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From Editor's Desk

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Dear Friends,

It gives me great pleasure to present the second issue of year 2017 to the Hon'ble Members of the Academy. In our endeavor to bring up the standard of the Journal, we have now increased the space between the lines from 1 to 1.15, we have also increased the font of the references, which as you already know, now are in Vancouver style. This issue contains 20 pages of coloured photographs and charts. All this was possible only because of the immense support and cooperation from the Editorial team and team of Reviewers headed by Prof. Manish Nigam.

Dr.Mandar R Sane joined our institute as Assistant Professor and he has been a great help to Dr.Amandeep Singh and me in the day to day work regarding the Journal. As per the powers vested in me by the Executive Committee in the first meeting, wherein I was given the authority to co-opt two members as Editorial team, I have taken the opportunity to include Dr.Mandar R Sane as a member of the Editorial Team.

The Journal, as you are aware, is indexed with SCOPUS, INDMED and IMSEAR as well as Indian Citation Index. Any suggestions and advice for improving the standard and quality of the journal will be highly appreciated.

Jai Hind & Long Live IAFM

Dr Dasari Harish
Editor

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Editorial

Dangerous Injury or Injury Dangerous to Life or Grievous Hurt Endangering Life: A Dilemma

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Abstract:

The dilemma whether ódangerous injuryôor óinjury dangerous to lifeôor an óinjury endangering lifeô are synonymous or do they have different meanings, continues even today, more than 156 years after the framing of the Indian Penal Code (IPC) in 1860. There have been numerous interpretations and decisions by various courts, including the Hon'ble Supreme Court, regarding the same. Some decisions have conveyed that these three terms are synonymous and mean one and the same thing, while the others have conveyed that they represent different degrees of gravity of the injury. We have tried to put forward all the facets of the dilemma and the explanation, based on case laws.

Key words: Dangerous injury, dangerous to life, endangering life, grievous hurt, Indian Penal Code, section 307 IPC, section 320 IPC.

Introduction:

Many a times, the police asks the doctor to opine whether a particular injury is ódangerous to lifeô or not. Often doctors themselves opine, without any specific query, that a particular injury is ódangerousô This opinion by the doctor ï whether asked by the police or on his own, results in the case being filed under section 307 IPC(Attempt to murder), instead of section 326 IPC (Voluntarily causing grievous hurt by dangerous weapons or means). Sometimes it is very difficult to differentiate between the cases under S, 307 IPC (attempt to murder) and cases under 325 IPC (causing grievous hurt) or 326 IPC (causing grievous hurt by dangerous weapons or means) because all these offences have some common ingredients among themselves. However, crimes under section 307 IPC are considered graver than under section 326 IPC.[1]

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Measuring the severity of injury sustained by trauma victims is a vexing problem. Determining the severity of physical injury for victims of violent assaultive crime has proven to be a difficult task. Past efforts have suffered from a lack of specificity, medical acceptability, methodological rigor, and ability to consider injuries derived from a variety of mechanisms. There are more than 15 potential criteria for severity index evaluation. Relevant medical variables include mortality, length of hospital stay, admission to intensive care unit, ambulance transport, intubation or tracheostomy, ventilatory support, blood transfusion, etc. The majority of scales now in use are concerned, to a greater or lesser extent, with ñthreat to life.ò World over such injuries are legally classified as aggravated assault, life threatening injury, serious injury, etc. Many systems of medical trauma scoring exist like Glasgow Coma Scale (GCS), Abbreviated Injury Scale (AIS), Probability of Death Score (PODS), the Revised Trauma Score (RTS), the Injury Severity Score (ISS), the New Injury Severity Score (NISS) and the Trauma and Injury Severity Score (TRISS). The criteria, when, quantifiable and objective, assist in providing a description of a patientôs status and treatment outcome. Trauma scores can be used for making more objective, standardised, and

accurate judgement on whether the injury was a life threatening one or not. Similarly, objective criteria are essential in order to be able to provide exact descriptions of the detriment caused to the victim and to ensure a fair penal system.[2-7]

Researchers have aimed at objectively correlating injury severity in assault, offence seriousness, criminalisation and punishment in relation to violence. Outcome in the criminal justice system was not predictable from injury severity scores and was only weakly linked to offence seriousness.[8]

Although in the Penal Code there is no exact definition for this concept, forensic medicine specialists generally use subjective medical criteria which define the injuries that threaten oneôs life. However, though the decision of a ódangerousôinjury in traumatic cases can be decided objectively in patients with traumatic focal lesions of brain, visceral organs and major vascular injuries, extensive burns and conditions similar to these, there may be conflictions in making an objective decision in some other life threatening conditions. For example, while compound fractures of the skull are accepted as life threatening injury by medical officers, some experts in the forensic medicine strongly suggest that the presence of intra-cranial haemorrhage or a medical intervention is a prerequisite to accept such fractures as a ódangerousôinjury.[2]

Case 1

The victim received a stick blow on the face resulting in a lacerated wound 2 x 0.2 cm on ala of nose with bleed.X-ray revealed no bony injury. However, before the final medical opinion could be given, the police framed charges under section 307 IPC. On the Courtôs intervention, the final medical opinion of a simple injury was presented. Based on this, the arrest of the accused was stayed and the police admonished for framing charges without the completed final medical opinion.[9]

Case 2

In an alleged case of assault with a laceration 1.5 x 0.5 cm on the vertex of the head, the resident doctor noted that the injury was trivial and did not order an X-ray skull. He just stitched the wound and advised pain killers. However, regarding the nature of injury, he opined ódangerous to lifeô Based on this, the police framed charges under section 307 IPC and arrested the accused. On the directions of the Court, a Board was constituted to opine regarding the nature of injury. The resident doctor justified the opinion ódangerous to lifeôas the injury was on a vital part of the body - óthe headô However, the Board, after going through all relevant medical record, opined the nature of injury as ósimpleô

In both the cases, it is the term, ódangerous to life/ Dangerous injuryô which created the problem and had the case filed under S. 307 IPC, instead of 326 IPC. This, despite the fact that, there is no definite legal entity by the aforementioned term. The Indian Penal Code defines óHurtô and óGrievous Hurtô but not a ódangerous injuryô

Section 307 of Indian Penal Code

Attempt to murder - Whoever does any act with such intention or knowledge, and under such circumstances that,

- if he by that act caused death, he would be guilty of murder, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine; and,
- if hurt is caused to any person by such act, the offender shall be liable either to imprisonment for life, or to such punishment as is hereinbefore mentioned.
- Attempts by Life Convicts: When any person offending under this section is under sentence of imprisonment for life, he may, if hurt is caused, be punished with death.

It is obvious that if no hurt is caused, a lighter punishment is provided in the first part, but if hurt is caused, then the second part of the section would come into play and the offender would be liable to enhanced punishment provided by that section.[10] The main ingredients under section 307 are[11-12]

(a) The act if not intercepted would lead to the death of the victim.
(b) The knowledge of the result of the act.
(c) The intention or mens rea to kill needs to be established without doubt.

For conviction under this section, the importance is given to *mens rea* (the intention or knowledge that constitutes part of a crime or the

crime itself) than *actus reus* (action or conduct that constitutes as part of a crime or the crime itself).

There are various relevant circumstances from which the intention can be gathered. Some relevant considerations are the following:[12-15]

(a) **Nature of the weapon** used.
(b) Manner of usage of weapon.
(c) **Part of the body** or place where the injuries were inflicted.
(d) Severity of the blow or **nature of the injuries** caused.
(e) Opportunity available which the accused gets.
(f) Motive for the crime.

However, the nature of the injury is not always used to ascertain the intention, that is, a very serious injury need not be caused to prove attempt to murder, *even if a simple injury is done with the intention*, it will be enough to convict the person under S 307 IPC. *If the intention or necessary knowledge to cause death, as envisaged by S 300 IPC (which defines murder) is there, then it is immaterial whether or not any hurt was caused to the victim by the accused*. The fact that an act results in minor injuries or even in no injuries at all is not relevant for the purpose of deciding whether it amounted to an attempt to murder or not.[10]

The Andhra Pradesh High Court reasoned that S 307 IPC envisaged two types of cases, one where the **victim suffered injury**, and other where the **victim didn't suffer any injury**. If the victim was injured in the attack, then the accused, after being convicted under this section, was given the sentence of imprisonment for life or for ten years with fine and in cases where the victim wasn't hurt, the punishment of imprisonment for ten years is given.[16] On the case of nature of injury, all the courts are giving different opinions. Bombay High Court and Orissa High Court have held that the act must be clearly of such a nature that if it was **uninterrupted then the victim would have died**, otherwise S 307 IPC will not apply. The deciding opinion in such case is the decision of the Hon'ble Supreme Court, which ruled that it is not mandatory to cause life threatening injury on the victim; *his intention, knowledge and the preparation that he took* will be the factors that will be looked into for his conviction.[17,18]

Under S 307 IPC, the **intention precedes the act attributed to accused**. Therefore, the intention is to be gathered from all circumstances, and not merely from the consequences that ensue. "The injuries caused to the complainant were not imminently dangerous nor caused on the vital part of the body. At best it can be said that there could be some remote chance of their becoming dangerous to life or becoming sufficient in ordinary course of nature, to cause the death of the complainant, in case medical aid was not rendered. Danger to life from an injury should be imminent to constitute it as a dangerous one. Such injuries are of serious nature like haemorrhage, shock or injuries implicating important structure or organs causing imminent danger."[19,20]

"No doubt, if the prosecution prove the act, the natural consequences of which would be a certain result and no evidence or explanation is given, then a jury may, on a proper direction, find that the prisoner is guilty of doing the act with the intent alleged."[21]

In a case of chest injury with a bhala, as a penetrating wound on the right side of the chest, with clean cut margins, according to the doctor, the wound in the chest was of a grievous nature, as the patient developed surgical emphysema on the right side of the chest. There was profuse bleeding and, according to him, the condition of the patient at the time of the admission was low and serious and the injury was dangerous to life. Out of the four injuries which he had noted, this injury was of a grievous nature, while the other three injuries were simple in nature. Where four or five persons attack a man with deadly weapons, it may well be presumed that the intention is to cause death. In the present case however, three injuries are of simple nature though deadly weapons were used, and the fourth injury, though endangering life could not be deemed to be an injury which would have necessarily caused death, but for timely medical aid. *The benefit of doubt was given, with regard to the injury intended to be caused and the offence was declared as not one under S.307 IPC, but S. 326 IPC.*[22]

"S 307 IPC envisages that whoever does any act with such intention or knowledge, and under such circumstances that, if he by that act caused death, he would be guilty of murder, shall be punished as mentioned therein. Section 300 IPC posits that except in the cases hereinafter expected, culpable homicide is murder, if the act by which the death is caused is done with the intention of causing death, or if it is done with the intention of causing such bodily injury as the offender knows to be likely to cause the death of the person to whom the harm is caused, or if it is done with the intention of causing bodily injury to any person and the bodily injury intended to be inflicted is sufficient in the ordinary course of nature to cause death, or if the person committing the act knows that it is so imminently dangerous that it must, in all probability, cause death or such bodily injury as is likely to cause death, and commits such act without any excuse for incurring the risk of causing death or such injury as aforesaid.

The conjoint and meaningful reading of these provisions would reveal that in order to invoke the penal provisions of S 307 IPC, **the intention or the requisite knowledge to cause death are the essential ingredients of this section**. An attempt for purpose of S 307 IPC should stem from a specific intention to commit murder. That means, an act though sufficient in the ordinary course of nature to cause death, would not always constitute an offence under this Section, if the necessary intention or knowledge on the part of the accused is lacking. Thus, for the purpose of this offence, what is material, is the intention or knowledge and not the consequence of the actual act done for the purpose of carrying out that intention. Intention and knowledge being a man's state of mind, cannot possibly be proved by direct evidence thereof except through his own confession. In the absence of such a confession, intention and knowledge can only be inferred and proved by the surrounding circumstances oozing out of the evidence on record."[23]

"...The question thus is whether the particular injury which was found to be sufficient in the ordinary course of nature to cause death, in the present case, was an injury intended by the appellant. Our answer to the question is an emphatic No. The solitary blow given by the appellant to the deceased was on the left clavicle a non-vital part and it would be too much to say that the appellant knew that the superior venacava would be cut as a result of that wound. Even a medical man perhaps may not have been able to judge the location of the superior venacava with any precision of that type. The fact that the venacava was cut must, therefore, be ascribed to a non-intentional or accidental circumstance."[24] The Hon'ble court struck off the charges under S 307 and replaced it with 326 IPC, owing to lack of intention/ knowledge.

Difference between Grievous Hurt and Culpable Homicide:

"The line separating Grievous Hurt and Culpable Homicide is very thin. In Grievous Hurt, the life is endangered due to injury while in Culpable Homicide; death is likely to be caused. Thus, **acts neither intended nor likely to cause death may amount to grievous hurt even though death is caused**."[25]

"The deceased was making publicity about the illicit intimacy between N and W. On the fateful day, N, W, and her husband A caught hold of D and tied him up to a pole and beat him as a result of which he died. They were not armed with any dangerous weapon and had no intention to kill him. N and W were held guilty of only causing grievous hurt."[21]

The main difference between S. 326 & S. 307 is that *in S. 307, intention/ knowledge precedes the act*. The intention or knowledge of the accused must be such as is necessary to constitute murder. The end result (death or otherwise) is immaterial. (vide Supra) The circumstances of the incident play an important role in deducing the intention. Without establishing this important ingredient, S. 307 IPC cannot be sustained.

Endangering Life Vs Dangerous Injury Vs Imminently Dangerous to Life:

What is meant by `imminently dangerous' which, in all probability, causes death or 'such bodily injury as is likely to cause death' came up for consideration, wherein it was held: In the absence of evidence, or reasonable explanation, that the prisoner did not intend to stab in the stomach with degree of force sufficient to penetrate that far into the body, or to

indicate that his act was regrettable accident and that he intended otherwise, it would be **perverse to conclude** that he did not intend to inflict the injury that he did."[26,27]

Hon'ble Punjab & Haryana High Court held that the words **"dangerous to life" are equivalent to "endangering life"** and such acts are squarely covered within the ambit of **clause 8 of Section 320 IPC**, which is punishable under Section 326 IPC.[28]

Few other Single Bench decisions, emphasised that the expression "dangerous to life" is somewhat milder and subdued as compared to the expression "endangered life" used in clause 'Eighthly' of Section 320 of the Indian Penal Code and, therefore, an injury which is described by the doctor as 'dangerous to life' cannot be held to be one which endangered life.[29]

Clause (8) S.320 IPC refers to injuries which are not only dangerous but which endanger life - much stronger expression. This term is designedly used to exclude cases of hurt, which, however dangerous to life, do not put life in a given case, in danger. The question is one of degree and must be ascertained in each case to what extent the hurt bears proximate relation to the risk of life.

There is no provision in the Indian Penal Code which envisages or refers to an injury described as 'dangerous to life'. It appears that the doctors who had been conducting the medico-legal examinations have been using the term 'dangerous to life' as synonymous with an injury which 'endangers life'. Even the Courts at times have considered an injury described as dangerous to life as an injury envisaged in clause 'Eighthly' of Section 320 of the Indian Penal Code.

In one case,[30] the injury was on the right side of the neck about 21/2" x 3/4" in dimension inflicted with a sharp edged weapon. The doctor had, in fact, in that case deposed that there was every possibility of the deceased surviving but for the wound becoming septic apparently as a result of it being pressed with hands and bandaged with dirty cloth in the initial stages before the deceased was taken to the hospital. The Court held that though a finding that the appellant knew that his act was likely to cause death, was not justified but at the same time, a wound on the neck, must at least be considered to be 'dangerous to life' within the meaning of Clause (8), Section 320, Indian Penal Code, and therefore, 'grievous'.

