel-based methods allow.

Using a large touch screen to display the body's 3D image, one can zoom into areas of the corpse they want to study in greater detail and remove layers of clothes and tissues without having to cut them. Every time a coroner requires an autopsy to be performed on a body, relatives of the deceased will be given an option of either subjecting the corpse to a conventional procedure free of charge, or opt for the digital autopsy for £500.

### Objectives:

The main objectives of imaging autopsy (IA) include determining of: [13, 18]

- a) Cause of death
- b) Gender identification in difficult Forensic cases;
- c) Body length and individual decedent feature identification;
- d) Identifying distinct foreign bodies like retained bullets, blades, etc.;
- e) identification of injuries and forensic three dimensional reconstructions, bullet tract identification;
- f) Education and clinical performance improvement process; and
- g) For research purposes – from medical to historical (i.e., mummies, etc).

### Advantages:

1. Post-mortem imaging can demonstrate findings that are not readily recognized during the traditional autopsy such as fast and accurate identification of foreign objects (bullets) in decomposing bodies, documentation and examination of neck muscle hemorrhages in Forensic cases, visualization and quantification of venous air embolism structure.

IA offers excellent accuracy, including very close estimation of solid organ weights and the ability to match decedent-environment relationships in fatal traumatic injuries. [19, 20] Imaging autopsies provide visualization of soft tissue patterns in cases of severe putrefaction. This is especially important when structural patterns are not otherwise distinguishable on traditional autopsy. [13]

2. Imaging Autopsy produces detailed records that show conclusively the cause or manner of death which can be kept intact and free of human intervention.

3. It eases the burden of determining the identity and cause of death in victims of mass natural disasters, particularly in large number of badly decomposed bodies.

4. Digital bodies can be sent to forensic pathologists who can conduct autopsies remotely.

5. In the wake of a biological contamination or biological terrorist attack, digital autopsy can be extremely valuable in determining further investigation that are necessary to identify the pathogenesis while at the same time protecting forensic pathologist from accidental exposure to biological contaminant.

6. Digital autopsy stream lines communication between forensic experts as well as pathologist to seek professional second opinion with experts abroad through a secured channel digitally.

7. It has the ability to recreate realistic 3D anatomic reconstructions of injuries which is useful when relating the patterns of injury to various environmental factors at the time of death.

8. Interactive visualizations are often easier for juries, lawyers and other court officers with a clearer understanding of the autopsy process, which can be vital when the manner of death must be established in a court case.

9. From the religious point of view, it provides an option to treat the deceased with dignity while at the same time achieve the medico legal requirement. Traditional autopsy may

be refused because of religious, social, cultural and/or personal beliefs. [21, 22] Imaging autopsy offers a non-invasive alternative of discovering the cause of death in such cases. [22]

10. CT scanning may be more suitable to body packer identification than conventional or plain abdominal X- Rays.

11. It gives a clean bloodless visualization of the documentation with high precision, contamination free sampling (poisons, infections, tissue etc) accurate to the millimeter.

### Limitations:

While devastating traumatic injuries may be obvious on a "virtual" autopsy, causes of death due to certain medical conditions (i.e., metabolic disorders) may elude even the most specialized and sensitive imaging techniques. [23] Important questions need to be answered before more widespread use of IA is instituted, including its medico-legal ramifications, medical-economic implications, and issues surrounding IA interpretation.

IA studies involve a number of controversial issues such as who should be responsible for obtaining and interpreting these studies, who will cover the expense of performing and interpreting them, and medico-legally who will be held liable for these autopsies.

The relatively slow acceptance of IA is likely related to certain medico-legal aspects, uncertainty over who should be responsible for interpreting such studies, as well as the cost and reimbursement associated with these studies prevents imaging autopsy from being accepted widely as an alternative to traditional autopsy.

### Conclusion:

The recent advances in the development of a non invasive technique of visualizing the insides of a person without hurting the cultural, religious and social beliefs ensure a dignified end to a person's life.

With the installation of the first autopsy suite in a morgue in Sheffield in Britain, one is hopeful for a cheaper, faster and efficient autopsy. Yet there is relatively slow acceptance of IA over traditional autopsy.

While imaging autopsies are unlikely to ever match some of the histological and metabolic information available from traditional autopsies, it may be that for certain diseases radiographic postmortem examination is actually superior. They take only a few minutes and may be viewed remotely without loss of imaging detail with easy sharing of the data among

experts. It does not require specialized facilities other than one time use of the imaging suite.

Image-based autopsy makes the cause-of-death determination process much less invasive and certainly much more “acceptable” to both the decedent’s family and the participating physician or medical trainee.

In addition, the routine performance of Imaging Autopsy could also help build an atmosphere of interdisciplinary cooperation between radiologists, pathologists, and primary physicians involved in clinical care of the decedent prior to his or her death. All too often, the reason for the patient’s demise can only be an “educated guess” which are frequently inaccurate.[24, 26] Information obtained from imaging autopsies offers the potential to do away with such guesswork.

Use of Imaging Autopsy will also prove to be an excellent educational tool that can provide much needed post-mortem information during the era of declining autopsy rates.

Development of Forensic telemedicine consultations will solve many of the problems associated with interpretation of IA studies during odd hours or at locations that do not have the necessary resources to perform such interpretations.

Hence Imaging autopsy or digital autopsy is fast moving away from being a fiction of being used as pre autopsy screening tool or complementary study to an alternative form of traditional post-mortem examination.

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## Review Research Paper

### Higher Impact Factor: Better Journal? Not a Necessity

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#### Abstract

Often, impact factor (IF) is considered as an important criteria to assess the academic repute of a scientific journal. It is considered as the all important criteria to decide how good the journal is. This has led to a mad rush for publishing articles in journals having higher impact factors. In recent years it has become a dilemma for the new comers to the field that how to search for a "Good" journal for their budding articles. In the present article we are going to discuss the pros and cons of using impact factor as the criteria for judging the quality of the article as well the journal in which it is published. A brief overview about the procedure of imparting impact factor to the journal is also presented. Additionally, a brief description of the other prevalent bibliometric measures is also discussed.

**Key words:** Impact factor, Bibliometric indicators, Academic Journal

#### Introduction:

For a promising academic carrier nowadays it has become mandatory to publish a paper into a journal of good repute. These papers and publications count a lot for recruitment of faculty and promotions as per the prevailing trends of Medical Council of India. But when it comes to the assessment of 'goodness' of repute of the journal, there arrives a question-how to judge this goodness.

Often, the impact factor is considered an important criterion to decide the academic repute of a journal. It has become a trend that authors are now assessed, not so much by the validity, interest or quality of the work itself, but by the impact factor of the journal. [1]

However, is impact factor an appropriate and justified bibliometric measure? Should it be the only criteria while selecting a journal? These and other relevant questions form the basis for the present article.

The article further revises the exponential growth of bibliometric and attempts to expose the overall dissatisfaction with the analytical quality of IF. [2]

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DOR: 12.11.2013 DOA: 29.05.2014

#### Who Reports Impact Factor?

Impact factor is obtained from the data that is produced by the Institute for Scientific Information (ISI) in Philadelphia since 1961. The ISI records scientific citations as represented by the reference lists of articles from a large number of the world's scientific journals.

The references are rearranged in the database to show how many times each publication has been cited within a certain period of time, and by whom. These results are then published as the Science Citation Index (SCI).

On the basis of this index and the list of authors' publications, the annual rate of citation of papers by a scientific author or a research group is calculated. Similarly, the citation rate of a scientific journal, known as the journal impact factor, can be calculated. By this definition, only research articles, technical notes and reviews are "citable" items, meaning that only these publications can be cited.

Other types of publications, like editorials, letters, news items, meeting abstracts etc. are "non-citable items", meaning that they are not used for the purpose of calculating impact factor. [2, 3]

In general **impact factor** (IF) of an academic journal is a measure reflecting the average number of citations to recent articles published in the journal. [4] In a given year, the impact factor of a journal is the average number of citations received per paper published in that journal during the two preceding years.

For example, if a journal has an impact factor of 3 in 2008, then its papers published in 2006 and 2007 received 3 citations each on

average in 2008. The 2008 impact factor of a journal would be calculated as follows:

$A$  = the number of times that articles published in that journal in 2006 and 2007, were cited by articles in indexed journals during 2008.

$B$  = the total number of "citable items" published by that journal in 2006 and 2007. ("Citable items" are usually articles, reviews, proceedings, or notes; not editorials or letters to the editor.)

2008 impact factor =  $A/B$ . [4]

### The Pros and Cons of Impact Factor:

Nothing in this world is perfect and the same implies to the celebrated bibliometric measure- impact factor. Here we have made an attempt to evaluate the merits and demerits of the usage of this criterion which are discussed as follows:

#### Pros:

1. It provides objectivity to the peer review process, which is the first requirement of any assessment system.
2. Better the article; more are its chances of being published. Therefore, the impact factor tells about the worthiness of the articles that are published.
3. It is a reasonably good measure of establishing quality, especially if used judiciously. [5]
4. It ensures maintenance of standards of article when they are published in the journal.
5. It brings bibliometric uniformity in the assessment system.
6. It is an important tool to prevent manipulation of the journals by big publications. Its presence ensures that the less popular journals of big publication houses are not given undue favours merely because of their names.
7. It makes peer review more transparent and helps in counterchecking its shortcomings. [6]

While the above mentioned advantages make IF an important tool in bringing subjectivity to the way different journals are ranked, it is not without its shortcomings. Some of these are documented below.

#### Cons:

1. In an ideal world, every citation must be accounted for. However, this is not the case with IF. There are situations like self-citations, 'ghostly' citations, letter to the editor etc. which increases the citation of the article, causing IF to be manipulated. [5,7,8]
2. IF can be manipulated by the industry based on their requirements.

3. Any article/manuscript that can have a positive effect on the respective company can be promoted by the respective company, thereby increasing the IF. [9]
4. It is an incomplete and inadequate method to measure the scientific merit of the published article.
  - a) It tells how many times the article is cited, not how deserving the article is. The number of citations depends on the amount of work that is being done on that subject, and not on its utility. Therefore, the fields which are dynamic, i.e. having large scale expansion and contraction, have more chances of being cited, and thus have higher impact factor. Thus, the fields that are short-lived are often favoured by the journals to boost up their IF, putting other specialties at a relative disadvantage.
  - b) The number of citations is highly dependent on the language and geographical location of the journal and author. A journal/author who is publishing from English speaking country, like USA, would be cited more often than someone who is from non-English speaking region, like Asia. [10-12]
5. The two year citation period is highly arbitrary and questionable. Dynamic and rapidly evolving fields like biochemistry and molecular biology would obviously cite more articles, thereby having higher IF, vis-à-vis a slowly developing field like Forensic Medicine. [8]
6. The length of the publication also affects the impact factor. It is seen that long articles collect many citations and give high journal impact factors. Consecutively, short publication lag allows many short term journal self citations and gives a high journal impact factor.
7. '**Coercive citation**' is another disturbing trend that is visible these days. In order to inflate the impact factor, the editors force the authors to add some citations from their journal, or out rightly reject those articles which do not have any citation of their journal. These spurious citations defeat the very aim of research and learning. [13]
8. One important criticism of IF is that the database that is used to calculate it is not complete. An important set of instrument that is not used is the books, which are important scientific publications.
9. Impact factor is distorted by positive feedback. This means that many times, the articles are cited not based on actual reading, but by their citation in other articles. People just add them, simply to increase the

bibliography of their article, without going through them. This distorts the actual citation of the article. [14,15]

10. Journals on basic sciences cover a large number of topics. So, obviously, they would have a higher impact factor, as compared to the specialist journals, that would have a lesser impact factor. [16, 17]
11. Manipulation by the journals: A journal can adopt editorial policies to increase its impact factor. For example, journals tend to publish more review articles, as they are cited more, thereby increasing the impact factor of the journal. This is evident from the fact that review journals generally have the highest impact factor in their respective fields. [18]
12. Statistical shortcomings: it is not necessary that every article of the journal is cited same number of times. Often, few articles are cited more, while others are cited less. This gives a skewed appearance to the article citation rate and consequently to the journal impact factor. [19]

#### **Other Bibliometric Indicators:**

Impact factor is not the only bibliographic measure that is present to assess the quality of the journal. There are other methods that can provide the same. Some of these include Google Scholar, Page Rank, H-index, Immediacy index, Eigen Factor etc., which are detailed below: [20]

1. **Immediacy Index:** It denotes the number of citations the articles in a journal receive in a given year, divided by the total number of articles published by the journal. (21).
2. **Cited Half-Life:** It is the median age of the articles that were cited in Journal Citation Reports each year. For example, if a journal's half-life in 2005 is 5, that means the citations from 2001-2005 are half of all the citations from that journal in 2005, and the other half of the citations precede 2001. [4, 21]
3. **Aggregate Impact Factor:** It is used for a subject category: This is calculated taking into account the number of citations to all journals in the subject category and the number of articles from all the journals in the subject category
4. **h-index:** This is an index that attempts to measure both the productivity and impact of the published work of a scientist or scholar. The index is based on the set of the scientist's most cited papers and the number of citations that they have received in other publications. The index can also be applied to the productivity and impact of a group of

scientists, such as a department or university or country, as well as a scholarly journal. It is sometimes called the Hirsch index or Hirsch number. [22]

5. **Page Rank:** It is used for websites. It works by counting the number and quality of links to a page to determine a rough estimate of how important the website is.
6. **Google Scholar:** While most academic databases and search engines allow users to select one factor (e.g. relevance, citation counts, or publication date) to rank results, Google Scholar ranks results with a combined ranking algorithm in a "way researchers do, weighing the full text of each article, the author, the publication in which the article appears, and how often the piece has been cited in other scholarly literature". [23]
7. **Eigen Factor Score:** Journals are rated according to the number of incoming citations, with citations from highly ranked journals weighted to make a larger contribution to the Eigen Factor Score than those from poorly ranked journals. [24]
8. **SCImago Journal Rank:** The SJR indicator is a measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from.

#### **Conclusion:**

Impact factor has become the most important barometer of measuring the reputation of the journal. However, it is not without its shortcomings, as we have seen.

Therefore, using it as the sole criteria for judging the journal is fought with danger. Although the use of impact factor-based indicators for science policy purposes has increased over the last two decades, several limitations have been pointed out and should be borne in mind.

As far as the field of Forensic Medicine is concerned, we have a limited viewership and readership. Impact factors of forensic journals are fairly low, in comparison with many other disciplines, probably because of the small size of the field, fewer active researchers and less pressure to publish. [25]

Bibliometric parameters may have academic consequences, e.g. in Central government institutes in India like AIIMS, the faculty of forensic medicine is at a relative disadvantage during the promotions and job upliftments as compared to their colleagues from the clinical fields.

This can be learnt from the fact that journals from the general medicine category like *Lancet* had an impact factor of 39.06 in 2011, while renowned journals of Forensic Medicine like **American Journal of Forensic Medicine and Pathology** had an impact factor of 0.883 in the same year.

For development of true research in the field of forensic medicine and toxicology we need to evaluate the journals beyond the scope of impact factor. [26] Although the current system may be effective at measuring merit on national and institutional scales, the most effective and fair analysis of a person's contribution derives from a direct assessment of individual papers, regardless of where they were published.

Forensic Medicine and Toxicology authors can consider other journal quality metric alternatives, in addition to the impact factor option, including the Eigen factor Score, Article Influence Score, h-index, SCImago Journal Rank (SJR), and discipline-specific generated journal quality measures. This should also be emphasized that there is no substitute for a well scrutinized and an informed peer-review procedure.

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## Case Report

# Fatal Cardiac Tamponade following Rupture of Saccular Aneurysm of Ascending Aorta: A Case Report

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### Abstract

Thoracic aortic aneurysms often go unnoticed as the patients rarely feel any symptoms. There have been many instances where a healthy person without any significant history of illness was found dead at home or at work place and such cases always raise a suspicion of foul play. A 40-year old man was found unconscious on the bank of a river and he was immediately taken to the hospital; however, he was declared brought dead on arrival. Foul play was suspected and his body was brought for autopsy at the Regional Institute of Medical Sciences, Imphal. On examination, massive haemopericardium along with an external rupture of a saccular aneurysm of the ascending aorta was observed. Aortic aneurysm is associated with significant mortality that mandates early identification and management. In India, routine health screening is prevalent only amongst the affluent class. Hence, health screening of the general population is recommended so as to avert such fatal outcomes and at the same time, it would help in reducing needless litigations.

**Key Word:** Ascending aorta, Atherosclerosis, Saccular aneurysm, Cardiac tamponade, Sudden death

### Introduction:

Sudden death is the sudden or unexpected termination of life of an apparently healthy individual, usually from some natural disease. Sudden death invariably arouses suspicion in younger individuals and the purpose of medico-legal autopsy in sudden death cases is to determine whether violence or poisoning has been in any way responsible for the death. [1] It is a known fact that diseases of the cardiovascular system account for about 45-50% of sudden deaths and one such condition is the rupture of the aortic aneurysm. [1, 2]

An aortic aneurysm is an enlargement of a weakened area of the aorta. Aneurysms which involve the ascending aorta, aortic arch and descending thoracic aorta are termed thoracic aortic aneurysms. The incidence of thoracic aortic aneurysms is estimated to be 5.9 cases per 100,000 person-years. [3]Thoracic aortic aneurysms affect approximately 15,000 people in the United States each year and are 13<sup>th</sup> leading cause of death. [4]

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### Case Report:

A 40-year old man was found unconscious on the bank of a river at about 4 P.M of 14<sup>th</sup> April 2011 and he was immediately taken to a nearby hospital; however, he was declared brought dead on arrival. Foul play was suspected and his body was brought for autopsy at the Regional Institute of Medical Sciences, Imphal on 15<sup>th</sup> April 2011.