The **expression 'dangerous' is an adjective and the expression 'endanger' is verb**. An injury which can put life in immediate danger of death would be an injury which can be termed as 'dangerous to life' and, therefore, when a doctor describes an injury as 'dangerous to life', he means an injury which endangers life in terms of clause (8) of Section 320 IPC, for, it describes the injury 'dangerous to life' only for the purpose of the said clause. He, instead of using the expression that this was an injury which 'endangered life', described that the injury was 'dangerous to life', meaning both the times the same thing.[28,31-33]

We are of the view that the Court is not absolved of the responsibility while deciding a criminal case to form its own conclusion regarding the nature of the injury, Expert's opinion notwithstanding. The Court has to see the nature and dimension of the injury, its location and the damage that it has caused. Even when an injury is described as to be one which endangers the life the court has to apply its own mind and form its own opinion in regard to the nature of injury, having regard to the factors that should weigh with the Court, already mentioned. We are also firmly of the view that wherever a doctor describes an injury as 'dangerous to life' and the nature of the injuries is such which could merit such a conclusion then such an injury has to be treated as 'grievous hurt' of the description mentioned in first portion of clause (8) of Section 320 of the Indian Penal Code."[31]

Again, "When the doctor is required to carry out medico-legal examination of the injury suffered in a criminal assault, he is required to examine the injury from two stand points i.e., a) for the purpose of opining the kind of weapon used to inflict the injury in question and b) to form an opinion regarding the degree of seriousness of the injury in question. *The Indian Penal Code recognises from the stand point of seriousness* ***only four types of injuries***

(1) simple injuries

(2) grievous injuries
(3) injuries of the kind inflicted with intent to commit murder described in clause Firstly and 2ndly of Section 300 IPC
(4) *injury sufficient to cause death in the ordinary course of nature envisaged by clause Thirdly of Section 300 IPC.*

There is no explicit provision in the Indian Penal Code which envisages or refers to an injury described as "dangerous to life". The medico-legal examination of the injured is intended to enable the Investigating Agency and the Court to find out the nature of the offence and, therefore, the doctor examining an injured person has to opine that the injury in question is one or the other of the type recognised in the Indian Penal Code for the purposes of a given offence. *When a doctor describes an injury as "dangerous to life", one has to see what had the doctor intended to convey thereby. Is it one to hold that since injury has not been described by the doctor as one which "endangered life", so the concerned injury cannot be held to be grievous on the specious ground that an injury described as "dangerous to life" is not as serious an injury which "endangers life".*

Therefore, in order to appreciate whether in the circumstances, offence under S. 307 IPC is made out, *the injuries are to be of kind as mentioned in Section 300 IPC except that death has not occurred*. The injury which has been described as dangerous to life may be a 'grievous injury' as defined in terms of Clause Eighthly of S. 320 IPC which envisages that any hurt which endangers life or which causes the sufferer to be during the space of twenty days in severe bodily pain, or unable to follow his ordinary pursuits, is a grievous hurt.

The danger to life from an injury should be imminent to constitute it as a grievous one. Haemorrhage, shock or injuries implicating important structures or organs are instances of injuries causing imminent danger. Extensiveness of the injuries may also cause imminent danger. Injuries which only cause remote danger to life cannot be treated as dangerous to life."[31]

"The **concept of an injury dangerous to life cannot in the very nature of things be very precise**. While there may be cases which can be easily placed either in the category of injury dangerous to life or in the other category, there may be marginal and border line cases where it may be very difficult to categorise the injuries as dangerous to life or not and in such cases the medical experts may also differ.

Since the concept of injury dangerous to life being not very precise, *it is necessary that the medical witness should not remain content with making bold statement that the injury in a particular case is dangerous to human life*. He should explain all relevant data namely, whether the injury caused haemorrhage or shock or implicated important structures or organs or was very extensive or otherwise caused imminent danger and should also state the various grounds on which he considers the injury to be a dangerous one.

In arriving at the finding whether an injury is dangerous to human life or not, the court applies its attention to all the relevant data brought on record and to the reasons given by the medical witness or witnesses and record its finding after an overall consideration or the materials on record, giving reasons for its conclusion.[31] As per Reddy,[34] dangerous injury is a variety of grievous injury. Dangerous injuries are those which cause imminent danger to life, either by involvement of important organs and structures, or extensive area of the body. If no surgical aid is available, such injuries may prove fatal.

Giving guidelines to the investigative agencies and courts regarding framing of charges and awarding appropriate sentence, the Hon'ble Supreme Court decreed that[35]"There are **certain factors which are required to be taken into consideration before awarding appropriate sentence to the accused**. These factors are only illustrative in character and not exhaustive. Each case has to be seen from its special perspective. The relevant factors are as under:

- Motive or previous enmity;
- Whether the incident had taken place on the spur of the moment;
- The intention/knowledge of the accused while inflicting the blow or injury;
- Whether the death ensued instantaneously or the victim died after several days;

- The gravity, dimension and nature of injury;
- The age and general health condition of the accused;
- Whether the injury was caused without pre-meditation in a sudden fight;
- The nature and size of weapon used for inflicting the injury and the force with which the blow was inflicted;
- The criminal background and adverse history of the accused;
- Whether the injury inflicted was not sufficient in the ordinary course of nature to cause death but the death was because of shock;
- Number of other criminal cases pending against the accused;
- Incident occurred within the family members or close relations;
- The conduct and behaviour of the accused after the incident. Whether the accused had taken the injured/the deceased to the hospital immediately to ensure that he/she gets proper medical treatment?

The list of circumstances enumerated above is only illustrative and not exhaustive. In our considered view, proper and appropriate sentence to the accused is the bounded obligation and duty of the court. The endeavour of the court must be to ensure that the accused receives appropriate sentence, in other words, sentence should be according to the gravity of the offence. These are some of the relevant factors which are required to be kept in view while convicting and sentencing the accused.

Conclusion:

The IPC distinguishes 4 kinds of injuries, based on the gravity of the danger posed to the life of the victim:

(1) Simple hurt - S. 319
(2) Any hurt which endangers life ï Eighthly, S. 320
(3) Bodily injury as is likely to cause death ï S.290/ 2ndly. S 300.
(4) Bodily injury sufficient in the ordinary course of nature to cause death ï 3rdly S. 300

There is no problem with simple hurt. Problem arises with the latter three. Hence distinction between these three types of injuries must be made.

ñAny bodily injury which is likely to cause death would certainly be one which would endanger life. The injury, the possible result of which may be death, would be an injury which endangers life. But an injury cannot be said to be likely to cause death merely because death is possibleò[36]

Based on these assumptions, we have three categories of injuries:[37]

(1) An injury, the result of which may possibly be death,
(2) An injury as a result of which, death is not merely possible, but is likely; and
(3) An injury as a result of which death is highly probable.

These three correspond to

(1) Any injury which endangers life
(2) Bodily injury as is likely to cause death
(3) Bodily injury sufficient in the ordinary course of nature to cause death

ôEndangering lifeô is a much stronger expression than ódangerous to lifeô[38] An injury, however dangerous to life, it may be, might not put life in a given case, in danger. The question is one of degree of gravity.[39]

However, in another case,[31] it was decreed that an injury which can put life in immediate danger of death would be an injury which can be termed as ñdangerous to lifeò, and therefore, when a doctor describes an injury as ñdangerous to lifeò, he means an injury which ñendangers lifeò in terms of Cl. 8 of S. 320, IPC. Wherever a doctor describes an injury as ñdangerous to lifeò and the nature of the injuries is such which could merit such a conclusion, then such an injury has to be treated as ñgrievous hurtò as per Cl. 8 of S. 320, IPC. In Madan Lal v. State of HP,[20] the Honôble Court held that danger to life from an injury should be imminent to constitute it as a ñdangerousò one.

Having said this, there is no provision in the IPC which envisages or refers to an injury described as ódangerous to lifeô The doctor examining an injured person has to opine that the injury in question is one or the other of the type recognized in the IPC for the purposes of a given offence. When a doctor describes an injury as ñdangerous to lifeò, one has to see what the doctor intended to convey thereby. Is one to hold that since the injury has not been described by the doctor as one which ñendangered lifeò, so the concerned injury cannot be held to be grievous on the ground that the injury described

as ñdangerous to lifeò is not as serious an injury which ñendangers lifeò.[31] It is true that injuries inflicted on vital parts of the body, such as the head, chest, or the abdomen, tend to endanger life, and are therefore dangerous, but they will not fall under this clause unless they are of such serious nature as to make the victim waver between life and death. The line between culpable homicide not amounting to murder and grievous hurt is a very thin and subtle one. In one case, the injuries are such as likely to cause death, in the other, they must be such as endangering life.[36]

Injuries inflicted on the head are always regarded as dangerous to life. It has also been held that neck being a vital part of the body, injury inflicted on the neck by a sharp edged weapon is dangerous to life.[40] The question whether a given injury is dangerous to life is relevant, but what is more relevant is how far it had placed the victim in danger of his life.The nature of the injuries and weapons used are merely clues that the judiciary uses to reach to a conclusion about the intention of the accused.

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References:

1. The Indian Penal Code, 1860 [Internet]. Oct 6, 1860. Available from: http://indiacode.nic.in/
2. Fedakar R, Aydiner AH, Ercan I. A comparison of ñlife threatening injuryò concept in the Turkish Penal Code and trauma scoring systems. Turk J Trauma Emerg Surg. 2007;13(3):192-8.
3. Goldberg JL, Goldberg J, Levy PS, Finnegan R, Petrucelli E. Measuring the severity of injury: The validity of the revised estimated survival probability index. J Trauma. 1984;24(5):420-7.
4. Allen RB. Measuring the Severity of Physical Injury Among Assault and Homicide Victims. J Quant Criminol. 1986;2(2):139-56.
5. Yates DW, Heath DF, Mars E, Taylor RJ. A system for measuring the severity of temporary and permanent disability after injury. Accid Anal Prev. 1991;23(4):323-9.
6. Ali T, Shepherd JP. The measurement of injury severity. Br J Oral Maxillofac Surg. 1994;32:13-8.
7. Bilgin NG, Mert E, C¸amdeviren H. The usefulness of trauma scores in determining the life threatening condition of trauma victims for writing medical-legal reports. Emerg Med J. 2005;22:783-7.
8. Shepherd J. Violence: the relation between seriousness of injury and outcome in the criminal justice system. J Accid Emerg Med. 1997;14(4):204-8.
9. Bhullar DS. Attempt to Murder (Section 307 IPC) and Medical Evidence ï A Case Report. J Indian Acad Forensic Med. 2004;26(1):35-6.
10. Dave D. Ramla vs State. Vol. 1963, CriLJ. p. 387.
11. Mudholkar JR. Sarju Prasad vs State of Bihar. Vol. 1965, AIR. p. 843.
12. Shetty K. Hari Kishan vs Sukhbir Singh. Vol. 1988, AIR. p. 2127.
13. Lahiri K. Kaul Ram Brahma vs The State Of Assam. Vol. 1977, CriLJ. p. 98.
14. Kiran Kumar vs State of Gujarat. Vol. 1985, CrLJ (NOC). p. 22.
15. Sharma NN. Pran Datt vs State of Uttar Pradesh. Vol. 1983, Crimes. p. 286.
16. Rao M. Jasti Punnarao vs State Of Andhra Pradesh. Vol. 1985, CriLJ. p. 16.
17. Beaumont J. Emperor vs Vasudeo Balwant Gogte. Vol. 1932, BOMLR. p. 571.
18. Rao P. Sukra Oram vs State of Orissa. Vol. 1959, AIR. p. 21.
19. Balasubramanian R. Arunachalam vs State Rep. By Sub-Inspector Of Police. 2000.
20. Singh B. Madan Lal vs State Of Himachal Pradesh. Vol. 1990, CriLJ. p. 310.
21. Sinha SB. Mohd. Asif vs State Of Uttaranchal. Vol. 2009, SCC. p. 497.
22. Palekar DG. Jai Narain Mishra And Ors. vs State Of Bihar. Vol. 1972, AIR. p. 1764.
23. Sullar MS. Bawa Singh & Ors. vs State of Punjab. CRA No.823-SB of 2000. 2013.
24. Koshal AD. Gokul Parashram Patil vs State Of Maharashtra. Vol. 1981, AIR. p. 1441.
25. Pandian S. M/s Formina Sebastian Azardeo & Ors vs State Of Goa, Daman & Diu. Vol. 1992, AIR. p. 133.
26. Bose V. Virsa Singh vs The State Of Punjab. Vol. 1958, AIR. p. 465.
27. Srinivasa Rao Y. The Theory of ñHurtò and ñGrievous Hurtò [Internet]. Articles On Law. 2015 [cited 2017 Jun 21]. Available from: https://articlesonlaw.wordpress.com/2015/03/27/the-theory-of-hurt-and-grievous-hurt/

28. Bhagwati J. Pritam Singh And Anr. vs The State Of Punjab. Vol. 1956, AIR. p. 415.

29. Jagrup Singh vs The State of Punjab. Vol. 1973, LR (Cri). p. 253.

30. Muhammad Rafi vs Emperor. Vol. 1930, AIR. p. 305.

31. Tewatia DS. Atma Singh vs The State Of Punjab. Vol. 1980, CriLJ. p. 1226.

32. Tej Ram vs State of Punjb. Vol. 1978, CriLJ. p. 76.

33. State of Punjab vs Tara Singh. Vol. 1987, RCR (Cr). p. 184.

34. Reddy KSN. The Essentials Of Forensic Medicine And Toxicology. 26th ed. Hyderabad: K Suguna Devi; 2005. 698 p.

35. Bhandari D. Gurmukh Singh vs State Of Haryana. Vol. 2009, SCC. p. 635.

36. Chagla J. Government of Bombay vs Abdul Wahab. Vol. 1946, AIR. p. 38.

37. Jhala RM, Kumar K. Jhala and Rajuôs Medical Jurisprudence. 6th ed. Lucknow: Eastern Book Company; 1997. 736 p.

38. Pasayat A. Niranjan Singh vs State Of Madhya Pradesh. Vol. 2007, RCR (Criminal). p. 373.

39. Tiwana IS. Dr. A.G. Bhagwat vs U.T. Vol. 1989, CriLJ. p. 214.

40. State of Karnataka vs Siddegowda. Vol. 1955, SCC (Cr). p. 931.

41. Harish D, Chavali KH, Singh A, Kumar A. Section 320 IPC ï An Appraisal. Anil Aggrawals Internet J Forensic Med Toxicol. 2013;14(1):6.

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Original Research Paper

Usefulness of Demirjian's Stages in Determining the Age of Majority: A Study on South Indian Population

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Abstract

In consideration of the constant increase in juvenile crimes or illegal immigration, need of a reliable means to determine the age of an individual and his/her attainment of age of majority remains to be a fundamental requirement in forensic practice. Mincer et al. in 2009 verified the usefulness of Demirjian tooth developmental stages in discrimination of juvenile/adult status. The third molars are the only available growing teeth during the period of late adolescence and considered to be the reliable biological markers for this purpose. The purpose of this study was to verify the usefulness of Demirjian's stages of root development in discriminating adults and minors in South- Indian individuals. For this purpose, a sample of 506 (227 males and 279 females) orthopantomograms aged between 14 and 22 years were analyzed. The results showed the sensitivity and specificity for stage H to be 0.74 and 0.84 for males and 0.73 and 0.92 for females, respectively. The estimated post-test probability for males and females using stage H was 0.82 and 0.91. Hence, the level of accuracy obtained using Demirjian stage H as a cut off value for discriminating juvenile/adult status may not be sufficient by taking the second type (ethically unacceptable) errors into consideration.

Key Words: Juvenile/adult discrimination, Demirjian's stages of tooth development, age of majority, South Indian population, Orthopantamograms

Introduction:

Estimation of age of an individual and predicting one's attainment of age of majority are the most common requirements by the investigating officers and are considered to be the part of contemporary forensic practice.[1-4]

Age estimation in children is carried out for many reasons and predicting age in young detainees is of paramount importance in criminal investigations.

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Moreover, the importance of properly discriminating adults and minors is related to their different treatment as per the specific civil and penal law of the land.[5,6] In general, significant legal differences exist between minors and adults with respect to their rights and obligations. Children proven below 18 years will be sent to reformatory houses and are often given proper care and support that the adults do not receive.[7-9]

Various methods are available in literature to estimate the chronological age. It is unfortunate that there is no such single age estimation method or any group of methods available to determine the exact chronological age of the individual.[7] So it is vital to apply age estimation methods that are safe, reliable, precise and can minimize mis-classifications (wrongful prediction of minors as adults or vice versa).

The essence behind the medical approach in predicting age of an individual is that human body grows and matures over time,

and one can compare these maturational changes of the body with age. It is recommended to use a combination of reliable methods as suggested by the international interdisciplinary Study Group on Forensic Age Diagnostics (AGFAD) of the German society of legal medicine.[10]This includes maturity of bones (skeletal), dental maturity and physical development.[11]

Assessment of age using eruption of teeth was in practice since the beginning of 19th century and it is still often the commonly used method in forensic context.[12] Dental maturation is a uniform process and the process of tooth mineralization is controlled more by genes than environmental factors which makes stages of tooth development as reliable markers for age estimation than skeletal development.[13,14] The stages of tooth mineralization can be accessed easily on the dental radiographs. For young adults or teenagers, whose dental maturation has almost finished by the age of 14 years, third molars (TMs) are the only teeth available. There are many methods available in literature that use TMs to assess dental maturation of the individuals.[15-17] Demirjianôs 8-stage classification has been widely accepted and most commonly used because of its objectivity, simplicity and accuracy.[18] Mincer, et al.[19] was the first to study the usefulness of Demirjianôs stages and TMs to discriminate adults from minors.

Till date it remains unanswerable how ethnic origin can influence tooth mineralization and further constitute a restraint on the reliability of age estimates and its applicability in forensic context.[20] Keeping in mind oneôs individual variation in the timing of development (skeletal or dental), the results of any method are subject to uncertainty when applied to reference populations. There willalways be biological variations and uncertainties associated with age estimates.[7]Olze, et al.[20] compared the mineralization of TMs of three different populations and recommended the use of population specific standards to further enhance the accuracy of forensic age estimates. Therefore, the purpose of the present study was to determine the usefulness of Demirjianôs stages of root development in discriminating adults and minors in South- Indian individuals.

Materials and Methods:

Sample

Digital Orthopantamographs (OPTs) of 506 South Indian individuals aged between 14 to 22 years were evaluated retrospectively **(Table 1).** Each OPT was assigned with unique identification number and chronological age and gender were recorded in separate excel file. The chronological age was obtained as the difference between date of exposure of the OPT and date of birth and then converted into decimal ages.

Method

To discriminate between individuals above and below 18 years of age, the mineralization of TMs was evaluated following eight stage method proposed by Demirjian, et al (Figure 1).[18] Only the lower left third molar was used for analysis and if in case it was absent or poorly imaged, the lower right third molar was used. The analysis of each OPT was undertaken by both examiners without having any prior information regarding subjectôs age. After grading the teeth using Demirjianôs method, the sample was decoded and chronological age was noted. Then the data was further subjected to statistical analysis.

Statistical analysis

All the analysis was carried out by two examiners independently. Each OPT was assigned numerical ID so as to prevent the observer bias and they were blinded as to the age and gender of the subjects. To access intra and inter observer reliability, 30 OPTs were collected randomly and were evaluated three weeks after preliminary evaluation. Cohen kappa statistics were used to measure intra-observer and inter-observer reproducibility of Demirjian stages.

The overall effectiveness of Demirjianôs stages in predicting attainment of age of majority was assessed by characteristic receiver operating curve (ROC).Accuracy of the test is measured by the area under the ROC curve. An area of 1 represents a perfect test; an area of 0.5 represents a worthless test.[21] The

performance of Demirjianôs stages was tested by 2×2 contingency table that displayed the number of participants who are true positives (TP), then participants who are false positives (FP), followed by those who are false negatives (FN) and those who are true negatives (TN).The performance was assessed using accurate classification, sensitivity, specificity, positive likelihood ratio (LR+) and negative likelihood ratio (LR-). The sensitivity or true positive rate measures the ability to correctly detect individuals who are adults, Se =(TP/(TP+FN)); while the specificity or true negative rate measures the ability to correctly detect individuals who are minor, Sp =(TN/(TN+FP)). Likelihood ratios combine the Se and Sp into a single value that indicates which cut-off will help us rule in or rule out diagnoses respectively in most situations. Values of LR+ between 2 to 5 present small, 5 to 10 present moderate, while over 10 present large and often conclusive increases in the likelihood of being an adult. LR- between 0.2 and 0.5 present small, 0.2 and 0.1 present moderate, while under 0.1 present large and often conclusive decreases in the likelihood of being adult.[22] According to Bayesô theorem, post-test probability may be written as

$$p = \frac{S_e \times p_0}{Se \times p_0 + (1 - Sp) \times (1 - p_0)}$$

Where p is post-test probability and p0 is the probability that the subject in question is 18 years old or older, given that he or she is aged between 14 and 21 years, which represent the target population. Probability p0 was calculated as the proportion of India between 18 and 21 years of age who live in the South India according to demographic data from the 2011 census (http://www.censusindia.gov.in/2011census/C-series/C-13.html) and those between 14 and 21 years which was evaluated from data from the same web source. This proportion was considered to be 0.50 both for boys and girls. All statistical analyses were performed using the IBM SPSS 22.0 software program (IBM® SPSS® Statistics, Armonk, NY). The significant threshold was set at 5% and 1% as reported in the text.

Results

The results of Cohen kappa statistics for the intra and inter-observer reliability of Demirjianôs stages were 0.94 and 0.89, respectively, indicating homogeneity in evaluation among both observers. **Figure 2** shows the distribution of age across Demirjian stages. **Table 2** also depicts the distribution of individuals who are 18 years or old by Demirjian stages and gender.The performance of the cut-off values of Demirjian stages were analyzed by 2×2 contingency tables for males and females, respectively **(Table 3).**

In males, values of Accuracy (Acc), Sensitivity (Se), Specificity (Sp) and probability (p) were 0.66, 0.90, 0.53 and 0.66 for stage F; 0.77, 0.85, 0.72 and 0.75 for stage G; 0.81, 0.74, 0.84 and 0.82,for stage H, respectively. In both males and females, stage H showed the best general performance: Acc, Se, Sp and p were 0.81, 0.74, 0.84 and 0.82, respectively, in males, while Acc, Se, Sp and p were 0.84, 0.73, 0.92 and 0.91 in females, respectively (Table 4).

Discussion

Analysis of the stages of third molar mineralization is the most commonly used method to assess the chronological age of the individuals around 18 years of age, as they proved to be the reliable biological markers during the period of late adolescence.[19,22-26] The stages of Demirjian system define the tooth formation by changes in shape and proportions but not the metric estimates.[18] Studies have found that the system of Demirjian stages performed best, not only for observer agreement, but also for the correlation between the estimated and true chronological age.[27,28] In this study, the reliability of Demirjian method was verified with inter-observer and intra-observer measurements. The agreement between the decisions made by the same observer and between two observers (kappa value 0.942 and 0.896) was ñalmost, perfect agreement,ò according to the six-category system proposed by Landis and Koch.[29]

In this study, we used ROC analysis to determine the accuracy of mineralization of third molar to discriminate adults and minors on the basis of Demirjian stages (Figure 3). Although the areas under the ROC curves differed

between populations of origin, fairly high values for AUC (from 0.8 to 0.9) were found for all populations according to Swetsô scoring system.[30] Based on this scoring system, a diagnostic test is considered ó highly accurateö when the area under the ROC is 0.9, ó useful for some purposesö at 0.7ï 0.9, and ó poorö at 0.5ï 0.7.In males, the area under the ROC curve for stage Fwas 0.719, for stage G was 0.792 and for stage H was 0.797. And in females, the area under the ROC curve for stage F was 0.794, for stage G was 0.832 and for stage H was 0.830.

Sensitivity, specificity, accuracy and post-test probability for mineralization stages (F to H) are shown in **Table 4.** In legal and forensic point of views, it is vital to minimize the proportion of errors while discriminating juveniles and adults. These errors are classified as technically unacceptable (adults mistakenly classified into non-adults) and ethically unacceptable errors (minors incorrectly classified in the adult group).[31,32] For medico-legal purposes, it is ethically more important to obtain better specificity, not to misclassify minors as over 18 years of age. In our study, using stage H, the error of first type (technically unacceptable) occurred in 30 out of 115 females, 21 out of 83 males, while 13 out of 164 females, 22 out of 144 male non-adults were recorded with second-type (ethically unacceptable) error **(Table 3).** Our results, in males were -for stage F, the Se and Sp values as 0.90 and 0.53; for stage G, 0.85 and 0.72; for stage H, 0.74 and 0.84, respectively. In females - for stage F, 0.96 and 0.62; for stage G, 0.89 and 0.76; and for stage H, 0.73 and 0.92, respectively. Only stage H ensured required specificity (0.84 and 0.92 in males and females) with significant decrease in sensitivity **(Table 4).**

Trevino, et alconcluded, in his study among Mexicans, that minors corresponded to A to F of Demirjianôs stages, and did not find any adult individual in this classification, and 52% of individuals who reached stage G were adults and so they made this stage as cut off stage for juvenile/adult discrimination.[33] Juliana, et al. in their study, found that 67% of the males and 87% of the females within stage G and 97% males and 95% females within stage H were adults.[34] In our study, 77% of males and 74% of females within the stage H were adults **(Table 5).** The mean results of stage G in males was 17.81 and in females, it was 17.83, while for stage H it was 19.18 and 19.56, for males and females, respectively **(Table 2).** Our mean results of stage G and stage H are lower, compared to the findings reported by Juliana, et al.[34] Mincer, et al.[19] and Costa, et al,[15] who studied the usefulness of stage G and H on all four wisdom teeth for discriminating adults and minors, reported that average age in Mexican and Columbian males were 17.8 and 18.3 years, for males and females, respectively, for stage G. Our findings are not generally not in line with the findings Mincer and Costa et al, as we found that only stage H is helpful in discriminating juveniles and adults.

Positive likelihood ratios (LR+) in our study was found to be highest for the stage H. It means that if males and females have finished maturation of TMs, then it is over 4 and 9 times likely, respectively, that an individual is an adult than a minor. One could ñreliablyò conclude on juvenile/adult status of an individual when the predicted probability was greater than 80%. 35 In the present sample, we obtained a post-test probability of 82% in males and 91% in females for Demirjian stage H. But in our sample, it was observed that 22 out of 144 males and 13 out of 164 females who were minors had TMs into Demirjianôs maturational stage H. These are the individuals who were falsely categorized as majors/adults, suggesting second type errors (i.e. ethically unacceptable) which is highly unacceptable in medico legal proceedings.

Conclusion:

The level of accuracy obtained using Demirjian stage H as a cut off value for discriminating juvenile/adult status may not be sufficient for the courts of law to rule an individual in question regarding his/her status of age of majority with adequate levels of certainty.

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References

1. Azevedo Ade C, Alves NZ, Michel-Crosato E, Rocha M, Cameriere R, Biazevic MG. Dental age estimation in a brazilian adult population using cameriere's method. Braz Oral Res. 2015;29:1-9

2. Focardi M, Pinchi V, De Luca F, Norelli GA. Age estimation for forensic purposes in italy: ethical issues. Int J Legal Med. 2014;128:515-22.

3. Cameriere R, Santoro V, Roca R, Lozito P, Introna F, Cingolani M, et al. Assessment of legal adult age of 18 by measurement of open apices of the third molars: study on the albaniansample. Forensic Sci Int. 2014;245C:205 e1- e5.

4. QuispeLizarbe RJ, SolísAdrianzén C, Quezada-Márquez MM, GalíÍ I, Cameriere R. Demirjian's stages and Cameriere's third molar maturity index to estimate legal adult age in Peruvian population. Leg Med (Tokyo). 2017;25:59-65.

5. Focardi M, Pinchi V, De Luca F, Norelli GA. Age estimation for forensic purposes in Italy: ethical issues. Int J Legal Med. 2014;128:515-22.

6. Thevissen PW, Kvaal SI, Willems G. Ethics in age estimation of unaccompanied minors. J Forensic Odontostomatol. 2012;30 Suppl 1:84-102

7. Eikvil L. Age estimation in youths and young adults. A summary of the needs for methodological research and development.2012. Available from: http://publications.nr.no/1355995517/Age_estimation_methods-Eikvil.pdf.; Last accessed 12th May 2017

8. Prieto JL, Barberia E, Ortega R, Magana C. Evaluation of chronological age based on third molar development in the Spanish population. Int J Legal Med. 2005;119:349-54.

9. Olze A, Schmeling A, Taniguchi M, Maeda H, van Niekerk P, Wernecke KD, et al. Forensic age estimation in living subjects: the ethnic factor in wisdom tooth mineralization. Int J Legal Med. 2004;118:170-3.

10. Schmeling A, Grundmann C, Fuhrmann A, Kaatsch HJ, Knell B, Ramsthaler F, Reisinger W, Riepert T, Ritz-Timme S, Rösing FW, Rötzscher K, Geserick G. Criteria for age estimation in living individuals. Int J Leg Med. 2008;122(6):457-60.

11. Schmeling A, Reisinger W, Geserick G, Olze A. Age estimation of unaccompanied minors. Part I. General considerations. Forensic Sci Int. 2006;159 Suppl 1:61-4.

12. Saunders E. The teeth, a test of age, considered with reference to the factory children: addressed to both Houses of Parliament, Westminster, London UK. London, U.K.: H. Renshaw, 1837.Available from https://wellcomelibrary.org/item/b21980895#?c=0&m=0&s=0&cv=8&z=-1.2191%2C0%2C3.4382%2C1.7397 Last accessed 19th May 2017

13. Ardakani F, Bashardoust N, Sheikhha M. The accuracy of dental panoramic radiography as an indicator of chronological age in Iranian individuals. J Forensic Odontostomatol. 2007; 25: 30-5.

14. Garn S, Lewis AB, Kerewsky RS. Genetic, nutritional, and maturational correlates of dental development. J Dent Res 1965;44(1):228-42.

15. Costa J, Montero J, Serrano S, Albaladejo A, Lopez-Valverde A, Bica I. Accuracy in the legal age estimation according to the third molars mineralization among Mexicans and Columbians. Aten primaria. 2014;46(5):165-75.

16. Mohamad M, NavidY,Ava V, Asana V, Amrita V. Radiographic assessment of third molars development and it's relation to dental and chronological age in an Iranian population. Dent Res J (Isfahan). 2015;12(1):64-70.

17. Muhammed A, Khalil IA, Khyrat YA, Ahmad MA, M Luqman. Age estimation using third molar teeth: A study on southern Saudi population.J Forensic Dent Sci. 2012 Jul-Dec; 4(2):63-65.

18. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. Hum Biol. 1973;45:211-27.

19. Mincer HH, Harris EF, Berryman HE. The A.B.F.O. study of third molar development and its use as an estimator of chronological age. J Forensic Sci. 1993;38(2):379e390. 21.

20. Olze A, Schmeling A, Taniguchi M, Maeda H, van Niekerk P, Wernecke KD, et al. Forensic age estimation in living subjects: the ethnic factor in wisdom tooth mineralization. Int J Legal Med 2004;118:170-3

21. Fletcher R, Fletcher S. Diagnosis. In: Fletcher R, Fletcher S, editors. Clinical epidemiology The essentials. Baltimore: Wolters, Kluwer, Lippincott, Williams & Wilkins; 2005. p.35-58

22. Grimes DA, Schulz KF. Refining clinical diagnosis with likelihood ratios. Lancet. 2005; 365: 1500-5.

23. P.M. Garamendi, M.I. Landa, J. Ballesteros, M.A. Solano, Reliability of the methods applied to assess age minority in living subjects around 18 years old. A survey on a Moroccan origin population. Forensic Sci. Int. 2005; 154: 3-12.

24. S. Arany, M. Iino, N. Yoshioka, Radiographic survey of third molar development in relation to

chronological age among Japanese juveniles, J. Forensic Sci. 2004;49:534-8.

25. K. Gunst, K. Mesotten, A. Carbonez, G. Willems, Third molar root development in relation to chronological age: a large sample sized retrospective study. Forensic Sci. Int. 2003;136:52-7.
26. J.L. Prieto, E. Barberĕa, R. Ortega, C. Maganĕa, Evaluation of chronological age based on third molar development in the Spanish population. Int. J. Legal Med.2005;119:349-54.
27. A. Olze, D. Bilang, S. Schmidt, K.D. Wernecke, G. Geserick, A. Schmeling, Validation of common classification system for assessing the mineralization of third molars. Int. J. Legal Med. 2005;119:22-26.
28. M. Maber, H.M. Liversidge, M.P. Hector, Accuracy of age estimation of radiographic methods using developing teeth. Forensic Sci. Int. 2006;159:68-73.
29. J.R. Landis, G.G. Koch, The measurement of observer agreement for categorical data. Biometrics.1997;33(1):159-74.
30. J.A. Swets. Measuring the accuracy of diagnostic systems. Science.1998;240:1285-93.
31. GaliĺI, Lauc T, BrkiĺH, VodanoviĺM, GaliĺE, Biazevic MG, Brakus I, Badrov J, Cameriere R. Cameriere's third molar maturity index in assessing age of majority. Forensic Sci Int. 2015;252,191. e1-e5.
32. De Luca S, Biagi R, Begnoni G, Farronato G, Cingolani M, Merelli V, Ferrante L, Cameriere R. Accuracy of Cameriere's cut-off value for third molar in assessing 18 years of age. Forensic Sci Int. 2014 Feb;235:102:1-6.
33. Treviño M. Estimation Of The Age Of Mineralization And Volume Of Third Molars In A Population Of 14 To 22 Years,In Monterrey (Nuevo Leon, Mexico) By Computed Tomography of Images. Granada, Spain: Universidad de Granada; 2009. Available from https://hera.ugr.es/tesisugr/18324204.pdfLast accessed 19th May 2017
34. Quispe- LizarbeRoselhy, J., SolísAdrianzen, C., Miruslava Quezada Marquez, M., GaliĺI., Cameriere, R., Demirjian's stages and camerieres third molar maturity index to estimate legal adult age in peruvian population. Legal Medicine. 2017;25:59-65.
35. Acharya AB, Bhowmik B, Naikmasur VG. Accuracy of identifying juvenile/adult status from third molar development using prediction probabilities derived from logistic regression analysis.J Forensic Sci. 2014;59(3):665-70.