### Autopsy Examination:

On examination, except for congestion of the face and eyes, no external injuries were observed on the body. On internal examination, massive haemopericardium (about 600ml. of clotted blood, Fig. 1) along with an external rupture of a saccular aneurysm of the ascending aorta, 14 mm (approx.) in diameter and 1.2 cm above the level of the semi lunar aortic valves was observed. (Fig. 2 & 3)

Histo-pathological examination of the aortic wall neighboring the rupture site showed atherosclerotic changes with cholesterol clefts.

Infiltration of adventitia by chronic inflammatory cells with angiogenesis and fibrosis extending into the fibrous tissue were also observed. (Fig.4 & 5) Atherosclerotic changes in both left and right coronary arteries without narrowing of the lumen were also observed.

The cause of death was given as to be due to **Cardiac tamponade following rupture of aortic aneurysm.**

### Discussion:

Some of the causes of aortic aneurysms include atherosclerosis, syphilis, trauma, bacterial infection, arteritis, connective tissue disorders, neoplasm, etc.

Atherosclerosis is the predominant etiology of aneurysms of the descending thoracic aorta. Conversely, atherosclerosis is an infrequent cause of ascending thoracic aortic aneurysms. [5]

Most of aortic aneurysms are fusiform, although up to 20 percent may be saccular. [6] Saccular aneurysms are spherical in shape and involve only a portion of the vessel wall.

If a saccular aneurysm is present in the ascending aorta, surgery is recommended when it reaches a size of about two inches (5 cm). [7]

Interestingly, in the present case, the rupture occurred in a small saccular aneurysm, which measured only 14 mm (approx.) in diameter. Aortic dissection and rupture are the main complications of thoracic aortic aneurysm and a ruptured aortic aneurysm can lead to life-threatening internal bleeding.

Thoracic aortic aneurysms often go unnoticed as the patients rarely feel any symptoms. Hypertension usually intensifies the force of blood on the walls of an aneurysm contributing to rupture.

In the present case, no medical records were available and as per the history given by the members of his family, he had no complaints and was absolutely symptom free before the occurrence of the fatal episode.

Nevertheless, hypertension could have been a predisposing factor in this case in presence of the evidence of atherosclerosis in the arteries. Supra-avalvular aortic aneurysms are less common, and predominantly affect male patients; the mean age at the time of diagnosis ranges from 59–69 years. [8]

However, the present case was relatively young and apparently healthy, and the circumstances surrounding his death were pointing towards possibility of a foul play.

There have been many instances where a healthy person without any significant history of illness was found dead at home or at work place and such cases always raise a suspicion of foul play.

Hence, aortic aneurysm is associated with significant mortality that mandates early identification and management. It is a known fact that there has been increased efficiency in diagnosing this condition and when detected in time, many patients have been treated in tertiary health care centres in India.

### Conclusion:

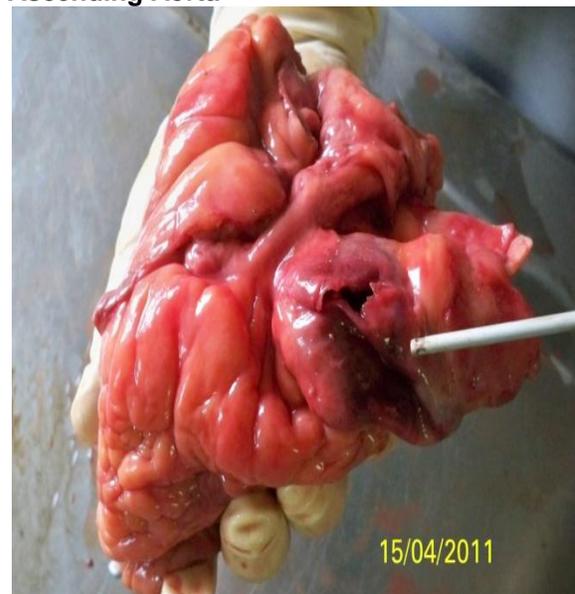
This case has been reported in view of the fact that the rupture occurred in a small atherosclerotic saccular aneurysm of the ascending aorta, that too in a relatively young individual who showed no signs of illness before the fatal episode.

Hence, a routine health screening, which is prevalent only amongst the affluent class in India, is recommended for the general population so as to avert such fatal outcomes and at the same time, it would help in reducing needless litigations.

**Fig. 1: Partly Clotted Blood (600ml.) Collected from the Pericardium**



**Fig. 2: Ruptured Saccular Aneurysm of Ascending Aorta**



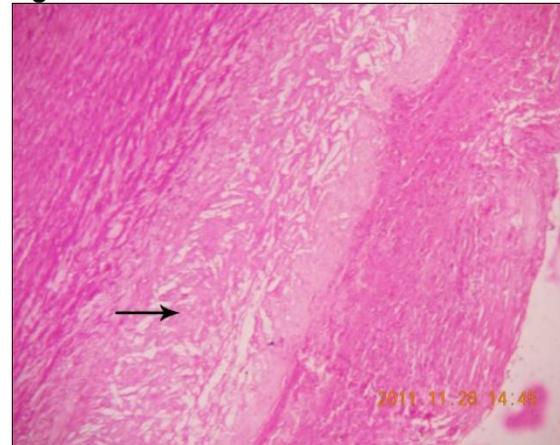
**Fig. 3: Inner Aspect of the Aorta showing the Opening of Saccular Aneurysm**



**Fig. 4: Atherosclerotic Ascending Aorta**



**Fig. 5: Cholesterol clefts**



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## Case Report

# Fatal Cut-Throat Injury Labeled as Suicide after Meticulous Autopsy: Case Report

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### Abstract

Dead body of a male aged about 25 years was brought for post mortem examination in the mortuary of Medico-legal Institute and Gandhi Medical College, Bhopal, with the history of injury over the neck. On autopsy, a cut - throat injury was seen. Cut - throat wound is usually homicidal and very rarely it is self inflicted or accidental. Pattern of cut-throat injury, its direction and associated injuries were reconstructed during the autopsy examination. Detailed history regarding the circumstances of the case was obtained from the police and the relatives of the deceased. The Forensic Pathologists did meticulous crime scene examination. Past medical records of the deceased were probed thoroughly, which revealed that deceased was suffering from Schizophrenia. The entire exercise helped the investigating agency to arrive at a conclusion regarding the manner of death. The detailed circumstantial evidences of this case along with post mortem findings have been discussed in this case report.

**Key Words:** Suicidal cut - throat injury, Suicidal incised wound, Self inflicted wound

### Introduction:

Determination of manner of death, whether suicidal, accidental or homicidal, is one of the most difficult tasks for a Forensic pathologist or a Medical Examiner.

Unlike medical examiner system, in Indian legal system the direction of any criminal investigation is decided by the police. But, due to his experience and training a Forensic Pathologist plays a crucial role in assisting the investigating agency to take a particular path, while investigating a case of suspicious death; and help them to arrive at a certain conclusion regarding the manner of death.

Also, in the early stages of death investigation his opinion may be crucial in initiating or aborting a homicide investigation-a decision which may have serious consequences; if wrong. [1] Cut-throat injury caused by sharp- edged object is usually homicidal and very rarely suicidal. [2] Proper history, meticulous crime scene investigation and carefully performed autopsy are vital in ascertaining the manner of death in such cases.

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DOR: 16.09.2013

DOA: 17.09.2013

This paper describes a rare case of fatal cut-throat injury which was labeled as suicide after meticulous autopsy.

### Case History:

Dead body of a young male aged about 25 years was found lying in the pool of blood on the floor of his room. His father saw the dead body and called the police. Dead body was lying in supine position. Clothes were completely soaked with blood. A deep cut - throat wound was present. Initial impression was suggestive of homicide.

On interrogation father told the police that he was watching television in the nearby room at that time. He also told police that his son was suffering from schizophrenia and was on medication for the last 5 years. He was a school drop-out and used to assist his father in his abattoir.

### Crime Scene Examination:

House was situated in a slum area, having 2 rooms of size 15x10 feet each. The room in which dead body was found had 2 doors. Body was lying supine on the floor. There was pooling of blood just below and along the sides of the body. There was spurting of blood on the floor at a distance of 1 to 2 feet away from the site where the body was lying.

A knife having iron blade and handle of length 20 cm was found at a distance of 35 cm from the right hand of the deceased. All the things were properly arranged in the room and there were no signs of struggle. Moreover, there

were no grossly visible foot prints or any trail of blood, ruling out the entry of any outsider into the room. [Fig. 1]

### Autopsy Findings:

All clothes were intact, having no cuts or tears. Clothes were soaked with blood particularly on the front aspect. Both hands were partially clinched. There were no defense injuries on the hands or forearms, which are very common in cases of assault caused by sharp edged object. Rigor Mortis was present all over the body and hypostasis was over back. Old scars, 4 in number, varying in size from 3x1cm to 2x0.5 cm were present horizontally over the left side of chest.