Table 1 - Sample of panoramic radiographs according to sex and age categories.

Age Groups	Males	Female	Total
14- 14.99	43	41	84
15- 15.99	39	47	86
16- 16.99	28	39	67
17- 17.99	34	38	72
18- 18.99	28	34	62
19- 19.99	26	41	67
20- 20.99	18	22	40
21- 21.99	11	17	28
Grand Total	**227**	**279**	**506**

Table 2 - Summary statistics of chronological age according to Demirjian's stages (C-H)

Demirjian stage		N	Mean	SD	Min	Med	Max	IQR
Females	C	06	15.32	0.82	14.51	15.17	16.64	1.58
	D	64	15.27	1.01	14.02	15.08	18.17	1.65
	E	35	15.95	1.32	14.13	15.68	19.39	2.04
	F	33	16.80	1.49	14.38	16.28	19.98	2.13
	G	43	17.83	1.31	15.01	17.84	21.02	2.07
	H	98	19.56	1.49	15.19	19.55	21.99	2.10
Males	C	09	14.55	0.57	14.04	14.37	15.71	0.86
	D	41	15.13	1.19	14.01	14.72	19.03	1.11
	E	35	15.96	1.29	14.22	15.63	19.35	1.72
	F	32	16.61	1.24	14.39	16.62	20.19	1.87
	G	26	17.81	1.72	15.15	17.57	21.47	2.32
	H	84	19.18	1.46	15.06	19.08	21.94	2.29

Abbreviation: N, number of individuals, Mean, mean age; SD, standard deviation of mean age; Min, Minimal age; Med, median age; Max, maximum age; IQR, Inter Quartile Range

Table 3 - Contingency tables describing discrimination performance between adults (≥18 years) and minors (<18 years) of the Demirjian's stages F to H for females and males

Females				Males			
Test	>18	<18	Total	Test	>18	<18	Total
>F	111TP	62FP	173	>F	75TP	67FP	142
< F	04FN	102TN	106	< F	08FN	77TN	85
Total females	**115**	**164**	**279**	**Total males**	**83**	**144**	**227**

Abbreviation: TP, true positives; FP, false positives; FN, false negatives; TN, true negatives

Test	>18	<18	Total	Test	>18	<18	Total
>G	103TP	38FP	141	>G	71TP	39FP	110
< G	12FN	126TN	138	< G	12FN	105TN	117
Total females	**115**	**164**	**279**	**Total males**	**83**	**144**	**227**

Abbreviation: TP, true positives; FP, false positives; FN, false negatives; TN, true negatives

Test	>18	<18	Total	Test	>18	<18	Total
>H	85TP	13FP	98	>H	62TP	22FP	84
< H	30FN	151TN	181	< H	21FN	122TN	143
Total females	**115**	**164**	**279**	**Total males**	**83**	**144**	**227**

Table 4 - The quantities derived from 2-by-2 contingency tables to test the age of majority in South Indian males and females for Demirjian's stages F to H

		F	G	H
Males	**Accuracy**	0.66	0.77	0.81
	Sensitivity	0.90	0.85	0.74
	Specificity	0.53	0.72	0.84
	LR+	1.91	3.03	4.62
	LR-	0.18	0.21	0.31
	p	0.66	0.75	0.82
Females	**Accuracy**	0.76	0.46	0.84
	Sensitivity	0.96	0.89	0.73
	Specificity	0.62	0.76	0.92
	LR+	2.52	3.71	9.12
	LR-	0.06	0.14	0.29
	p	0.72	0.79	0.91

Table 5 - Cross tabulation by age group and developmental stage for the base sample

Sex	Age Groups	Demirjian's Developmental Stages						Total
		C	D	E	F	G	H	
Males	**<18 years**	9(6.2)	37(25.7)	31(21.5)	28(19.4)	17(11.8)	22(15.3)	144
	>18 years	0(0)	4(4.8)	4(4.8)	4(4.8)	9(10.8)	62(74.7)	83
Females	**<18 years**	6(3.7)	62(37.8)	33(20.1)	25(15.2)	25(15.2)	13(7.9)	164
	>18 years	0(0)	2(1.7)	2(1.7)	8(7)	18(15.7)	85(73.9)	115
Total		**15**	**105**	**70**	**65**	**69**	**182**	**506**

Figure 1: Demirjian stages of Tooth development

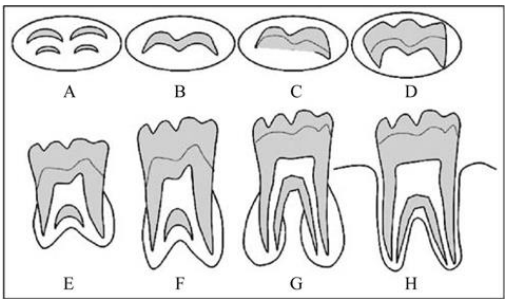


Figure 2: Box-plot of the relationship between age and Demirjian's stages of mineralization of the third molar in South Indian males and females.

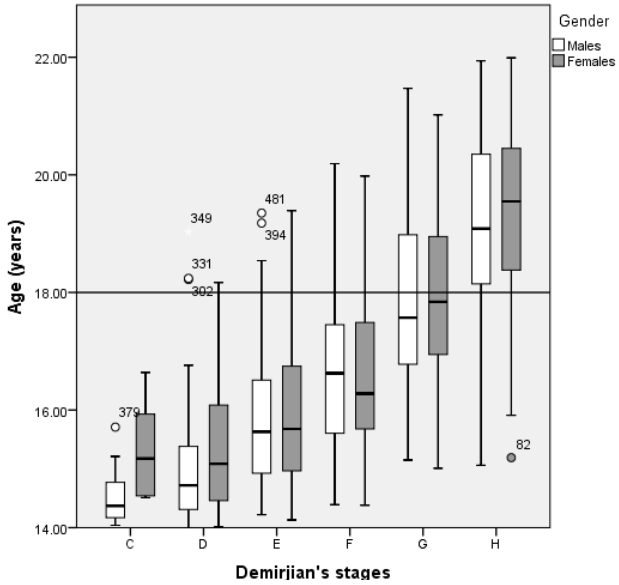
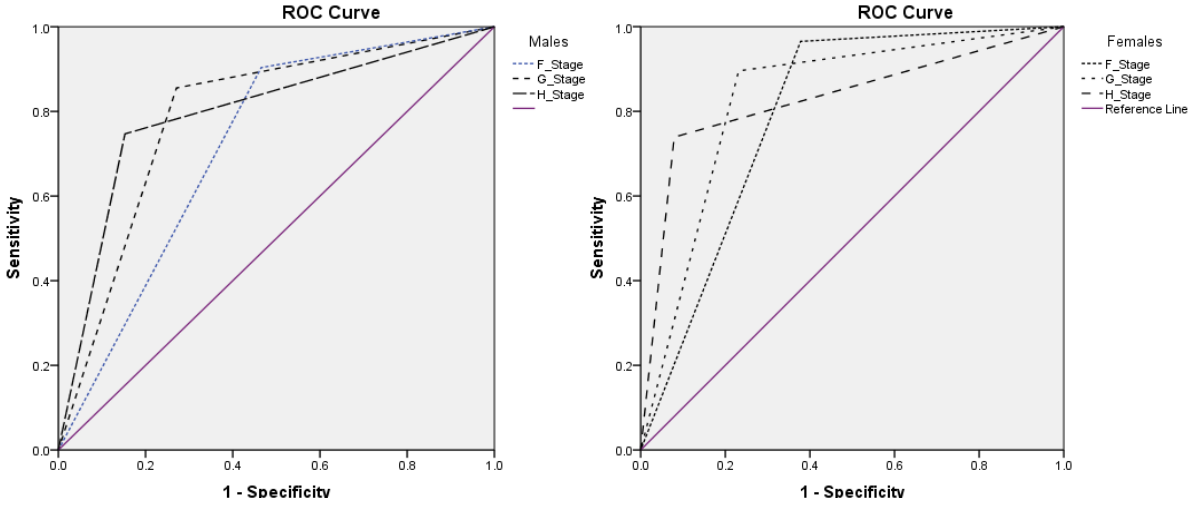


Figure 3: Receiver operating characteristic (ROC) curves for mineralization stage of tooth 38 for males (left) and females (right)



Original Research Paper

Burns in Married Women - An Autopsy Based Study

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Abstract

Burn deaths have tremendous medico-legal importance. They are regarded as the commonest cause of unnatural deaths in India. Burning of married females is very common in our country. The present cross sectional study was done on dead bodies of married female victims died due to burn injuries, brought for Autopsy to Midnapore Medical College Mortuary, from May 2014 to April 2015. Maximum no. of cases was of age group 21-30 yrs (37%), 95% were Hindu, 51% victims were educated up to or below 10th std, 75% were of low socio-economic class, 42% victims had more than 90% of BSA involved, 38% died of shock and 32% due to septicemia, 50% died in winter. Involvement of rural population was 93%.

Key Words: Burns, Married women, Cause of death, Manner of death

Introduction:

The invention of fire is one of the greatest achievements in the history of human race. But it also became the main cause of human death, a weapon to take revenge and destroy its own race.

Immediate causes of death in burn are shock, asphyxia and hypovolemia. Delayed causes are inflammation, toxaemia, hypoproteinemia, exhaustion, diseases of internal organ and infection, while remote causes are Curling's ulcer, decubitus ulcer, diarrhoea, malena, Marjolinôs ulcer, gangrene, tetanus and septicemia. Manner of death is mainly suicidal and accidental but homicidal burns have also been reported.

Burning of married females is very common in our country. These cases have increased probably due to marital disharmony, dowry harassment, humiliation, issues of property and land, failure in love, depression aroused from physical torture and domestic violence. The reasons behind this action may dowry, marital infidelity, sexual jealousy, and oedipal dominance of mother in-law over the grooms, etc.[1]

The custom of payment of dowry by the brideôs family to the prospective bridegroomôs family is ancient and widely prevalent. Young married women are either being burned or forced to commit suicide, just because of the demand of dowry. Both homicides and suicides can constitute ódowry deathsô[2] Burning is being preferred over other modes of homicide because culprits think that they can show these cases as suicide or just an accident. Burn deaths have tremendous medico-legal importance. They are regarded as the commonest cause of unnatural deaths in India. Most of these cases are accidental or suicidal in nature[3]. Higher incidence of burn in Paschim Medinipur District, where advanced medical facilities are available, prompted us to undertake this study.

Material and Methods:

This cross sectional study was carried out on 100 medicolegal autopsy in cases of burn in married women in the Midnapore Medical College Mortuary from May 2014 to April 2015 i.e. one year period. Unmarried females, children, Decomposed burned cases,

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Unknown cases and cases with incomplete data were excluded.

Observations & Results:

In the present study maximum no. victims, 37 (37%) belonged to age range 21-30 yrs, followed by age group 11-20 yrs (23%) and 31 to 40 yrs (22%). **(Table-1)** Fifty one percent victims were of education level below 10th standard, 29% were 10th pass, while only 3% were graduate. **(Table 2)** Lower socio-economic background was the highest in this series with 75% cases, followed by middle class with 25 cases. **(Table 3)** 30% cases had history of familial disharmony, while 70% had no such background.**(Table 4)**

In 15% cases, history of torture was present, while 85% cases gave no such history. **(Table 5)**. Maximum burns occurred in Kitchen, 69% , followed by bedroom, 20%. 7% of the incidents occurred outside the house, while only 2% each in Verandah and Bathroom/ Toilet. **(Table 6)** Maximum no. of instances took place between 6pm to 12pm (52%), next being between 6am to 12pm (25%), followed by 12pm to 6pm (18%). **(Table 7)** 93% cases were from rural areas. **(Table 8)**.

Forty two percent victims had more than 90% of TBSA involved, while 27% victims had more than 80 to 90% of TBSA involved. **(Table 9)** It was observed that 32% victims survived for 1 to 3days, 27% survived for 3-7days, while only 2% survived for more than 1month. **(Table 10)** 38% victims died due to shock. 32% due to septicemia, 25% cases died due to toxaemia and 5% due to other infections.**(Table 11)** Manner of death in 70% cases was accidental. **(Table 12)** Soot was present beyond bifurcation of trachea in 6% of cases. Twenty four incidents occurred during summer (March to June), 26 during rainy season (July to October) and 50 during winter (November to February). **(Table 13).**

Discussion:

The present study demonstrated that maximum no. victims, 37 (37%) belonged to the age range 21-30 yrs, which was consistent with the studies of Ambade VN and Godbole HV[4], Sharma BR et al[5], Agarwal S and Agarwal SN[6], Rajesh Dere and Rajoo KM[7] also found maximum incidence in similar age range.

In our study, 51% of the victims were educated below 10th standard which is consistent with Dasgupta and Tripathi,[8] who noticed that 59% of the victims were illiterate, while 23% received only primary education. Kumar V et al[9] and Sakhare[10] also made similar observations. Again, most of the victims were from Lower socio-economic strata, which is consistent with study of Sharma BR et al[5] and Groohi B et al[11].

We noticed that 30% cases had history of familial disharmony, which is corroborated with study of Jha SS.[12] Maximum burns occurred in Kitchen, which was consistent with the studies of Kumar, et al,[13] who reported that maximum victims sustained burns in the kitchen; and Keswani,[14] who reported 80% of burn injuries occurred at home especially in the kitchen.

Again, maximum no. of incidences took place between 6pm to 12pm, which is well corroborated with study of Singh D et al,[15] who found that maximum incidence was between 5 to 11 pm i.e in the evening hours. Actually, in India these are the periods when housewives are generally engaged in cooking. 93% cases were from rural areas, which was consistent with the studies of Kumar, et al[16] (73.2%); Batra AK[17] (75%); Shaha KK and Mohanthy S[18] (71.87%). More cases from rural area might also be due to primitive cooking habit in rural areas which still uses Chulha and woods from trees to cook.

Forty two percent victims had more than 90% of TBSA involved, 27% had more than 80 to 90% of TBSA involved, which is consistent with study of Dasgupta and Tripathi[17] who observed that 50-100% of the body area was burnt in majority of the victims (92%). Shaha KK and Mohanthy S [18] also found that in more than 68.8% of cases, the total body surface area involved was more than 80%.

Present study shows - 32% victims survived for 1 to 3 days and 27% survived for 3 - 7days, but Shaha KK and Mohanthy S[18] observed that most victims died at the time of the incident, or within the subsequent 24 hours, due to hypovolaemic shock, whereas D'Avignon LC et al[19] noted that the time to death following burn was < or =7

days in 30%, < or =14 days in 59% and < or =21 days in 67%.

Our study showed that 38% of cases died due to shock and 32% cases died due to septicemia, whereas Sharma BR, et al[5] found septicemia to be the most common cause. In present study septicemia is second most common cause of death, Shock being the first. Manner of death in maximum cases was accidental, which is consistent with study of Subrahmanyam M,[20] who noticed 79.4 per cent of the burns were accidental in nature and Bullar DS,[21] who noted 62.9% death to be accidental. 50 incidences occurred during winter. Main reason behind increase in accidental death by burning in winter is Indian habit to warn body by open fire. In the present study, 4 cases was caught fire when they were trying to warm their own body.

Suggestions and Recommendations:

A) Social and economic measures:

1. Public awareness should be increased regarding the social problem and dirty customs like Dowry and also about the violence against women.
2. For this an effective coordination should be sought between the nongovernment, voluntary and law enforcing agencies to prevent and control crime against women.
3. People taking or giving dowry should be boycotted from society.
4. People should be educated through different media of mass communication about safety precautions to be adopted to prevent domestic accidents. It should be communicated to the families through government and non government agencies.
5. Promoting literacy among the women to make them economically independent and free by providing job opportunities.
6. Proper training about first aid of burn should be given to heath workers.
7. Facilities to treat burn patients should be made available to every PHC, easily achievable from all villages under it.
8. High incidences of burns can be reduced by proper counselling of people about most common causes of burns and their prevention.

B) Legal measures:

1. Early marriage should be discouraged and punitive measures to be strictly implemented in case of default.
2. Special training should be given to those girls, who are going to marry to tackle the adverse conditions, so that small stresses could not compel them to commit suicide.
3. Enact more stringent laws taking care of the torture of housewives by their husbands and In-laws.
4. Inquest by a magistrate or a senior police officer should be made in all cases of females deaths especially of burns cases and the existing laws to be strictly adhere to.
5. If patient is about to die, doctor should arrange for recording dying declaration in burn deaths cases particularly if there was no time to call the magistrate.
6. Forensic Medicine expert should essentially visit to the crime scene along with the expert in Forensic Science with a well-equipped team.
7. Steps should be taken to strengthen the Mahila Courts.
8. Women protection cell working in the State should be given to deal with deaths resulting from burns with adequate and sufficient facilities.
9. There should be transparency and accountability in the Judicial system.
10. Early marriage should be discouraged and punitive measures to be strictly implemented in case of default.