A cut - throat injury in the form of deep gaping incised wound was present over front aspect of neck, cutting through the skin, superficial fascia, platysma, sternocleidomastoid muscle on left side, left jugular vein, left common carotid artery and anterior and lateral wall of trachea. Length of the wound was 10.5 cm and maximum width of the wound was 5 cm in the center, depth of wound was 4 cm near the left angle and 1 cm near the right angle. (Fig. 2)

On careful examination of cut throat injury, three very superficial incised wounds of size varying from 0.8x0.2cm to 0.5x0.2cm were found near the left angle of the main wound, suggestive of hesitation cut marks. (Fig. 3)

The hesitation cuts were so superficial that they could be identified with the help of a magnifying glass only. No other external injuries were present over the body. Internal examination revealed that all organs were pale. Stomach was empty.

After overall considerations, cause of death was opined as **“shock and hemorrhage as a result of self-inflicted cut throat injury caused by hard and sharp edged object.”**

### Discussion:

As per the data provided by the national crime records bureau, the so called “Soft method of committing suicide” such as hanging (37%) and poisoning (29.5%) are most commonly adopted means of committing suicide in India. “Hard methods” like self-cutting, self-stabbing, are very rare, being employed in only 0.4% of suicides and having a male predominance. [3, 4]

There are certain characteristic specifically associated with self-inflicted sharp force injury. These injuries are commonly seen on accessible parts of the body such as wrist, elbow and rarely over the neck and are usually superficial. For a right handed person self-inflicted injury is seen over the left side of the

body, directed from left to right, with greater depth on the left and tailing off to the right. [5, 6]

In the present case, injury was present over the neck and also it was very deep extending up to posterior wall of trachea, which makes this case very unique. Biagio Solarino et al, have reported 3 such cases in Italy and Germany, but in none of the cases, depth of the wound was as deep as seen in the present case. [7]

Another important characteristic of Self-inflicted sharp force injuries is the presence of hesitation cuts. “Hesitation cuts” also known as “Tentative cuts” are multiple superficial cuts present around the commencement of the main wound. These cuts indicate the divided state of the mind of the person, as it is normal human instinct to preserve life. [5, 6]

Hesitation cuts have been described in 60-80% of such cases. [8] On the contrary, Shetty BS et al have reported a case of ‘Atypical Suicidal cut throat injury’, in which no hesitation marks were found. [9]

In the present case hesitation cuts were seen, which were so superficial that they could have been very easily missed by an inexperienced person. Also, there was no defense injury, a fact which strongly supports the hypothesis of self-infliction. [2]

A 2005 report from the National Association of State Mental Health Program Directors found a mortality gap of 25 years between schizophrenia patients and the general population; and concluded that 40% of the excess mortality was related to suicide and other unnatural causes. Self-mutilation is a common finding in schizophrenics. [10, 11]

In the present case deceased was known schizophrenic with evidence of previous self-inflicted injury over chest.

In conclusion, we emphasize that homicide might be initially suspected in cases of self-inflicted cut-throat injury; because for a lay person it is very hard to understand that somebody could slit his throat to commit suicide. But proper history, crime scene investigation and meticulous autopsy assist in correctly establishing the manner of death in such cases.

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**Fig. 1: Dead body lying in the Pool of blood along with Spurting of Blood**



**Fig. 2: A Deep Cut-Throat Wound**



**Fig.3: Hesitation Cuts near the Commencement of Cut-Throat Wound**



## Case Report

# Hydatid Cyst Disease with Hepatic Encephalopathy and Multi-organ Failure: A Rare Case

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### Abstract

Hepatic Encephalopathy is a serious and fatal complication of chronic liver disease and is broadly defined as an alteration in mental status and cognitive functions occurring in presence of liver failure. The diagnosis of hepatic encephalopathy is mainly clinical, sometimes aided by relevant laboratory (biochemical) investigations-if the infrastructural facilities permit. Histopathological findings in the brain and other organs are either meager or absent. Hydatid disease is caused by ingestion of eggs of Echinococcus species. Human beings are accidental intermediate hosts. Two third of hydatid cysts are found in liver. Though obstructive jaundice occurs as a complication of this cestode infestation, encephalopathy is rare or does not happen. The determination of the definitive cause of death may depend on elucidating the histological features of non apparent or equivocal macroscopic lesions. In this case presentation it has been attempted, to illustrate a rare postmortem finding of hydatid disease in a clinical presentation of hepatic encephalopathy where post-mortem histopathological examination shows multi-organ ischemic necrosis.

**Key Words:** Hepatic Encephalopathy, Hydatid Disease, Autopsy, Histopathology, Multi-organ failure

### Introduction:

It is fortunate that all Forensic Pathologists have to deal not only with Criminal, Sudden, Suspicious, Accidental and Suicidal Deaths but with wide range of deaths due to natural causes.

Remember the famous comment of Prof. Bernard Knight "Involvement with natural deaths means frequent professional intercourse with clinicians and non Forensic pathologists with all the consequent benefits of cross fertilization of knowledge and ideas".

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DOR: 01.10.2013 DOA: 20.04.2014

When a team of Forensic and non Forensic pathologists keeps in touch with clinicians to deal a case of death due to natural causes, the result is surprising as we have seen in the present case study.

### Case History:

One 27 years old male, Muslim by religion, was admitted to the district hospital on the first week of April'2011, with history of fall on the roadside followed by transient unconsciousness and recovery. He was suffering from chronic ill health, anorexia, vomiting, pain in the upper abdomen and yellowish discoloration of the whole body.

As his condition worsened in spite of treatment, the said patient was transferred to Calcutta National Medical College at Kolkata on the first week of May' 2011. But the patient succumbed to his illness on mid of June 2011.

The cause of death as recorded in the death certificate was "Multi-organ failure in a case of Hepatic Encephalopathy". The dead body of the said subject was sent to NRS Medical College for autopsy.

The clinical entities like "Multi-organ failure" and "Hepatic Encephalopathy" can hardly be documented through routine autopsy procedures. The role of supplementary ancillary investigations is very much relevant in this context. In the present case study the incidental

finding of Hydatid Cyst Disease further complicated the scenario. In this vexing situation we have attempted to establish a causal relationship between the clinical findings, autopsy findings and results of histopathology.

### Autopsy Findings:

#### External Findings:

- Deep yellow discoloration of sclera, conjunctiva and skin of the whole body.
- Surgically made wound at the right flank of the abdomen for drainage of ascitic fluid.

#### Internal Findings:

- Brain and both lungs were pale and edematous.
- Spleen was blackish in colour and was grossly enlarged-weighing 800 g. multiple small, hard, whitish areas (calcifications) were found over the costal surface. (Fig. 3)
- Liver was grossly enlarged, weighing 2400 g, yellowish coloured and firm in consistency. Multiple small, hard, whitish (calcifications) nodules were found at places over both the lobes.

Over the diaphragmatic surface of the right lobe there was a whitish hard area (calcified) of 1" x 1", which on cut section shows multiple small cysts within the substance of the liver. (Fig. 1& 2)

#### Histological Findings:

- Brain- Congestion, dilatation of meningeal vessels accompanied by focal areas of ischemic necrosis (infarct). (Fig. 4)
- Lungs- Patchy bronchopneumonia with serous fluid and hemosiderin laden macrophages in the alveoli. Foci of ischemic necrosis (infarct) seen at places. (Fig. 5)
- Heart- Heart muscles separated by edema fluid with dilatation of blood vessels. Foci of ischemic necrosis (infarct) seen at places. (Fig. 6)
- Liver- Multiple focal areas of ischemic necrosis (infarct) seen. Rest of the liver tissue shows inflammatory cell infiltration and degenerative changes. (Fig. 7)
- A piece of liver tissue (8cm x 6cm x 4cm) - Cut section shows large cystic areas of size 4cm x 4cm with multiple vesicle-like structure. On microscopic section it shows histology of hydatid cyst with multiple daughter cysts along with pricyst and adjacent liver tissue.

#### Cause of Death:

Death was due to "Multi-organ Failure in a case of Hepatic Encephalopathy."

### Discussion:

Cestodes are segmented worms. The adults reside in the gastrointestinal tract but the larvae can be found in almost any organ. Human cestode infections are of two major clinical groups. In one group human are the definitive hosts, with the adult tapeworms living in the gastrointestinal tract (e.g. *T. saginata*, *Dyphllobothrium*, *Hymenolepis* etc.). In the other group, human are intermediate hosts with larval stage parasites present in the tissues (e.g. *Echinococcus*, *Spargonium* etc.). [1, 2]

Echinococcosis is an infection caused in human by larval stage of the *E. granulosus* complex. *E. granulosus* complex parasites are prevalent in areas where livestock is raised in association with dogs. The parasites are found in all continents with areas of high prevalence in China, Central Asia, and Middle East, the Mediterranean region, Eastern Africa and parts of South America. [1, 2]

The definitive hosts for *E. granulosus* are canines (dogs) that pass egg in their feces. Human are *accidental intermediate hosts* and get infected by ingestion of food contaminated with eggs of *E. granulosus* shed by dogs. Embryos escape from the eggs, penetrate the intestinal mucosa, enter the portal circulation and are carried to various organs. Two thirds of *E. granulosus* cysts are found in liver, 5-10% in the lungs and rest in the brain, bones or other organs. Before developing into cysts, the larvae lodge in the capillaries of various organs and incite inflammatory reaction.