Conflict of interest: None

Financial Assistance: None

References

1. Kumar V. Bride burningï a social evil. J For Med Toxicol 1999;(1):28-9.
2. Banerjee P. Dowry in 21st century India: the sociocultural face of exploitation. Trauma Violence Abuse. 2013;15(1):34ï 40.
3. Reddy KSN. The essentials of forensic medicine and toxicology. 31st Ed, pp:296- 306.
4. Ambade VN, Godbole HV. Study of burn deaths in nagpur, central india. Burns. 2006;32(7):902-8.

5. Sharma BR, Harish D, Singh VP, Bangar S. Septicemia as a cause of death in burns: an autopsy study. Burns. 2006;32(5):545-9.

6. Agarwal S, Agarwal SN. Analysis of causes of fatal burns. J Ind Acad Foren Science.1967;6:40-3.

7. Dere RC and Rajoo KM. Study of Unnatural Deaths in Females, A Medico-legal Study at Rural Medical College, Loni. J Indian Acad Forensic Med. 2011;33(3):211-213.

8. Dasgupta SM, Tripathi CB. Burnt wife syndrome. Annal Acad. Med. 1984;13:37-42

9. Kumar V, Tripathi CB, Kanth S. Burnt wives: a circumstantial approach. J For Med Toxicol. 2001;18(3):14-9.

10. Sakhare S. Analytical study of 1200 suspicious deaths of newly married women in vidharbha region of maharashtra state in india. In: Women's Decade World Conference 1985;Nairobi, Kenya. Available at: http://www.burnsjournal.com/article/S0305-4179(02)00235-8/

11. Groohi B, Rossignol AM, Barrero SP, Alaghehbandan R. Suicidal behavior by burns among adolescents in kurdistan, iran: a social tragedy. Crisis. 2006;27(1):16-21.

12. Jha SS. Burns mortality in Bombay. Burns 1981;8:118-22.

13. Kumar V, Tripathi CB, Kanth S. Burnt wives: a sociological study. Int J Med Toxicol Legal Med 1999;2(2):27-24

14. Keswani MH. The prevension of burning injury. Burns. 1986;12(8):533-9

15. Singh D, Singh A, Sharma AK, Sodhi L. Mortality in chasdigarh zone - 25 yr autopsy experience from a tertiary care hospital of india. Burns. 1998;24:150-6

16. Kumar V, Tripathi CB, Kanth S. Burnt wives: a study of autopsy findings. J Ind Acad For Med. 2000;22(2):33-39.

17. Batra AK. Burn mortality: recent trends and sociocultural determinants in rural India. J Intl Soc Burn Inj. 2003;29(3):270-5.

18. Shaha KK, Mohanthy S. Alleged dowry death: a study of homicidal burns. Med Sci Law. 2006;46(2):105-10.

19. D'Avignon LC, Hogan BK, Murray CK, Loo FL, Hospenthal DR, Cancio LC, Kim SH, Renz EM, Barillo D, Holcomb JB, Wade CE, Wolf SE. Contribution of bacterial and viral infections to attributable mortality in patients with severe burns: an autopsy series. Burns. 2010;36(6):773-9.

20. Subrahmanyam M. Epidemiology of burns in a district hospital in western India. Burns. 1996;22(6):439-42.

21. D.S. Bhullar: Profile of unnatural female deaths between 18-30 years of age. J For Med Toxicol. 1997;13(3&4):5-8.

Table No 1: Age Wise Distribution of Cases

S. No.	Age (yrs)	No. of Cases	% ages
1	0 – 10	00	00
2	11-20	23	23
3	21-30	37	37
4	31-40	22	22
5	41-50	07	07
6	51-60	04	04
7	61-70	06	06
8	71-80	01	01
9	81-90	00	00
10	91-100	00	00
Total		100	100

Table No 2: Education Wise Distribution of Cases

S no	Education	Total no of cases	%age
1	Below 10th	51	51
2	10th	29	29
3	11-12th	17	17
4	Bachelors	03	03
5	Masters	00	00
Total		100	100

Table No 3: Economical Status of Cases

S no	Economic class	Cases	%age
1	Lower(less than 30,000 Rs per annum)	75	75
2	Middle (Rs 30,000-60,000Rs per annum)	25	25
3	Upper (more than 60,000Rs per annum)	00	00
Total		100	100

Table No 4 : Familial Disharmony Amongst Cases

S.No	Familial Disharmony	Total No of Cases	%age
1	Present	30	30
2	Absent	70	70
Total		100	100

Table No 5: History of Torture

S no	History of torture	No of cases	%age
1	Present	15	15
2	Absent	85	85
Total		100	100

Table No 6: Place of Occurrence

S no.	PO	No of cases	%age
1	Kitchen	69	69
2	Bedroom/Room	20	20
3	Bathroom/Toilet	02	02
4	Verandah	02	02
5	Outside House	07	07
Total		100	100

Table No 7: Time of Occurrence

S no	Time of occurrence	No of victims	%age
1	6am- 12pm	25	25
2	12pm- 6pm	18	18
3	6pm- 12pm	52	52
4	12pm- 6am	05	05
Total		100	100

Table No 8: Habitat of Victim

S no	Habitat	No of cases	%age
1	Rural	93	93
2	Urban	07	07
Total		100	100

Table No 9: Percentage of Total Body Surface Area of Victims Involved

S no	TBSA (%)	No of cases	%age
1	Less than 10	00	00
2	10-20	00	00
3	20-30	02	02
4	30-40	03	03
5	40-50	03	03
6	50-60	08	08
7	60-70	10	10
8	70-80	05	05
9	80-90	27	27
10	90-100	42	42
Total		100	100

Table No 10: Period of Post Burn Survival

S no	Period of post burn survival	No of cases	%age
1	Less than 12 hrs	14	14
2	12-24 hrs	13	13
3	1-3 days	32	32
4	3-7 days	27	27
5	7- 15 days	08	08
6	15days – 1month	04	04
7	More than 1 month	02	02
Total		100	100

Table No 11: Cause of Death

S no	Death due to	Total no of Cases	%age
1	Shock	38	38
2	Toxaemia	25	25
3	Septicemia/Sepsis	32	32
4	Other Infections	05	05
Total		100	100

Table No 12: Manner of Death

S no	Manner of death	No of cases	%age
1	Suicidal	18	18
2	Homicidal	12	12
3	Accidental	70	70
Total		100	100

Table No 13: Seasonal Variation of Incidence

S no	Season	No of cases	%age
1	Summer(Mar - June)	24	24
2	Rainy season (July-Oct)	26	26
3	Winter (Nov - Feb)	50	50
Total		100	100

Original Research Paper

Ashtagandha Powder: A herbal formulation for deciphering latent fingerprints

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Abstract

Number of formulations is in use these days for developing latent fingerprints on different surfaces. In this paper, an easily available herbal powder, which is cheap as well as non-toxic, has been used for the visualizing latent prints. This powder has not only given results successfully on different surfaces such as wood, glass, plastic, paper and marble, but also posed no threat for the technicians who inhale fine particles of the powder during the sprinkling over the latent prints. The study has been recorded for up to 10 days.

Key Words: Latent prints, Fingerprints, Herbal Powder, Ashtaganda

Introduction

Fingerprints are one of the most valuable physical evidence found at the crime scene. Most of the criminals leave their fingerprints inadvertently at the crime scene. Most of the times, fingerprints found at crime scene require means of development or enhancement for the visualization. Latent prints need to be developed as they are not visible to the naked eye. Latent fingerprints are formed with the composition of sweat, along with traces of chlorine, calcium, sulphur, urea, amino acid, phenol, sodium, potassium, ammonia, cholesterol, lactic acid, free fatty acid, wax, esters with triglycerides, etc.[1-3] Fingerprint development is an area in which many new researches and developments are going on from past many decades.

Particularly, in the realm of methods for developing latent prints; new techniques and methods are still being developed and are updated to the conventional methods. Various workers have applied number of techniques such as ninhydrin dipping, iodine fuming, silver nitrate soaking, cyanoacrylate technique, chemical powders, organic base powers, heat therapies, dyes, light sources for the visualization of latent prints present on different types of substrates.[4,5] In the past, powder dusting was the most commonly used method for latent print development on many surfaces. When the fingerprint powder is sprinkled over the affected area, it adheres to the sweat and other material left on the fingerprints. At the same time, fine chemicals of latent print powders are inhaled by the technicians which poses a health concern. In order to overcome this disadvantage, organic base powders were tried to develop latent prints.[6-15] But still, an improved technique needs to be formulated which can effectively make all the latent prints visible on all type of substrates, as well as does not create any kind of threat to the health of a investigator.

Therefore, in the present study, an attempt has been made to develop latent prints with "Ashtagandhaò powder which is a herbal, non toxic, cheap and easily available (**Figures 1& 2**). Ashtagandha powder is believed to be a holy powder which is mixture of different items that includes camphor (cinnamomum camphora), turmeric (curcuma longa), saffron (crocus sativus), essential oil plant bark, ambar

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& nagkesar (mesua ferrea) and kumkum (bixa orellan).[16] It has many medicinal uses also.[17] This powder is used during the puja in the morning in every hindu house. It is mixed with rosewater and applied on the forehead as ñTilakò It is known for its antibacterial and cooling properties and generates the feeling of love, compassion and develop positivity.[16]

Camphor is derived from Cinnamomum camphora plant and is a waxy, flammable, white or transparent solid with a strong aroma. It is a terpenoid with the chemical formula $C_{10}H_{16}O$.[18]

Saffron is a spice derived from the stigma of Crocus sativus flower. It's taste and fragrance results from the chemicals picrocrocin and safranal that contains a carotenoid pigment, crocin that imparts a rich golden-yellow hue to dishes and textiles.[19]

Turmeric (*Curcuma longa)* is a rhizomatous perennial plant of the, Zingerberaceae family and has one active ingredient curcumin that imparts color to the food and a distinctly earthy, slightly bitter, slightly hotpeppery flavor and a mustardy smell.[6]

Kumkum (Achiote -*Bixa orellana*) is a shrub or small tree and is the best known source of a natural orange-red condiment annatto that is obtained from the waxy arils that cover its seeds. Annatto and its extracts are widely used as food colour in variety of dishes and many other products. The color of the seed coating is due mainly to the carotenoid pigments bixin and norbixin.[20]

Amber is derived from the Latin word succinum which means a substance that is ultimately derived from sap or juice. Succinum originates from the resin of ancient and long-extinct trees, including conifers (e.g., pine trees), as well Fabaceae and other genera that has resided in the ground for millions of years. So, Amber is a fossilized tree resin used as an ingredient in perfumes, as a healing agent in folk medicine, and as jewelery. Oil of amber is yielded after heating above 200 °C the amber resin whose polymerization, isomerization reactions, cross-linking and cyclization had taken place over the years. A black residue left behind after heating commonly known as "amber colophony", or "amber pitch", which is dissolved in turpentine or linseed oil to forms "amber varnish" or "amber lac".[21]

Nagkesar (Mesua ferrea) commonly known as Sri Lankan ironwood, Indian rose chestnut, or cobra's saffron, is a species in the family Calophyllaceae. The principal constituents of M. ferrea include mesuaferrone-A & B, mesuaferrol, mesuanic acid, & ß amyrin and ß-sitosterol present in the stamen. The presence of essential oils, xanthones and coumarins in seeds has been reported.[22-23] Traditionally, it's flowers, leaves, seeds and roots are used as herbal medicines and widely used for curing many ailments in India.

In this paper, an endeavor has been made to make the latent prints visible with the herbal powder that is available in almost every Hindu family home across the world.

Materials and Methods:

The development of latent fingerprints was carried out on six different substrates which included both semi porous and non porous surfaces. The different substrates that were used in the study include wooden table, A4 size paper - normal and bond, in semi porous surfaces category; whereas non porous surfaces included steel glass, plastic jug, compact disk surface, marble slab and window glass. The latent fingerprints were generated by employing all the ten fingers of the subjects on different substrates. The experiment was carried out in the month of May and July, when the subjects were sweating, while depositing the latent prints on different substrates. The temperature and humidity was ranging from 42-45^{o}C and 65-75%, respectively. The study was experimented and recorded up to ten days. Every day, 2-3 fingerprints were developed on each different substrate with Ashtagandha powder. The first fingerprints were developed four hours after depositing them on each different substrate. Similarly, for next nine days, fingerprints were developed around the same time on different substrates. Particle size of the Ashtagandha powder was not measured. It was available in earthy orange red color. Ashtagandha powder was applied to the latent prints with fingerprint brush made of marabou feather. The brush was first lightly touched with the Ashtagandha

powder and then very carefully applied to latent prints in one direction with repeated strokes. Powder particles were deposited gently over the oily components of the ridges of the fingerprint to be revealed, without rubbing away the delicate residue of the fingerprint itself. The excessive powder was blown away. Similar method was followed for next nine days for developing the latent prints on all the substrates.

Results and Discussion:

The result of the latent fingerprints developed by using Ashtagandha powder on six different surfaces i.e. wooden table, A4 size paper - normal and bond, steel glass, plastic jug, compact disk surface on both sides, marble slab and window glass were recorded and are shown in **Figures 2-9**. It was observed that all the latent fingerprints present on different substrates were successfully developed with Ashtagandha powder. It is also worth mentioning here that the ridges of latent fingerprints developed on different days or the last day i.e. tenth day of the study, were equally clearly evident as were evident in the fingerprints developed on first day of the study. The adherence of Ashtagandha powder with the latent fingerprints can be due to the formation of hydrogen bonds between the fatty acids /glycerides of sebum and the carbonyl and hydroxyl group of the components of the powder.[6,16-19] It has been observed from the comparative study of all the substrates that surfaces with darker background generate better visualizing results than the surfaces having lighter background. Results obtained by us suggest that Ashtagandha powder can be successfully used for developing the latent prints present on the wooden surfaces, glass surfaces, plastic surfaces, steel surfaces and marble surfaces, having darker background for the personal identification in various crime scenes. It is surprising to mention that Ashtagandha powder used for the developing the latent prints on compact disk surface did not damage or interfere with the data contained in it. Moreover, due to herbal formulation of the Ashtagandha powder, it did not pose any type of health problem to the investigator while developing the latent prints.

Conclusion:

It is concluded from the present study that a herbal, cheap, non-toxic and easily available Ashtagandha powder can be successfully applied for developing the latent fingerprint on different surfaces such as wooden, glass, steel, plastic, paper and marble present on the crime scene and shows equivalent results to the other successfully applied powder methods. This herbal formulation provides a good substitute for the technicians that inhale fine particles of toxic chemical powders while applying or sprinkling over the latent prints to develop them.

Conflict of interest : None
Financial Assistance: None

References

1. Garg R., Singh K., Sharma S. Visualization of latent fingerprints using silica gel G: A new technique. Egyptian Jour Foren Sci. 2013;3:20-5.
2. Sodhi G.S., Kaur J. Physical developer method for detection of latent fingerprints: A review. Egyptian Jour Foren Sci. 2016;6:44-7.
3. Christophe C., Chris L., Margot P., Stoilovic M.,Fingerprints and other ridge skin impressions. CRC Press, Boca Raton, London, New York, Washington, DC (2004) chapter 4.
4. Sodhi GS, Kaur J. A fingerprint powder formulation based on aniline blue dye. Indian Police J 2002;49(3):44-5.
5. Sodhi GS, Kaur J, Garg RK. A fingerprint powder formulation based on Azure I dye. Indian J Criminol 2003;31(1-2):4-5.
6. Garg RK, Kumari H, Kaur R. A new technique for visualization of latent fingerprints on various surfaces using powder from turmeric: A rhizomatous herbaceous plant (Curcuma longa Egyptian Jour Foren Sci. 2011;1:53-7.
7. Kerr FM, Haque F, Westland AD. Organic based powders for latent fingerprint detection on smooth surfaces. Part II. Can Soc Foren Sci Int. 1983;16:140-2.
8. Kerr FM, Haque F, Barson IW. Organic based powders for latent fingerprint detection on smooth surfaces (Part I). Can Soc Foren Sci Int. 1983;16(1):39-44.
9. Kerr FM, Haque F, Westland AD. Organic based powders for latent fingerprint detection on smooth surfaces, Part II. Can Soc Foren Sci Int. 1983;16:140-2.

10. Sodhi GS, Kaur J. A novel cost effective organic fingerprint powder based on fluorescent eosin yellow dye. Ind Jour Criminol. 1999;27(3-4):73-4.
11. Sodhi GS, Kaur J, Garg RK. A fingerprint powder formulation based on Azure I dye. Ind Jour Criminol. 2003:31(1-2):4-5.
12. Sodhi GS, Gupta GP, Kaur J. A novel, cost effective organic fingerprint powder based on fluorescent eosin blue dye. Res Pract Foren Med 1997;40:121-3.
13. Sodhi GS, Kaur J. A novel, cost effective organic fingerprint powder based on fluorescent eosin yellow dye. Ind Jour Criminol. 1999;27(3-4):73-4.
14. Sodhi GS, Kaur J. Novel, cost effective organic fingerprint powder based on phloxine B dye. Def Sci Jour. 2000;50(2):213-5.
15. Sodhi GS, Kaur J, Garg RK. Fingerprint powder formulation based on organic, fluorescent dyes. J Foren Ident. 2004;54(1):4-8.
16. Accessed from - http://www.rudraksha-ratna.com
17. Tabassum N., Hamdani M. Plants used to treat skin diseases: Pharmacognosy Review. 2014;8(15):52-60.
18. Pragadheesha VS, Arvind S, Anju Y, Chanotiyaa CS, Alam M, Samad A. Chemical characterization and antifungal activity of cinnamomum camphora essential oil. Industrial crops and products. 2013;49:628-33.
19. Ríos JL, Recio MC, Giner RM, Máñez S. An update review of saffron and its active constituents Phytotherapy Research. 1996;10:189-93.
20. Benteley BL. Protective functions of ants visiting the extra floral nectraries of Bixa Orellana, Jour Ecology. 1977;65:27-38.
21. Rottllander RCA. On the formation of amber from pinus resin archaeometry. 2007;12(1):35-52.
22. Banerjee R, Choudhary AR. Mesua ferrea: chemical constituents and biological activity. J Chem Soc Pakistan 1993;15:207-11.
23. Chanda S, Rakholiya K, Parekh J. Indian medicinal herb: antimicrobial efficacy of *mesua ferrea* l. seed extracted in different solvents against infection causing pathogenic strains. J Acute Diseases. 2013;2(4):277-81.

Fig: 1 Ashtagandha Powder

Fig: 2 Ashtagandha Powder

Fig: 3 Showing the development of fingerprints on CD surface after 3 days

Fig 4: Showing the development of fingerprints on marble surface after 4 days

Fig 5: Showing the development of fingerprints on glass surface after 6 days

Figure 6: Showing the devlopment of fingerprints on plastic jug surface after 8 days

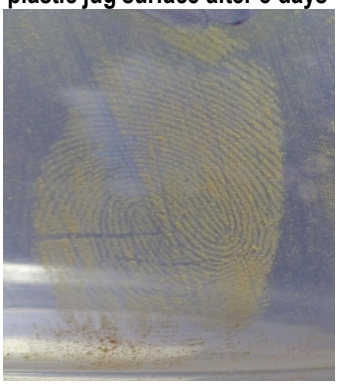

Fig 7: Showing the development of fingerprints on steel glass surface after 10 days

Fig 8: Showing the development of fingerprints on wooden table surface after 7 days

Fig 9: Showing the development of fingerprints on white A4 size paper after 5 days

Original Research Paper

Pattern of Scalp Injuries and its Correlation with Injuries to Skull and Brain amongst Autopsies Conducted at a Tertiary Care Centre

[1]Udaya Shankar B S, [2]Girish Chandra Y P, [3]S.Harish

Abstract

The study of ñPattern of scalp injuries amongst autopsiesò was carried out at the Department of Forensic Medicine in a tertiary care centre over a period of 18 months with the Aim to study the pattern of scalp injuries and to correlate them with injuries to skull and brain and with age and sex.

A total of 181 cases fulfilled the criteria, most vulnerable age group was 21-30 years (30.4 %); males (84.5 %) outnumbered females; 116 cases (64.1 %) were due to RTA, 31 cases (17.1 %) due to fall, 19 (10.5 %) and 10 cases (5.5 %) were due to railway injury and assault, respectively. External injury to the scalp was present in 158 cases (87.3 %) only and laceration was the most common type, accounting for 70 cases (38.7 %), followed by abrasions and contusions, each in 39 cases (21.5 %). Among the lacerations, split laceration was the commonest and was more commonly seen over bony prominences in parietal and frontal regions. Comminuted fracture of calvaria was commonest, accounting for 64 cases (35.4 %), followed by fissured/ linear fracture, 55 cases (30.4 %).

The common intracranial haemorrhage in the present study was combination of subdural and subarachnoid haemorrhage, 145 cases (80.1 %), and Brain contusion, 81 cases (44.7 %), was the commonest injury to brain. Of the 135 cases with fractures, temporal bone in 29 cases (21.4 %) and middle cranial fossa in 17 cases (12.5 %) were the commonest sites involved. Least involved area was the occipital bone, 13 cases (9.6 %).

Most of the abrasions on scalp had corresponding fissured/ linear fractures (59 %) and most of the lacerations had corresponding comminuted fractures (52.8 %) of calvaria. Correlation of injuries with age and sex had no significance. Thus this study emphasizes that autopsy is the gold standard in observing the various lesions amongst fatal cases and form a very vital cog in medico legal cases for the administration of justice.

Key Words: Scalp injury, head, skull fracture, brain haemorrhage

Introduction:

ðHead injuryô or ócranio-cerebral injuryô, defined by the National Advisory Neurological and Stroke Council is a morbid state resulting from gross or subtle structural changes in scalp, skull and/or contents of skull produced by mechanical forces, restricted to those forces applied externally to head.[1]

Head injury is a major cause of morbidity and mortality in all age groups, ranging from an infant, who is a victim of abusive head injury, to an elderly person, who is injured in a fall; while motor vehicle accidents are the most common cause of severe blunt force head injury particularly affecting young to middle-aged adults.[2] According to the WHO, traumatic head

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injury is the main cause of fatal and non-fatal injury in RTA.[3]

The soft tissues covering cranial vault form the scalp.[4] Its primary function is to protect and insulate the skull. It extends anteriorly up to supraorbital margins and posteriorly up to occipital protuberance and superior nuchal lines. Laterally, it projects down to zygomatic arch and external acoustic meatus. Wounds of scalp bleed profusely as vessels are prevented from retracting by fibrous tissue.[5]

In any head injury, soft-tissue injuries of scalp are very common.[6] Scalp skin is frequently traumatized, and the forensic pathologist must be able to adequately observe and document the full extent of this injury. Where injuries were inflicted with an implement, one may see patterned abrasions reflective of particular characteristics of weapon.[7] Since scalp lacerations usually result from direct blows to head, they often indicate deeper, more serious injuries.[6] The degree of violence required to produce a fracture of skull depends upon its thickness in different regions, tending to be thinner where they are covered by muscles, e.g in temporal region, and thicker where muscles attach, e.g. in occipital region.[5]

Rapid and accurate recognition of traumatic injuries is extremely important in emergency room and surgical settings to save life of victims, especially in cases of head injury. Scalp injuries, of course, are only one manifestation of head injury and must be correlated with skull fractures, intracranial pathology and circumstances of death.

Aims & Objectives:

1. To study the pattern of scalp injuries.
2. To correlate scalp injuries with injury to skull and brain.
3. To correlate scalp injuries with age and sex.

Materials & Methods:

Source of Data: All cases with head injury subjected for medico-legal autopsy at Department of Forensic Medicine in a tertiary care centre, Bengaluru.

Method of Collection of Data: Prior clearance from the Ethics Committee was obtained. History was furnished by police in forms 146 (i) and (ii) and further by a questionnaire regarding scene of occurrence, circumstantial evidence, manner of injury and scene photograph. Post mortem examination of each case was carried out as per standard procedure mentioned by Otto Saphire[8] and various types of injuries to scalp and skull bones; haemorrhages and injury to brain were recorded and photographed. For better visualization of injuries, scalp hairs were shaved; and injuries were examined by palpation and using a hand lens in suspected cases. Further, comparative evaluation of post mortem findings of head injuries was analyzed.

Inclusion Criteria:

All cases with head injury.

Exclusion Criteria:

Cases where bodies were in advanced state of decomposition.

Sample Size Determination:

Sample size was estimated using N-Master software[9] to estimate a single proportion.

Expected proportions of scalp injuries: 0.76 (76 %)

Relative precision: 10 %

Desired confidence interval: (1-alpha) % = 95 %

Required sample size: 121 (approximated to 125)

Results:

From prospective record analysis of autopsy cases over a period of 18 months fulfilling inclusion criteria, 181 cases were eligible. Of these, 116 cases (64.1 %) were due to RTA, 31 (17.1 %) due to fall, 19 (10.5 %) due to railway injury and 10 (5.5 %) were due to assault. Five (2.8 %) were due to other causes like industrial accidents, gunshot injuries, electrocution and burns. (**Fig 2**)

External injury to the scalp was present in 158 cases (87.3 %). These scalp injuries were more commonly seen over parietal region, 55 cases (39.2 %), followed by temporal region, 34 cases (24.2 %). Laceration was the most common type of scalp injury, accounting for 70 cases (38.7 %), followed by abrasions and contusions each, 39 cases (21.5 %). Among the lacerations, split laceration was the commonest, 57 cases; 18 cases had crush injuries and 5 cases had avulsion. Among the abrasions, grazes were the commonest, 32 cases. (**Fig 3**)

Lacerations were the most common scalp injuries in all mechanisms of injury, including RTA, railways, fall etc. Incised wounds (2 cases) and chop wounds (2 cases) were exclusively seen in assaults. Punctured wounds (2 cases) were observed in gunshot injuries. A combination of abrasion and contusion were observed in RTA (1 case) and fall (1 case), whereas combination of abrasion and laceration were observed in railways (1 case) and assault (1 case).

Cranial vault and base of skull bones were fractured in 135 cases (74.6 %) and in remaining 46 cases (25.4 %) there was no fracture. (**Fig 4**)

Intracranial haemorrhage was present in 165 cases (91.2 %), the commonest being combination of subdural and subarachnoid haemorrhage, 145 cases (80.1 %), followed by subarachnoid haemorrhage alone, 7 cases (3.9 %) and combination of extradural, subdural and subarachnoid haemorrhages in 5 cases (2 %). Others (4 cases) included diffuse axonal injury and intraventricular haemorrhage. (**Fig 5**)

Brain contusion, 81 cases (44.7 %), was the commonest brain injury, followed by cerebral oedema, 44 cases (20.3 %) and brain laceration, 37 cases (20.5 %), while 19 cases (11 %) showed complete extrusion of brain matter. (**Fig 6**)

Most of the scalp abrasions had corresponding fissured/ linear fractures (59 %) of cranial vault and base of skull bones, followed by comminuted fractures (30.8 %). Scalp lacerations more commonly had corresponding comminuted fractures (52.8 %) of calvaria followed by fissured/ linear fractures (24.2 %). But, as lacerations were only scalp tissue deep in 12 cases (15.7 %), there was no fracture of skull bones. Incised wounds (2 cases) and chop wounds (2 cases) had corresponding cut fractures with bevelling seen rarely. In falls, lacerations, bruises and abrasions over back of head were seen almost as frequently as on forehead, whilst a smaller proportion exhibited these injuries in both locations. 65 % had a skull fracture, and the majority of these were basal fractures. (**Fig 7**)

All type of scalp injuries had corresponding combination of subdural and subarachnoid haemorrhages as commonest followed by subarachnoid haemorrhage alone. 28 cases had coup and contrecoup injuries (Plates 1, 2), suggestive of a moving head in RTA and falls. (**Fig 8**)

Plates 1 -3 show the various pictograms of the study.

Discussion:

The vulnerable age group was the 21-30 years (30.4 %), followed by age group of 31-40 years (22.1 %). (**Fig 1**) The reason may be that they form the work group, and hence are prone to injuries due to RTA, falls, assaults, etc. Majority, 153 cases (84.5 %), were males since they are more into outdoor activities like driving vehicles, working outdoors hence more prone to accidents whereas females succumbed mainly to either accidental falls at their residence or due to RTA, they being pillion riders without headgear. Similar observations were made by Mukesh K Goyal, et al,[10] Kelly C. Bordignon,[11] Raju K, et al.[1]

Laceration was the most common type of scalp injury, more commonly seen over bony prominences in parietal and frontal regions. Similar results were drawn in studies by Sharma, et al[9] and Mohammad et al,[13] where scalp laceration was noticed in 104 cases (28.34 %) followed by scalp abrasion in 56 cases (15.26 %).

Among the fractures of calvaria, comminuted fracture - 64 cases (35.4 %) - was the commonest, followed by fissured/ linear fracture - 55 cases (30.4 %). Similar results were found in study by Shivendra Jha, et al,[12] where about half (45.2 %) of skull vault fractures (93.9 %) were comminuted fractures, followed by depressed and linear Fractures. In contrast, a study done by Mohammad, et al[13] concluded that linear fracture (43.04 %) was the commonest, followed by basilar fracture (17.73 %) and comminuted fracture (07.61 %). Nagesh K R, et al[14] and Gupta S, et al[15] had observed that fracture of skull was found in 62 % and in 66 % of the cases respectively, and fissure type of fracture was the most common type, followed by depressed comminuted fracture (57 %).

In our study, subarachnoid haemorrhage was found to be the commonest intracranial

haemorrhage associated with head injuries. This was in contrast with studies done by Abhishek Yadav, et al,[16] Goel Saurabh, et al,[3] and Gupta S, et al,[15] wherein the commonest type of intracranial haemorrhage found was subdural, followed by subarachnoid haemorrhage (31 %).

In the present study, diffuse involvement of whole brain was common, seen in 61 cases (33.7 %). This observation is similar to that by Ganveer GB, et al,[17] which showed that cerebral contusion 41 cases (56.1 %) was the commonest, followed by cerebral oedema, 24 cases (32.8 %). In contrast, Gupta S, et al observed that brain laceration (9 %) was common than brain contusion (7 %).[15]

All injuries were more commonly seen in males owing to more number of male victims and hence in our study, correlation of injuries with sex has no significance. Incised wounds (2 cases), chop wounds (2 cases) and punctured wounds were exclusively seen in males, as they are involved more commonly than females in assaults.

As most vulnerable age group is between 20 to 30 and 30 to 40 years age group, correlation of scalp injuries with victimôs age has no significance. It is a well-known fact that skull fractures in young and scalp injuries in old are less common due to injury as compared to other age groups.

On considering the site of skull vault fracture, temporal bone was involved in 29 cases (21.4 %) as it is the thinnest bone and more prone to fractures, followed by parietal and frontal bones, 26 cases (19.2 %) and 20 cases (14.8 %), respectively. On considering the site of skull base fracture, majority of cases involved middle cranial fossa, 17 cases (12.5 %), due to larger area of side impact and thinness of this part of base of skull, as compared to anterior and posterior cranial fossae, each accounting for 15 cases (11.1 %). Least involved area in fracture was occipital bone in 13 cases (9.6 %). In studies by Nagesh K R, et al,[14] parietal bones and bones of middle cranial fossa were commonly involved areas. In contrast, Saurabh Goel, et al[3] and N.K. Aggarwal, et al[16] had noted frontal bone (33 %) and posterior cranial fossa involvement in 12 cases (40 %) being the commonest sites respectively.

Conclusion:

Lacerations were the commonest scalp injuries in all mechanisms of injury, commonly seen over bony prominences in parietal and frontal regions. Most of abrasions on scalp had corresponding fissured/linear fractures (59 %) and most of lacerations had corresponding comminuted fractures (52.8 %) of calvaria.

Correlation of injuries with age and sex had no significance.

Recommendations:

To Treating Surgeon

This study highlights importance of better appreciation of pattern of injuries by shaving scalp hair and palpation for scalp contusions, which helps to diagnose acute cranio-cerebral traumas early, improve management and appropriately predict prognosis of condition and also results in more accurate identification of inflicting weapon (**Plate 3**) and assailant.

When an adequate amount of force is involved in impact, a scalp abrasion is a clue that victim is likely to have an underlying fissure fracture. Similarly, a scalp laceration is a clue that victim is likely to have an underlying comminuted fracture.

To Autopsy Surgeon

To reflect scalp posteriorly as low as possible and to report contusions if any and correlate them with corresponding fractures and coup and contre coup injuries as they play a significant role in constructing manner of causation/ infliction of injury.

Study can be taken up where a Neurologist, Radiologist and a Forensic Pathologist are all involved in each level and thorough correlation between clinical findings, radiological and autopsy observations can be put forth.

Conflict of interest: None
Financial Assistance: **None**

References:

1. Raju K, Aramani CS, Honnurgar RS, Bai MKH. Correlation of pattern of lesions, morbidity and mortality in head injury cases at KLESôs hospital and MRC, Belgaum. Ind J Foren Med Toxicol.