Many such larvae are destroyed while some larvae develop into fluid filled unilocular *Hydatid cysts* that consist of an external membrane and an inner germinal layer.

**Daughter cysts** develop from the inner aspect of germinal layer as do germinating cystic structures called Brood Capsules. New larvae called protoscolices develop in large numbers within the brood capsules. The cysts expand over a period of years while some may degenerate during the process.

The degenerated cysts are replaced by scarring followed by calcification. Initially the *Echinococcus* cysts are asymptomatic.

But as they expand they produce features of space occupying lesions, impairing functions of the organ. There may be leakage of cystic fluid due to rupture (accidental or otherwise) producing fever, urticaria, pruritus, eosinophilia or anaphylaxis. In the liver it characteristically present as slow growing tumor with progressive destruction of liver tissue, compression of bile duct or leakage of cystic

fluid into the biliary tree (which may mimic recurrent cholelithiasis) and biliary obstruction that can result in jaundice.

The lesion may infiltrate adjoining areas or may metastasize to spleen, lungs or brain. [1-4] Hepatic Encephalopathy is a disturbance in functions of central nervous system because of hepatic insufficiency due to either acute or chronic liver failure.

Alteration of consciousness is its most relevant manifestation and is influenced by concurrent clinic-pathological factors such as inflammation, hypoxemia, and gastrointestinal hemorrhage or electrolyte disturbances. [3-7]

A large body of work points at ammonia as a key factor in the pathogenesis of hepatic encephalopathy. In acute and chronic liver diseases increased arterial levels of ammonia are commonly seen.

Furthermore the abnormalities in the glutaminergic, serotonergic, GABA-ergic and catecholamine pathways have also described in experimental hepatic encephalopathy.

Depletion of zinc and accumulation of manganese may play some role. But it is a prudent fact that inflammation elsewhere in the body may precipitate encephalopathy through the action of cytokines and bacterial polysaccharides on astrocytes.

It has also been well recognized that bacterial and other infections/inflammations lead to the systemic inflammatory response syndrome, sepsis and Multi-organ failure. [7-12]

In the present case postmortem finding of Hydatid cysts is incidental. But considering the findings all together and after going through authentic texts and reviews it can be proposed that the Hydatid cyst disease may have contributed towards pathogenesis of hepatic encephalopathy and multi-organ failure in the present case. It is noteworthy to mention here that Dulger A C et al, [13] reported one case of Hepatic Encephalopathy where the later was precipitated in connection with Budd-Chiari Syndrome that resulted from infection with *Echinococcus Multilocularis*.

In that case the worm- damaged hepatic venous system led to biliary cholangitis, sepsis, elevation of liver related transaminases, higher cholestatic enzymes, hyperglobulinemia, eosinophilia, higher C-reactive protein levels and ultimately hepatic failure as a result of massive liver destruction. [12, 13]

### Conclusion:

1) Autopsy of cases of death due to diseased condition is basically a challenge for the autopsy surgeon.

- 2) Methodical external and internal examination (naked eye) and meticulous dissection of the organs may give us vital clues as to the cause of death.
- 3) Even in smallest doubts histopathology may give us surprising outcomes.
- 4) In the arena of Forensic Pathology, histological examination may be suggested as compulsory for every autopsy, if infrastructural facilities permit, as to determine specific cause of death.

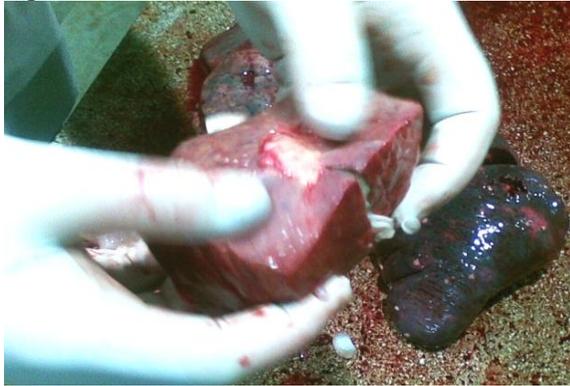
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Fig. 1: Cut Section of Liver



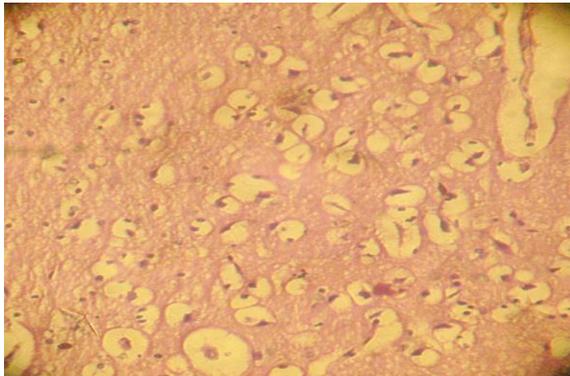
**Fig. 1: Calcified Area over Liver**



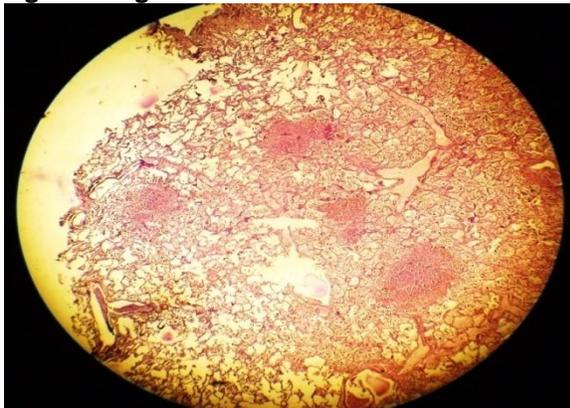
**Fig. 3: Calcified Areas over Spleen**



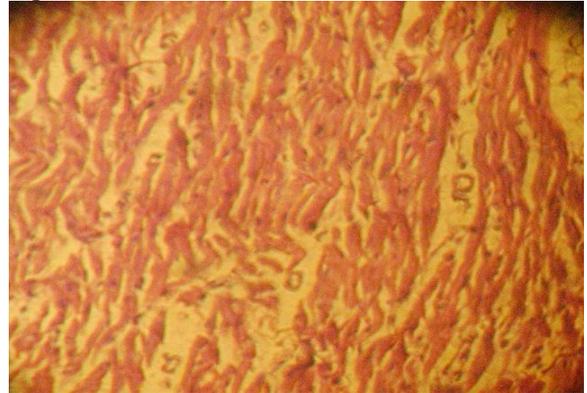
**Fig. 4: Congestion of Brain with focal areas of ischemic necrosis**



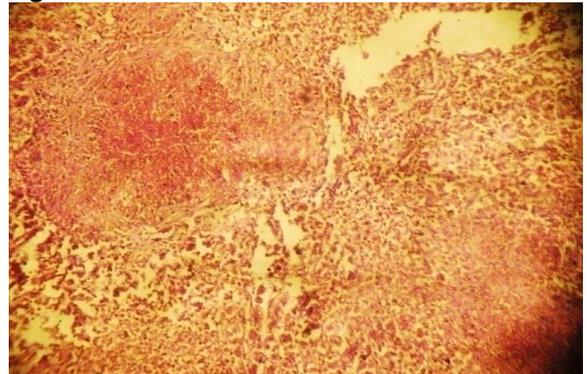
**Fig. 5: Lung**



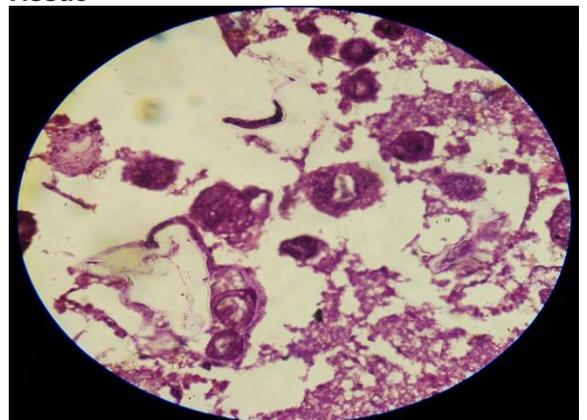
**Fig. 6: Heart**



**Fig. 7: Liver**



**Fig. 8: Hydatid Cyst with Multiple Daughter Cysts along with Pericyst and Adjacent Liver Tissue**



## Case Report

### Injury to Spleen after fall from Height in an Unusual Posture

<sup>1</sup>Mohd Asrarul Haque, <sup>2</sup>Munawwar Husain, <sup>3</sup>Jawed A. Usmani

#### Abstract

Normally any history of abdominal injury points toward an emergency because of intrusion of concealed trauma. There could be an envisaging of spectrum of injuries camouflaged under the guise of pain. Spleen is one organ which is easily injured under force of blunt trauma. Therefore, a farsighted surgeon would obviously focus his attention to this aspect. A 22 years old, unmarried female, presented herself at the Emergency section of J. N. Medical College Hospital, AMU, Aligarh, with complaint of severe pain in abdomen and difficulty in maintaining an erect posture about 2 hours back. She gave history of fall from lower 3<sup>rd</sup> of the staircase from a height of about 3-4 feet. Physical examination didn't reveal any clue. However USG report showed sub-capsular hematoma in the spleen. This case report merited detailed study because she gave details of unusual posture while falling down. Ordinarily such a fall would not have precipitated such findings as available in the ultra-sonogram; details of these are discussed in the paper.