2011; 5(2):92-5.

2. Dolinak D, Matshes WE, Lew OE. Forensic neuropathology, explosive injury, child abuse. forensic pathology principles and practice. 1st ed. London: Elsevier Academic Press; 2005: 134, 423-48, 378-9.
3. Goel S, Singh V B, Agarwal N, Niranjan A. Head injuries in road traffic accident and its presentation in emergency room: A retrospective study. Ind J Public Health Res Dev. 2011;2(2):165-7.
4. Chaurasia BD. Scalp, Temple and Face. B D Chaurasiaís human anatomy regional and applied dissection and clinical. 4th ed, Vol 3. New Delhi: CBS publishers and distributors; 2006:45-50.
5. Standring S, Borley N R, Healy J C, Collins P, Johnson D, Wigley C B, et al. Face and scalp, nervous system. grayís anatomy: the anatomical basis of clinical practice. 40th ed. Spain: Churchill Livingstone Elsevier Ltd; 2008:467-481,901-1202.
6. Hoff M. Head and Spinal injuries. Manitoba: 2010 Aug:20-23. Cited 2012 Sept 15. Available from: http://paramedicsofmanitoba.ca/storage/10-11ARML/Head%20and%20Spinal%20Injuries.pdf
7. Dolinak D, Matshes WE, Lew OE. Forensic neuropathology, explosive injury, child abuse. forensic pathology principles and practice. London: Elsevier Academic Press; 2005:423-48,134,378-9.
8. Otto Saphire. Autopsy diagnosis and technique. 4th ed. Illinois: Hoeber Harper; 1965:17-30.
9. Sharma BR, Harish D, Singh G, Vij K. Patterns of Fatal Head Injury in Road Traffic Accidents. Bahrain Medical Bulletin. 2003; 25(1):22-25.
10. Goyal MK, Verma R, Kochar SR, Asawa SS. Correlation of CT scan with postmortem findings of acute head trauma cases at sms hospital, jaipur. J Ind Acad Fore Med. 2011;32(3):208-211.
11. Bordignon KC, Arruda WO. CT scan findings in mild head trauma. Arq Neuropsiquiatr. 2002; 60(2-A):204-210.
12. Jha S, Yadav BN, Agrawal A, Thakur D, Karna A, Subedi N, et al. The pattern of fatal head injury in a teaching hospital in eastern nepal. J Clin Diag Res. 2011;5(3):592-6.
13. Mohammad ZE, Shameem JR. A study of the pattern of head injury in district Aligarh, U.P, India. J Ind Acad Fore Med. 2005;27(2):103-107.
14. Menon A, Nagesh KR. Pattern of fatal head injuries due to vehicular accidents in manipal, J Ind Acad Fore Med. 2005;27(1):19-22.
15. Gupta S, Roychowdhury UB, Deb PK, Moitra R, Chhetri D. Demographic study of fatal cranio-cerebral road traffic injuries in North Bengal region. Medico-Legal Update. 2007;7(1):1-3.
16. Yadav A, Kohli A, Aggarwal NK. Study of pattern of skull fractures in fatal accidents in northeast Delhi. Medico-Legal Updatel. 2008;8(2):7-12.
17. Ganveer GB, Tiwari RR. Injury pattern among non-fatal road traffic accident cases: A cross ï sectional study in central India. Ind J Med Sci. 2005; 59:9-12.

Table No. 1- Age and Sex distribution of cases

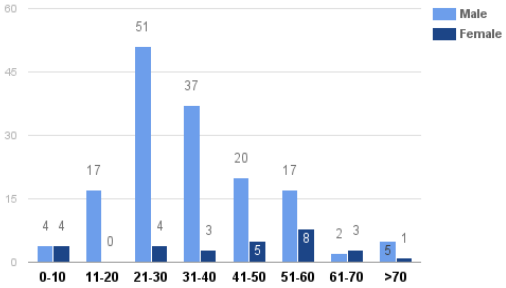


Table No. 2- The different trauma mechanisms related to the cases

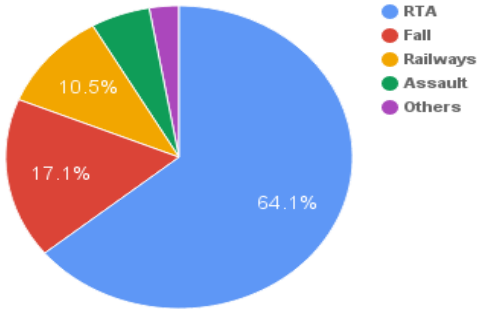


Table No. 3- Pattern of Scalp injuries

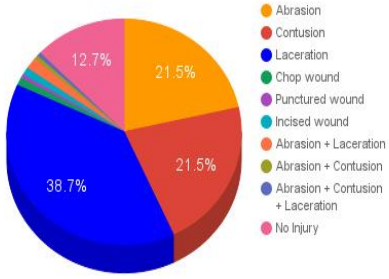


Table No. 4- Pattern of Fractures of calvaria

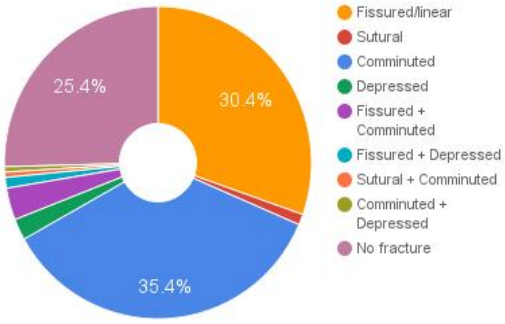


Table No. 5- Pattern of Intracranial haemorrhage

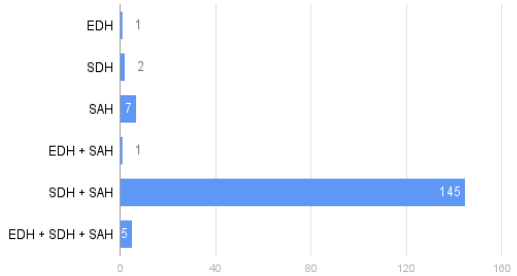


Table No. 6- Pattern of Brain injury

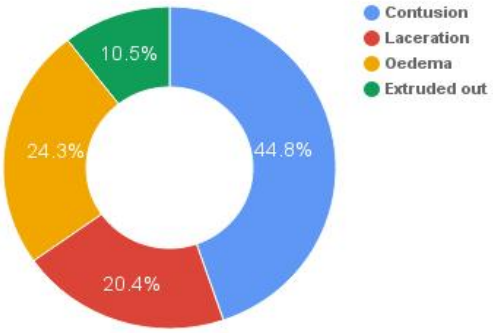
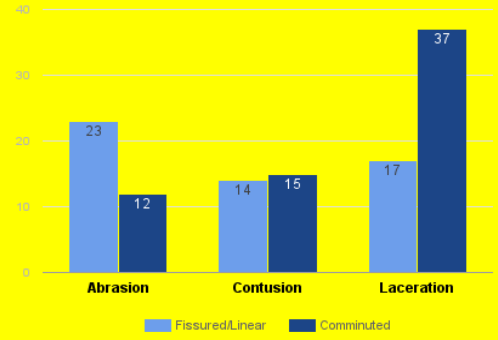
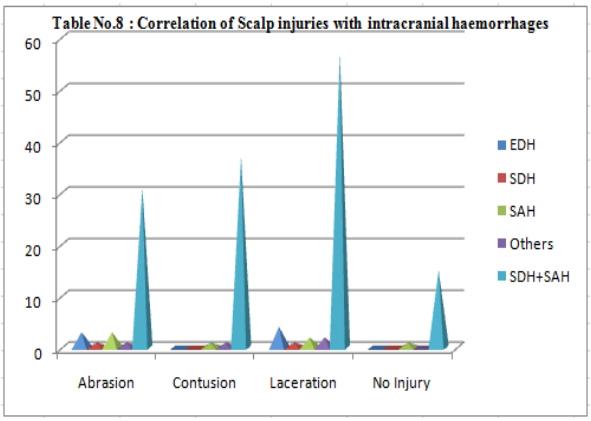


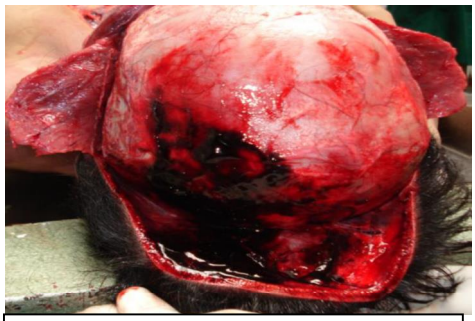
Table No. 7- Correlation of scalp injuries with fractures of calvaria



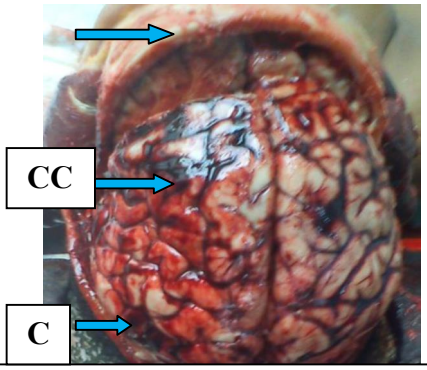


PM no: 27/11 – Scalp abrasion on back of the head in a case of ground level fall

Scalp abrasion over left occiput



Corresponding underneath scalp extravasation

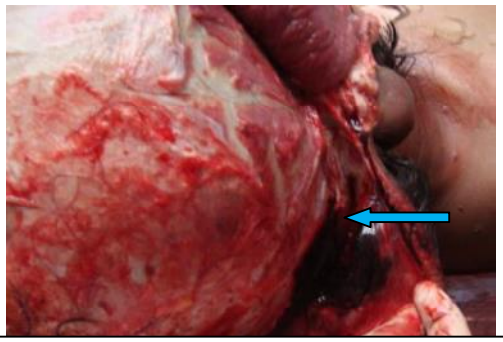


Corresponding SDH over left occipital lobe (coup) and SDH over left frontal lobe (contrecoup)

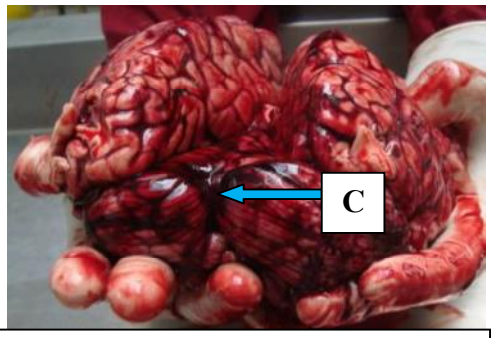
Plate 1: In cases that are brought with alleged history of found dead under the influence of alcohol or with a history of ground level fall, such a sequential correlation of head injury is useful which is suggestive of a moving head and a backward fall.

----x----x----x----x---x---

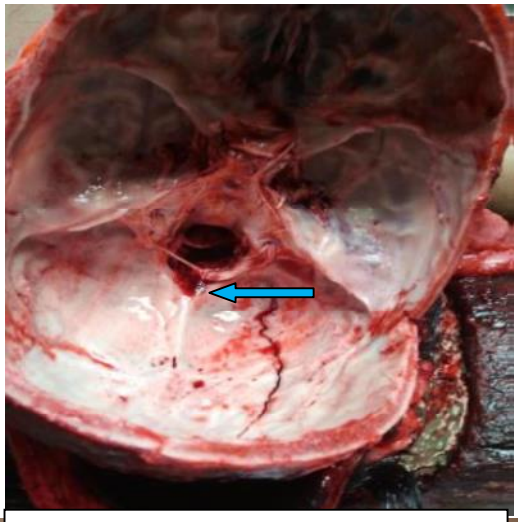
PM no: 73/12 – Scalp contusion in a case of suspicious death



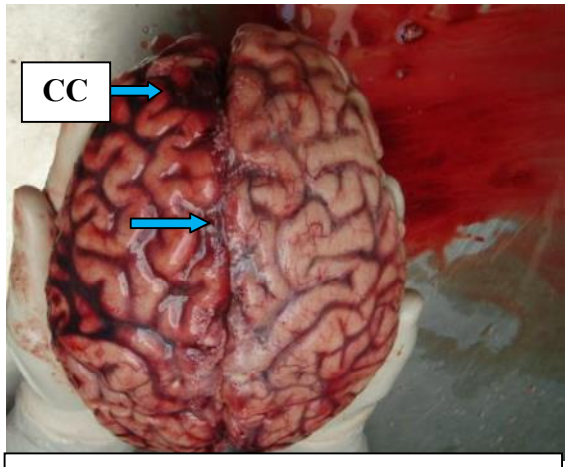
Contusion over right occipital region-Primary impact



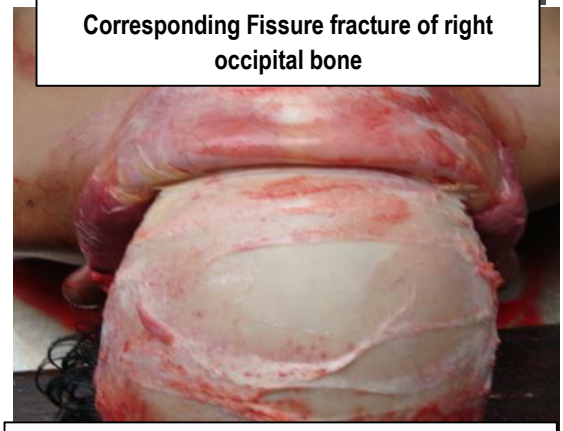
SDH and SAH over posterior aspect of cerebellum and occipital lobes (COUP)



Corresponding Fissure fracture of right occipital bone



SDH over left frontal lobe (contrecoup), right cerebral hemisphere is washed off to show there was no SAH



No scalp injury over frontal region

Plate 2: This case highlights the importance of reflecting the scalp posteriorly as low as possible so as to appreciate the contusions and correlate them with the corresponding fractures and coup and contrecoup injury to the brain suggesting of a backward fall on to a hard surface. In this case, back of head had come in contact with a cement block.

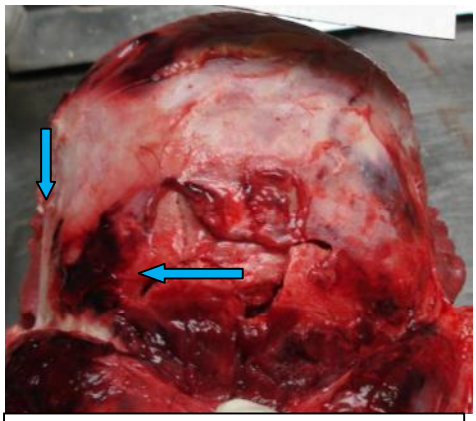
---x---x---x---x---x---x---

PM no: 638/10 – Scalp laceration in a case of assault

Scalp hair adherent with blood clots

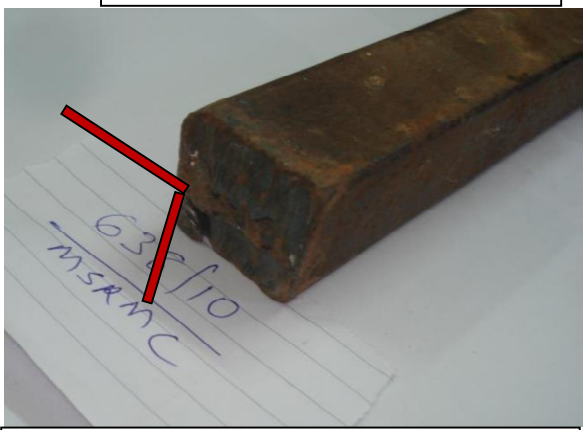
Upon shaving revealed multiple lacerations merged together

Upon approximating the wound edges, it revealed an 'L' pattern



Corresponding pattern of skull fracture with scalp extravasation

Brain covered with blood and blood clots



Weapon: Two edges of the face of the square iron bar correlated with the injury

Plate 3: In a case of assault, shaving of scalp hair, approximation of lacerated wound led to the pattern of the weapon used which in this case was a square iron bar which was struck repeatedly over the back of head resulting in a series of L-shaped lacerations which were merged. The vertical and horizontal limb of the 'L' matched with the two sides of the square face of iron bar.

---x---x---x---x---x---

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Original Research Paper

Estimation of Stature from Foot Length in North Indian Population

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Abstract

Body part measurements and estimation of stature of the individual from these measurements is of utmost relevance in cases where dismembered bodies are found. The aim of the present study was to find the relation between stature and foot length and to generate population-specific equations. The stature and bilateral foot lengths of 293 individuals (178 Females and 115 Males) of the age group 18 to 25 years were measured using standard measuring technique. An effort was made to establish statistically significant correlation between foot lengths and stature of the individual. Statistical analysis was done to establish population specific equation for identification. An analysis of data was conducted with SPSS version 2.0. The mean values of all the parameters in case of males were higher than in females and the sex differences were statistically highly significant ($p< 0.001$). A significant correlation of stature was observed in the foot lengths of both feet and in both males and females. Linear regression equations were also derived to calculate stature from foot length of an individual.