**Key Words:** Splenic injury, Sub-capsular hematoma, Non-rupture spleen, Height of fall

#### Introduction:

Innumerable references have been cited about injury to spleen for diverse reasons, including blunt injury, stab injury, road traffic accidents, steering wheel injuries, and fall from height. [1-5] Generally the height of fall causing injury to spleen is not less than 10 feet. [5] This case study merits attention because the fall from height is merely 4 feet. However, bodily posture has contributed significantly in causing injury in this particular case.

#### Case History:

A female aged 22 years, unmarried, came to emergency section of JN Medical College, Aligarh, in the month of May 2013 with major complaint of severe pain in abdomen.

Additionally she felt difficulty in breathing accentuated by erect posture. She felt comfortable while pressing left flank of abdomen by her hand. No other significant symptom was present. She complained that she had fallen down from the lower 3 steps of the staircase. While falling down her left hand was folded at the elbow joint and was unusually abducted.

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DOR: 27.02.2014 DOA: 22.05.2014

She particularly noticed that after slipping from the stairs she fell down doubling-up and the elbow fiercely intruded the left side of abdomen. Momentarily she felt as if an electric current has passed over the left arm and radiated to the abdomen. She could not get up on her own and one of the family members assisted her in getting up. She could not maintain an erect posture. She was quickly brought to the casualty section. There is no history of chronic malaria and filariasis, vomiting, giddiness, vertigo, diplopia, loss of consciousness, or seizures.

#### Physical Examination:

She was afebrile with pulse was 86/minute, regular; BP 110/70 mm Hg; Respiration: 18/minute. On Systemic examination tenderness on left upper quadrant with a slight bluish discoloration 1.5x1.5 cm on left flank was seen. Abdomen is soft on palpation and bowel sound was absent. All other systemic examination is within normal limit.

USG of the patient shows minimal free fluid in the sub-capsular region of spleen (sub-capsular hematoma). However, parenchymal echo texture appears normal. (Fig. 1)

#### Discussion:

Normally the spleen is secured in the left side of abdomen. Its anatomical position shows that its lower border touches distal transverse colon and splenic flexure of colon. It is covered by peritoneum except at the hilum. Its posterior and lateral surface is related to left hemi diaphragm and postero-lateral lower ribs.

Posteriorly, it is related to left iliopsoas muscle and left adrenal glands. Postero-medial surface is related to body and tail of pancreas.

Antero-medially it is related to great curvature of stomach. (Fig. 2 & 3) The spleen is injured by a blunt pressure directed vertically/horizontally towards its body. It is firmly encapsulated; therefore any pressure not impinging directly would cast away its affect.

In this case the history elaborated the bent elbow joint firmly striking the left side of abdomen. Therefore the pressure transmitted due to fall coupled with partial folding of the body in the region of abdomen transmitted pressure in a constricted space and angularity.

Hence sub-capsular hemorrhage of spleen took place though the pressure was not high enough to cause rupture of the spleen. The surgeon examining the patient was at a loss to diagnose the disease on the basis of history alone. The real picture was apparent when the ultrasound was done.

**Conclusion:**

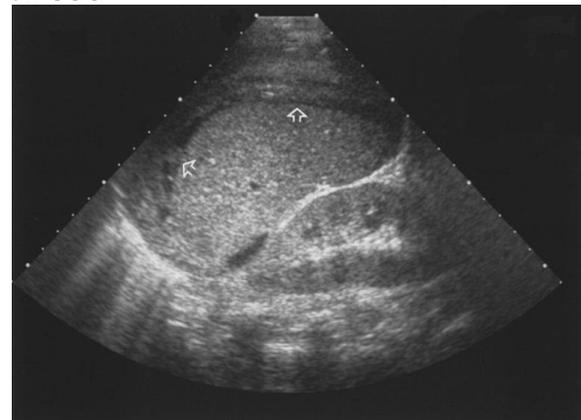
This case study brought into focus that trivial trauma can damage the spleen provided it is focused in a limited space. It is not necessary that spleen may only be damaged by a large blunt force. Therefore, it may be surmised that the ratio of trauma: damage to abdomen may not be on reciprocal basis analogous to head injury. Any history of trauma directed towards the abdomen must be viewed in the light of

signs, symptoms and collated with USG, CT scan or medical resonance imaging.

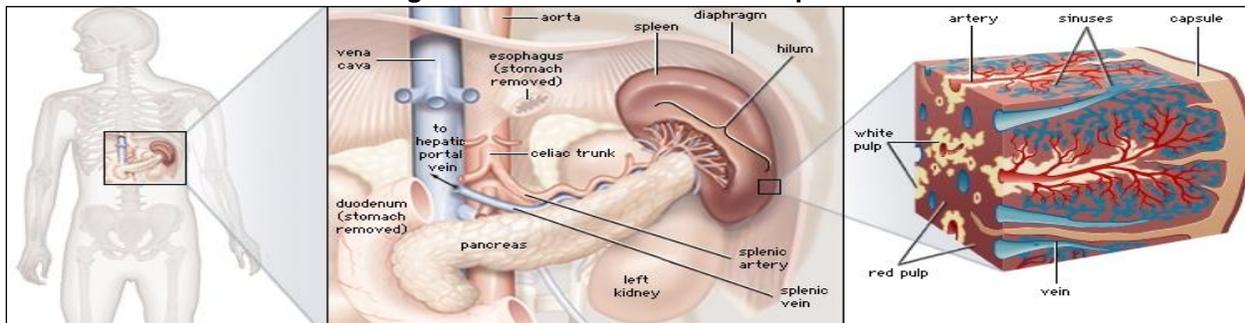
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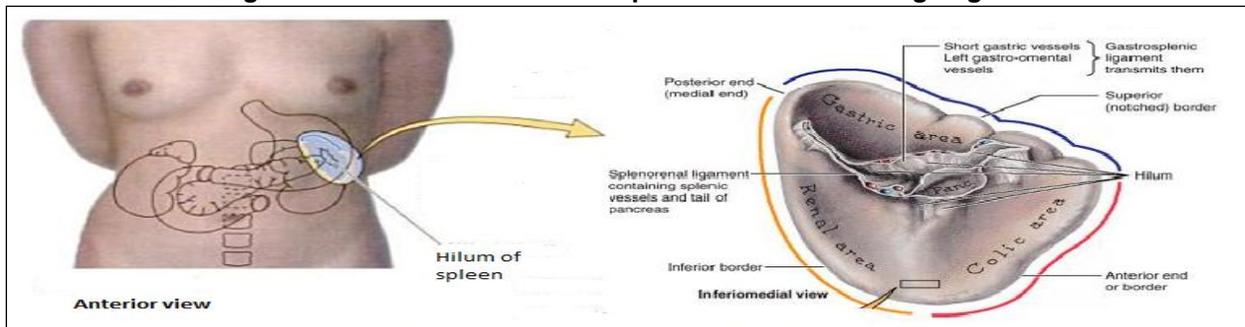
**Fig. 1: Sub-capsular hematoma in the Spleen on USG**



**Fig. 2: Anatomical Relations of Spleen**



**Fig. 3: Anatomical Relations of Spleen with Surrounding Organs**



## Case Report

# Natural Intracranial Hemorrhage and Its Forensic Implications: A Case Review

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### Abstract

An aneurysm is an abnormal, weak spot in a blood vessel that causes an outward bulging or ballooning of the arterial wall. An aneurysm confined to the head cause a serious medical condition, like a hemorrhagic stroke, which leads to brain damage and death. Berry aneurysms are the most common kind of aneurysm in the brain. The most common site of berry aneurysm is the anterior cerebral artery. These aneurysms remain asymptomatic for a long time or may rupture and cause intracranial hemorrhage and sudden death, there by arising suspicion in the eyes of his near and dear ones. In cases of trivial trauma to head leading on to brain hemorrhage causing the death of the individual the defense counsel takes the advantage of the aneurysm to be the cause of brain hemorrhage. This is a case, report where deceased was found dead in bathroom, following rupture of berry aneurysm and we have reviewed the literature regarding the berry aneurysm and tried to corroborate with the legal scenario.

**Key Words:** Berry aneurysm, Circle of wills, Subarachnoid hemorrhage, Sudden death

### Introduction:

An aneurysm is the dilatation of a localized segment of the arterial system. Morphologically, it can be saccular (also known as Berry aneurysm), fusiform or dissecting. [1]

This localized dilatation is due to deficiency in the tunica media leading to weakness of the vessel wall. The Subarachnoid hemorrhage (SAH) could be either traumatic or non-traumatic. The most common cause for non-traumatic SAH is the rupture of aneurysm in the brain. The incidence of berry aneurysm is reported to be 2% and the incidence of subarachnoid hemorrhage is 6-8/100000 person years. [2] Aneurysms occur most commonly at the junction of two arteries in the circle of Willis.

Aneurysms are most commonly saccular also called as berry aneurysm, and is caused by head trauma in 1% of cases. [3] They usually remain asymptomatic for a long time or may rupture and cause intracranial hemorrhage and sudden death. Aneurysms are associated with a high mortality rate.

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The presence of berry aneurysm in a case of head injury carries significance as to the origin of intracranial hemorrhage.

This case report highlights a similar situation where an elderly female died due to rupture of aneurysm suddenly.

### Case History:

We received a dead body of female aged 45 years for post-mortem examination. According to the investigating officer she was found in an unconscious state in the bathroom and was taken to hospital, where she was declared as dead on arrival. Relatives of the deceased did not have any knowledge regarding the past medical history.

### Autopsy Findings:

The deceased was moderately built & nourished. Rigor noted throughout the dead body. Post-mortem lividity noted over the back surfaces of the body. Remaining external appearance was normal and unremarkable. No external injuries were found over the body.

On internal examination, the scalp was intact. Brain showed subdural hematoma & diffuse subarachnoid hemorrhage. Subdural hematoma was noted over base of brain. (Fig 1)

A partial capsule of ruptured aneurysm was present at junction of anterior cerebral & anterior communicating artery on left side. (Fig. 2) No atherosclerotic changes noted in the remaining part of cerebral vessels. Heart walls, valves and chambers were normal. Coronaries were patent. Aorta showed mild atherosclerotic

plaques. All the other organs were intact & unremarkable.

### Discussion:

Berry aneurysms, also known as saccular aneurysms, are sac-like out-pouching in the cerebral blood vessels, which appear berry-shape on external examination, hence the name. Aneurysms usually reside in the Circle of Willis. [4] Rupture of aneurysm leads to sudden death due to intracranial hemorrhage. [5]

There are four main types of intracranial aneurysms: **saccular, fusiform, dissecting, and mycotic type**. Saccular aneurysms occur when there is collagen deficiency in the internal elastic lamina and breakdown of the tunica media and accounts for 90% of intracranial aneurysms. An out pouching, consisting of only tunica intima and adventitia, protrudes through the defect in the internal elastic lamina and tunica media to produce the aneurismal sac. [6]

All studies to date show peaks at various ages in the 40-70 year range, which is consistent with our case where the age of the deceased is 45yrs. [7] however a case of death due to a ruptured berry aneurysm has been reported in a 3.5 year old child. [8, 9]

With regard to sex, studies showed that men have a lower average age at time of rupture than women, with the difference between men and women ranging from 2 to 4 years. It is slightly more common in females, with the male: female ratio being 2: 3. [10]

Rupture of these aneurysms leads to hemorrhage in subarachnoid space and sometimes in brain parenchyma. The most common pattern noted is subarachnoid hemorrhage alone, but hemorrhages in other areas are fairly common. [11]

But occasionally, an aneurysm may also rupture into the subdural space, resulting in a subdural hematoma [12] Most of the studies report that approximately 85% of cerebral aneurysms develop in the anterior part of the Circle of Willis at the junction of anterior cerebral & anterior communicating artery which is consistent with our case. [4] Few studies also suggest that the middle cerebral artery was cited as the location of most aneurysms. [13]

The exception was the study by Inagawa and Hirano, who named the internal carotid artery as the most common location. [7] Aneurysms in the posterior half of the circle of Willis tend to have a significantly worse prognosis than those in the anterior half.

Survival following rupture was poorer in anterior circle aneurysms compared to posterior circle aneurysms; although the ratio was

reversed in rate of survival 30 days post rupture. [14] About 60% of patients die immediately after rupture which was found in our case. [13]

But few studies suggest that survival after rupture lasted either less than one day or longer than one week. [15]

In most of the studies home is the common location at the onset of symptoms, and presence of associated physical exertion. [16] Patients with berry aneurysms more frequently have histories of persistent headache, pregnancy-induced hypertension, long-term use of analgesics, and a family history of stroke. [17]

The pathogenesis of berry aneurysm formation is multi-factorial. [18] The risk factors for developing berry aneurysms include any condition that causes hypertension, including atherosclerosis, renal disease or weakening of blood vessel walls such as connective tissue disorders, infections, family history, smoking and polycystic kidney disease. [19, 20]

However, some controversy exists about the roles of underlying disease in the rupture of cerebral artery aneurysms, particularly hypertension and atherosclerosis.

The prevalence of aneurysms is increased in certain genetic diseases; the classic example is autosomal dominant polycystic kidney disease (ADPKD), but other diseases such as Ehlers-Danlos syndrome, neurofibromatosis, and  $\alpha$ 1-antitrypsin deficiency also demonstrate a link. [4] But in our case the past medical history was not available and therefore cannot be correlated.

Specific genes have also had reported association with the development of intracranial aneurysms, including perlecan, elastin, collagen type 1A2, endothelial nitric oxide synthase, endothelin receptor A and cyclin dependent kinase inhibitor. Recently, several genetic loci have been identified as relevant to the development of intracranial aneurysms. These include 1p34-36, 2p14-15, 7q11, 11q25, and 19q13.1-13.3. [21]

### Forensic Significance:

A thorough autopsy is an essential part in the diagnosis of berry aneurysm. In cases, where the death of the individual is due to intracranial hemorrhage, the question of natural or unnatural causes has to be ruled out.

During autopsy the presence of intracranial hemorrhage accompanied by evidence of trauma like scalp contusion/fracture of skull bone rules out the natural causes.

The common cause of berry aneurysm is hypertension, atherosclerosis etc., makes the vessel prone for rupture. In such a scenario,

even the minor trauma to the head causes bleeding leading to death of the individual. If the head is protected by a turban or hair, one may not find scalp contusion or fracture. It becomes a challenge for the Forensic pathologist to rule out unnatural causes for intracranial hemorrhage.

The defense counsel takes advantage of such cases and makes the expert evidence of medical witness biased, so that his/her client can be acquitted from the clutches of law.

In court of law defense counsel often takes the plea of natural disease as cause of death or injury as contributory factor or injury aggravates disease process leading to death and may be convicted under S 299 IPC.

The fact that the death of a human being is caused is not enough. Unless one of the mental states mentioned in ingredient (Sec 299 IPC) is present, an act causing death cannot amount to culpable homicide.

In cases of death of the person as a result of intracranial hemorrhage due to an impact over head, and if it is proved in the court that the intention and act of the accused at that material time is important to decide, whether it is merely an act of applying criminal force (Sec 350 IPC) / causing grievous hurt (320 IPC) / causing grievous hurt on provocation (335 IPC).

So as a Forensic expert one should be careful in giving such opinion and before opine evaluate medical history, thorough autopsy findings and histopathology report.

**Conclusion:**

Ruptured aneurysms must be considered as a possible cause of death in bodies brought for autopsy where internal findings show SAH/SDH with no external trauma. Autopsy and dissection of the cerebral vessels is vital to diagnosis, particularly when deaths are unexpected in nature. This is vital both for the family to understand the cause for their loved ones demise and also for any legal or insurance purposes that may follow.

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**Fig. 1: Hemorrhage over Brain Surface**



**Fig. 2: Ruptured Giant Berry Aneurysm**



## Case Report

# Atypical Ligature Mark of Hanging Mimicking Ligature Strangulation: A Case Study

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### Abstract

A male person aged about 23 years, resident of local area of Kakinada East Godavari district, committed suicide by hanging in his room with the help of white knitted cotton rope from a ceiling fan on 05/11/2012. On receiving the information, police people went to the scene of crime and observed no foul play. The body was sent to the mortuary of Rangaraya Medical College, Kakinada, Andhra Pradesh for the post-mortem examination on 06/11/2012 at 5:00 am. Post-mortem examination conducted on 06/11/2012 at 10:00 am. During the post-mortem examination, ligature mark was observed around the neck. No other external injuries and internal injuries were found except ligature mark. This ligature mark was unusual in appearance with multiple marks, which mimic the strangulation by ligature even though it is case of suicidal hanging. This unusual appearance of ligature mark is due to application of ligature material in multiple rows by the deceased.

**Key Words:** Hanging, Ligature mark, Atypical, Strangulation, Post-mortem

### Introduction:

The ligature produces a furrow or a groove in the tissue which is pale in colour, but later it becomes yellow-brown or dark brown and hard like parchment. It may be produced by the application of a ligature to the neck even after death. Certain marks on the neck produced after death may simulate ligature mark. Normally it is in single row in suicide, multiple rows are seen in homicides. [1]

### Case History:

A male, aged 23 years, resident of a local area of Kakinada, was working in a small software company for a pay of Rs. 6000 a month. His elder brother is working in a big software company on salary of about Rs. 30,000 a month. The deceased got frustrated in his life by comparing with his brother's income, got addicted to alcohol, smoking and committed suicide by hanging at his residence at about 08:00 pm, on 05/11/2012. On receiving information, police broke into his room by 05:00 am on 06/11/2012.

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DOR: 20.02.2014      DOA: 15.05.2014

Autopsy was conducted over his body on 06/11/2012 at 10:00 am.

### Autopsy Findings:

There were two externally visible ligature marks seen on the neck. The Upper ligature mark was of 21 cm in length with a gap of 10 cm in between right and left ends; width is 2 cm, 5 cm, below chin, 3 cm from left ear and 2cm from right ear.

It was running obliquely upwards above thyroid cartilage, with margins abraded. The second lower ligature mark was 33 cm around entire circumference of the neck, at the level of thyroid cartilage, 2 cm in width, 9 cm from right ear on right side, 9cm from centre of chin, 7cm from left ear on left side. Apart from these ligature marks no other external injuries were found. (Fig. 3, 4)

On dissection of ligature mark subcutaneous tissues, ribbon muscles of neck were contused and ecchymosed. They showed congestion in the internal tissues of lower neck region Thyroid cartilages and hyoid bones were physically intact. [1-6]

### Final Opinion:

On perusal of case, P.M. Examination findings, the death is due to asphyxia as a result of ante-mortem hanging.

### Discussion:

This is a case of atypical hanging which showed multiple ligature marks on the neck. It is due to application of ligature material in multiple rows by the deceased. Externally, by seeing the

ligature mark appears atypical and it appears as if it could be due to a homicide, i.e. strangulation by ligature. Pattern of the ligature material could also be well appreciated. [2-6]

On reviewing the crime scene photography, visiting the crime scene, and going into the history of the case, they revealed no foul play, except for the frustration by the deceased. (Fig. 1, 2) There was no other entry into the room in which he committed suicide except for the door which the police broke open.

There were no marks of violence on his body except for the above described ligature marks. He lost interest in his life and committed suicide by partial hanging.

**Conclusion:**

This case stands as an eye opener for fresh Forensic Medicine students and faculty advocating them not to conclude as a homicide for a suicide by hanging, just by looking at the ligature mark.

Never hesitate to go through the crime scene photography / visit crime scene, personal history of the deceased to suspect any foul play, whenever it is available. Before giving final opinion, we should think twice and study the facts that are present on the body. As our ancestors say, dead body speaks truth.

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**Fig. 1: Distance view of Scene of Crime**



**Fig. 2: Closed view of scene of crime**



**Fig. 3: Ligature marks front view**



**Fig. 4: Back View of Ligature Mark**



## Case Report

# Newborn Infanticide within Hospital Premise An Unusual Case Report

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### Abstract

Many a time's forensic pathologists come across infant deaths. Neonaticide is the deliberate killing of a child within four weeks of birth. Infanticide is the killing of a child who is less than one year of age. The killing of newborn infants has been practiced from time immemorial for a variety of reasons.

Today, the social stigma attached to the out-of-wedlock pregnancy is usually the most common motivating factor to resort to the commission of such a crime. Infanticide can be performed by the acts of commission or acts of omission. Acts of commission include strangulation, smothering, blunt head injury, multiple injuries, drowning and poisoning. In infant strangulation deaths, the classical features of asphyxia are often absent, presumably because of the ease with which the vulnerable infant dies. Infant death is a challenge to forensic pathologist and to law enforcement authorities. Here we present an unusual case of male newborn infanticide by ligature strangulation while he was along with his mother in postnatal ward.

**Key Words:** Neonaticide, Infanticide, Ligature Strangulation

### Introduction:

Foeticide is the killing of the foetus at any time prior to birth. Neonaticide is the deliberate killing of a child within 4 weeks of its birth. Infanticide is the killing of a child who is less than one year of age. [1] Historically, infanticide has by no means always been a crime, and has been practiced as a social and economic necessity since the dawn of humanity.

The Forensic Pathologist, however, has to deal with the practicalities of infanticide as they exist today and should be able to assist in identifying the mother, to estimate the maturity of the child, to determine stillbirth or live birth and to determine cause of death and manner of death. The social stigma attached to the out-of-wedlock pregnancy is usually the most common motivating factor to resort to the commission of such a crime. Superstitions, poverty and ignorance may be the other factors, especially amongst the village folk. [2]

### Case Report:

As per clinical papers a newborn male baby was born to a primigravida mother by normal delivery at our hospital.

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The baby cried immediately after birth and was then with mother. After 17 hours of his birth, grandmother of the baby brought the baby to NICU in limp condition with complaint of baby not accepting the feed. The on duty resident of the NICU examined the baby, noted ligature mark over the neck and declared the baby as dead at 09.45 am on 13.02.2014. Information was given to the police.

### Autopsy Findings:

On autopsy, weight of the baby was 2500 gm and length was 47cm. Other physical parameters were within normal limits.

Umbilical cord was clean cut and clamped. Rigor mortis was less marked in extremities, post-mortem lividity was present on back and was not-fixed and there were no signs of decomposition.

Face was congested, lips were bluish and dried, and fingernails were bluish.

Following injuries were noted over the body;

1. Pressure abrasion in the form of ligature mark present over lower neck transverse, completely encircling, except 1cm area over left lateral region.

The ligature mark was of length 15.5 cm, breadth variable from 0.3cm to 1.5 cm (At the centre-0.3cm, right lateral-1cm, left lateral-1.5cm, posterior-0.8cm). The ligature mark situated 4.5cm below chin, 1.5cm above supra-sternal notch, and 3.5 cm below each angle of mandible, 2.5 cm below occipital protuberance, and 2.5 cm above C7 spinous process.

The ligature mark was dry and reddish brown. Double ligature mark seen prominently over nape of neck, 4x0.8cm. (Fig. 1 & 2)

On dissection-infiltration of blood seen within underlying subcutaneous tissues, posterior aspect of cricoid cartilage and anterior spinal muscle on left side.

2. Crescentic abrasion in the midline over lower anterior neck, 0.3cm above the ligature mark, 1.2x0.3cm, dry, reddish brown
3. Two abrasions over left supra-clavicular region, 0.5x0.4cm and 0.5x0.3cm, dry, reddish brown
4. Three abrasions over sub-mandibular region, 0.6x0.2cm, 0.5x0.3cm and 0.5x0.1cm, dry, reddish brown
5. Under scalp hematoma over left parieto-occipital region, 7x5cm, dark reddish black. (Fig. 3)

Internal organs were congested. Stomach contained mucus and there was no abnormal smell. Cause of death was given as "Ligature strangulation".

### Discussion:

Legal definitions of infanticide vary among different countries; the medical concept of infanticide is uniform, being the deliberate killing of a newborn infant. In England, the Infanticide act was re-enacted in a more satisfactory form in 1938. [3]

In India, there is no distinction in law between infanticide and murder. In cases where infanticide is not proved, the mother may be charged with concealment of birth and the punishment in such cases may extend to imprisonment up to two years or fine or both.

Infanticide is usually committed at the time of, or within a few minutes or hours after the birth. [1] In case of the newborn deaths, the points to be decided are;

1. Whether the child was stillborn or dead born and was the viability attained or not?
2. Whether the child was born alive, if born alive then how long did the child live?
3. What was the cause of death?

Infanticide can be performed by the acts of commission or acts of omission.

Acts of omission include omission to make the necessary preparation for the birth of the child, omission to tie the cord after dividing it, omission to remove the child from the mother's discharge, omission to protect the child from exposure to cold or heat and omission to supply proper food. [2]

Acts of commission include strangulation, smothering, drowning, blunt head injury, multiple injuries, poisoning and live burial.

Strangulation presents the usual features of bruises and abrasions on the neck. The classical features of facial congestion, cyanosis, edema and petechiae may be present, but are often absent, presumably because of the ease with which the vulnerable infant dies.

Smothering is a simple, convenient and extremely difficult to prove as it may not leave any evidence, especially if caused by soft cloth. If more force is used bruising of inner surface of lip may be seen. Blunt head injuries are relatively common.

Cutting of the umbilical cord so as to cause exsanguinations of the newborn is another mode of newborn infanticide.

In old day's arsenic, tincture of opium has been used for infanticide. In Western countries coal gas has been used by mothers to include her child in suicidal pact. [2]

Mishra K et al reported two cases female Neonaticide committed by their mothers while in the maternal wards. [4] Pawan Mittal also reported a case of female infanticide by inflicting multiple contusions all over her body. [5] Infanticide by decapitation was described by Amoroso. [3]

Neonaticides are most often committed by poor, relatively young, single women who lacked prenatal care. [6] The killing of a child within the first 24 hours of life was motivated in 83% of cases researched by Resnick by the fact this was an unwanted child and murder was committed to silence the intruder. [7]

The killing of newborn infants has been practiced from time immemorial for a variety of reasons. Many strategies are proposed and many of them have been implemented like strengthening of existing laws, save the girl child campaign to counter act the problem of infanticide especially female infanticide.

### Conclusion:

To conclude majority of infanticides occur within minutes or hours of birth. The most frequent methods to commit infanticide are suffocation, strangulation, blunt head trauma and drowning. Forensic pathologist has to be very cautious while examining a case of suspected infanticide so that there should not be any miscarriage of justice.

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**Fig. 1: Ligature Mark over Neck (Anterior)**



**Fig. 2: Ligature Mark over Neck (Posterior)**



**Fig. 3: Under Scalp Hematoma**



**Fig. 4: Tongue Block**