Key Words: Stature, Foot length, Identification.

Introduction:

Various parameters are used to establish individuality. Stature is one of the commonest parameters for identification. Stature is estimated from bony remains, especially in cases of dismembered and mutilated bodies. Many researchers have used various techniques to estimate stature from body measurements, including percutaneous body measurements, isolated long bones and radiography. Estimation of stature from measurements of upper limb and lower limb bones has been studied by many researchers.

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However, several researchers observed difficulty in accurately measuring long bones. Ossification and maturation of bones of the foot occurs earlier than other long bones and therefore, stature of an individual could be more accurately predicted from foot measurements.[1-4] In addition, variation in determining stature from various parameters among people of different race and demographic region was also observed. So, it is desirable to derive population specific equations by conducting group specific studies. In the past, various studies have been conducted on estimation of stature from foot measurements. The present study was carried out with the objective of finding an association between foot length and Stature of North Indian population.

Materials and Methods:

The study was conducted in Dehradun, Uttarakhand, from Jan 2015 to June 2016 to determine the correlation between stature and foot length of North Indian population. The study sample consisted of 293 individuals (178 Females and 115 Males), in the age group of 18 to 25 years. Informed consent was taken from

the subjects. Subjects having any skeletal deformity were excluded.

Stature of the individual was measured in standing erect anatomical position in centimetres with the help of a Stadiometer with subject standing barefoot. Foot length was measured by using Vernier Callipers. The maximum length of the foot was measured as direct distance from the most prominent part of the back of the heel to the tip of the first toe (Great toe or Hallux), or to the tip of the second toe, whichever was longer.

Observations and Results:

The data of 293 individuals (178 Females and 115 Males) was collected and statistically analyzed using SPSS version 20.

Table 1 illustrates the mean, standard deviation, Pearson correlation (r, correlation coefficients), Coefficient of determination (r square) and p-value between stature and dimensions of feet on left and right sides in both the sexes. The means values of all the measurements of parameter in case of males are higher than in females and these sex differences are statistically highly significant ($p< 0.001$). All the measurements exhibit statistically significant correlation with stature ($p < 0.01$). It suggest that if either stature or foot length is known, the other parameter can be calculated. Correlation coefficients(r) of the foot length measurements are higher in females bilaterally and the highest correlation is exhibited by left foot ($r = 0.650$). However, no significant bilateral difference in foot length was observed.

Regression Equations:

Multiplication factor method was used earlier for estimation of stature from various anthropometric measurements of body parts but today regression formula is the most acceptable and widely used method.[4]

Stature (Y) = Value of constant (a) + Regression coefficient (b) x Foot Length.

Table 2 shows linear regression equations for foot length in male and female subjects and standard error of estimate (SEE).

Discussion:

Estimation of stature from anthropometric measurements of human skeleton has been studied by many researchers for the purpose of identification. Nowadays, the most reliable and widely used method for estimation of stature from various parameters is the regression equation.[4,5] However, due to racial and demographic variation, it is desirable to derive population specific equations by conducting group specific studies.

Ozden, et al studied both foot and shoe lengths for estimation of sex and stature. They found that use of shoe measurements rather than bare foot measurements are better to obtain meaningful results.[3] However, it is not easy to find out the shoe size of a person in cases of mass disasters. Nowadays, researchers prefer foot measurements better than the shoe size for estimation of stature and gender.

Many researchers found that there is no significant bilateral difference in foot length.[4-7] However, Krishan, et al studied 2080 footprints obtained from 1040 Gujjars of North India and observed that T-1, T-4 lengths and breadth at ball indicate statistically significant bilateral asymmetry and the values are larger on the left side.[8] In the present study, no significant bilateral difference in foot length was observed. It might be attributed to small sample size.

Various Indian researchers observed highly significant sex difference in all the measurements and found that mean values are greater in males then female.[4,6,9,10] In the present study, the mean values of all the parameters in case of males were higher than in females and these sex differences were statistically highly significant ($p< 0.001$). This can be due to the fact that in females the epiphyseal fusion of the bones occurs earlier than males.

Estimation of height from foot length measurement was used accurately rather than width measurements and it was also observed by many researchers that bare foot measurements gave better results than shoe measurements.[11-14] However, Patel, et al concluded that both foot length and foot breadth shows highly significant correlation with stature and could be used for estimation of stature.[15] In the present study, only foot lengths of the individuals were measured to find out the correlation with stature.

The mean values of foot length and height, observed by Jakhar, et al in Haryana region of both gender together, were 24.279cm and 166.335cm respectively.[4] Similarly, Parekh, et al observed mean foot length and height of 25.42cm and 161.73cm in males of Gujarat respectively.[6] However, Karaddi, et al observed mean foot length and height 25.13cm and 172.34cm in males.[7] In the present study, the mean foot length and height were 26.53cm and 172.85cm respectively in males (**Table 3**). The mean value of height in present study was higher than Jakhar, et al[4] and Parekh, et al[6] and this may be attributed to the fact that mixed North Indian population was studied. The disparity in foot length and height may be due to geographical distribution and therefore it is important to conduct more population specific researches in relation with different geographical regions.

The correlation coefficients between stature and foot lengths were found to be positive and statistically significant and the left foot length of both the gender together exhibits overall the highest value of correlation (0.808). Similar findings were observed by Jakhar, et al[4] in Haryana region. They found overall highest value of correlation between left foot length of both the gender together and stature (0.969). In the present study, the correlation coefficient (r) was observed to be more in females than male, This is also in concordance with Jakhar, et al.[4]

In the present study, the standard error of estimate (SEE) for estimation of height from foot length is lower in female subjects. It suggests that estimation of stature from foot length of female subjects can be more accurately calculated than the male subjects (**Table 2**).

Conclusions:

It was concluded that foot length shows highest correlation with stature. So, stature estimation can be carried out using foot length. The mean values of all the measurements were higher in males and no significant bilateral difference in foot length was observed. However, it is felt desirable to conduct population specific studies and to derive population specific regression equations.

Acknowledgements

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Conflict of Interest: **None.**
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References:

1. Basu RS, Deepika V, Potturi BR. Estimation of stature from foot length. Int J Pharmacy Bio Sci. 2013;3(3):266-70.
2. Rutihauser IH. Prediction of height from foot length: use of measurement in field surveys. Arch Dis Childh.1968;43:310-2.
3. Ozden H, Balci Y, Demirustu C, Turgut A, Ertugrul M. Stature and sex estimate using foot and shoe dimensions. For Sci Intt. 2005;147:181-4.
4. Jakhar JK, Pal V, Paliwal PK. Estimation of height from measurements of foot length in haryana region. J Ind Acad Fore Med. 2010;32(3):231-3.
5. Krishan K, Sharma A. Estimation of stature from dimensions of hands and feet in a north indian population. J Fore Leg Med. 2007;14(6):327-32.
6. Parekh U, Patel R, Patel P. A Study of relation of stature with foot length in natives of gujarat state. NHL J Med Sci. 2014;3(1): 22-5.
7. Karaddi S, Suntnoore, Garampalli SS , Mugadlimath A, Hiremath R. Estimation of stature by foot length in males. Int J Biomed Advance Res. 2013;4(7):443-7.
8. Krishan K. Estimation of stature from footprint and foot outline dimensions in gujjars of north india. Fore Sci Int. 2008;175:93-101.
9. Dayananda R, Umesh B, Kiran J. Estimation of stature from dimensions of foot. Int J Med Toxicol Fore Med. 2014;4(1):1-5.
10. Kanchan T, Menezes RG, Moudgil R, Kaur R, Kotian MS, Garg RK. Stature estimation from foot dimensions. Fore Sci Int. 2008;179(2-3):241-5.

11. Jasuja O P, Singh J, Jain M. Estimation of stature from foot and shoe measurements by multiplication factors: a revised attempt. Fore Sci Int. 1991;50;203-15.

12. Singh J P, Meena MC, Rani Y, Sharma GK. Stature estimation from the dimensions of foot in females. Antrocom Online J Anthropol. 2013;9(2):237-41.

13. Rani M, Tyagi AK, Ranga VK, Rani Y, Murari A. Stature estimates from foot dimensions. J Punjab Acad. Fore Med Toxicol. 2011;11(1):26-30.

14. Mohanty BB, Agarwal D, Mishra K, Samantsinghar P, Chinara PK. Estimation of height of an individual from foot length: A study on the population of Odisha. Int J Review Life Sci. 2012;2(2):69-74.

15. Patel SM, Doshi V, Ruparelia S, Zalawadia A, Parekh D, Rathod SP, Parmar A. Anthropological study of the foot and its relationship between different parameters and stature in an adult population of different areas of Gujarat. Natl J Integr Res Med.. 2011; 2(3):67-70.

Table 1: Statistical Values for Stature vs. Foot Length

	Mean +/- S.D.	Pearson Correlation (r)	Coefficient of determination (r^2)	p-Value
Male Right Foot length (MRF)	26.53 +/- 1.50	.512	.262	0.000
Male Left Foot Length (MLF)	26.51 +/- 1.47	.525	.276	0.000
Female Right Foot Length (FRF)	23.80 +/- 1.21	.641	.411	0.000
Female Left Foot Length (FLF)	23.83 +/- 1.23	.650	.422	0.000
Right Foot Length (Both Gender)	24.87 +/- 1.89	.805	.648	0.000
Left Foot Length(Both Gender)	24.88 +/- 1.86	.808	.653	0.000
Male Height	172.85 +/- 6.72			
Female Height	158.20 +/- 5.50			
Height (Both Gender Combined)	163.95 +/- 9.34			

* Foot Length and Height were measured in cm.

Table 2: Regression Equations & Standard error of estimates.

	Regression Equation	SEE
Male Right Foot length (MRF)	Y= 111.928 + 2.296 x (MRF)	5.80317
Male Left Foot Length (MLF)	Y = 109.214 + 2.401 x (MLF)	5.74979
Female Right Foot Length (FRF)	Y= 89.332 + 2.894 x (FRF)	4.22509
Female Left Foot Length (FLF)	Y = 88.925 + 2.907 x (FLF)	4.18641
Right Foot Length (Both Gender)	Y = 64.888 + 3.984 x (RF)	5.55279
Left Foot Length(Both Gender)	Y = 63. 178 + 4.050 x (LF)	5.51407

Original Research Paper

Adipocere formation – revisited: A 3 year study

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Abstract

Adipocere formation is a modified form of decomposition. In this condition the body fat is hydrolyzed and hydrogenated to saturated fatty acid. A recent study from New Delhi pointed that adipocere formation can take place in less than 2 days. The present study was undertaken to know duration for formation of adipocere in this region i.e. South-Western part of Maharashtra. This is a prospective study carried over a period of three years. Total 14 cases were found during the three year period. Amongst them, 9 were male and 5 female. Complete adipocere formation was noted in 11 cases and partial adipocere formation noted in 3 cases. 4 cases were received from river bank and nullaha/ under-bridge, respectively, while 2 cases were recovered from Krishna River. The optimum conditions required for adipocere formation have been proposed to be a damp, warm and anaerobic condition.

Key Words: Adipocere, Decomposition, Death, Environment, Time of Death.

Introduction:

Adipocere formation is a modified form of decomposition. In this condition the body fat is hydrolyzed and hydrogenated to saturated fatty acid.[1] Numerous modifying factors affect adipocere formation. Therefore, no precise time period can be stated for this in India.[2] However, in temperate climate, it takes weeks to develop, while in India, it starts to begin within 4 to 5 days.[2] Dr. Coull Mackenzie found it occurring within 3 to 15 days in bodies submerged in Hooghly River or buried in damp soil of lower Bengal.[1] A recent study from New Delhi pointed that adipocere formation can take place in less than 2 days.[2] Mohan Kumar, et al reported case of early adipocere within 3 days.[3] Considering this, the present study was undertaken to know duration for formation of adipocere in this region i.e. South-Western part of Maharashtra.

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Materials and Methods:

This is prospective study was conducted over a period of three years from June 2013 to July 2016. All cases referred for postmortem examinations to Government Medical College Hospital, Miraj, and Government Hospital, Sangli were analyzed. Only those cases where times of death/ disappearance were known, were included. Information was collected in a pre-designed format. Information like age, sex, cause of death, and circumstances were recorded. Postmortem findings were recorded. Adipocere formation was noted on gross examination and designated as complete or partial adipocere formation Similarly, environmental details like temp., humidity, rain fall etc. were recorded.

Results:

Total 14 cases were found during the three year period. Of these, 9 were male and 5 female. Their age ranged from 1 to 55 years and mean the age was 37.5 years. Clothes were present in all the cases. Complete adipocere formation was noted in 11 cases and partial in 3. 4 cases were recovered from river bank and nullaha/ under-bridge, respectively while 2 cases were recovered from Krishna River. One case each, was recovered from sugarcane farm, hut, OPD terrace and well, respectively. Period required for adipocere formation and season are displayed in Table 1. Table 2 shows

environmental conditions. Figure 1 to 2 provide additional information.

Discussion:

Except for a few Indian studies and case reports,[2-5] no data is available regarding formation of adipocere in Indian environmental conditions. In fact, in India we also have geographical variations with different set of environmental conditions. This study was conducted in relatively cool environment. In a recent study conducted at New Delhi, 16 cases were included and in all cases, adipocere formation was noted during the months May to October. During these months, average room temperature was 27 to 39 ^{o}C, with humidity between 20 to 90 %. In the series, adipocere formation was seen in less than two days in five cases. Rate of adipocere formation was not different with reference to sex or age.[2] In another study, Pradeep Kumar, et al studied 7 cases and noted complete adipocere formation within 1 week to 3 month period. Among these seven cases, 2 bodies were recovered from water and showed complete adipocere formation within 1 week.[4] Mohan Kumar, et al noted complete adipocere formation within 3 days in an ambient temperature of 30 to 35 ^{o}C with humidity of 80 - 90% during the month of October.[3]

When the results of our study are compared with these studies, then we had observed complete adipocere formation within 3 to 5 days, whereas partial adipocere formation in 3 days in winter and rainy season. In summer season, complete adipocere formation was noted between 5 to 7 days and partial within 3 days. In rainy, winter and summer seasons, the average day temperature was 27.25^{o}C, 28.75^{o}C and 35^{o}C, respectively; while average night temperature was 20.25^{o}C, 16.5^{o}C and 18.5^{o}C, respectively. In rainy, winter and summer seasons the average humidity was 84.75%, 59.75% and 51%, respectively. The optimum conditions required for adipocere formation have been proposed to be a damp, warm and anaerobic condition.[4] The ideal temperature for adipocere formation is 21 - 45 ^{o}C.[3,4] The rate of adipocere formation reported by Sikary and Mohan Kumar was earlier than ours.[2,3] This could be because of difference in weather conditions. Moreover, development of adipocere, as reported by Pradeep Kumar, et al, within one week in 2 bodies recovered from water are consistent with our findings.[4]

The limitations of present study are: 1) small number of sample size, 2) not being able to correlate pattern of adipocere formation with age and sex, 3) not being able to correlate pattern of adipocere formation and clothes 4) not being able to correlate between different groups recovered from different circumstances ï like recovered from river and riverbank or from under-bridge or closed spaces etc. However, advantage of this study is that it confirms the notion that adipocere formation begins early in our country than the temperate climate.

Conclusion:

Numerous factors affect the formation of adipocere. So caution should be exercised while opining time since death. Nevertheless, from the present study it can be concluded that if favorable environmental conditions exist, then adipocere can occur within a week or less than a week. In addition, larger studies are required with appropriate correlation of sex, age, presence of clothes and environmental conditions so as to evolve a national data that can be helpful and can utilized to estimate time since death.

Conflict of Interest: None

Financial Asistance: None

References:

1. Mathiharan K, Patnaik AK. Postmortem changes and time since death. In: Modiís Medical Jurisprudence and Toxicology, 23rd ed 2005, LexisNexis Butterworths, New Delhi. 423-61
2. Sikary AK, Murty OP. Early formation of adipocere in subtropical climate. Int J Med Health Biomed Bioengineer Pharmaceut Engineer. 2015;9:660-3
3. Mohan Kumar TS, Monteiro FNP, Bhagavath P, Bakkannavar SM. Early adipocere formation: A case report and review of literature. J Foren Leg Med 2009;16:475-7
4. Pradeep Kumar MV, Jayaprakash G. An autopsy based study of adipocere formation and its correlation with time, cause and location. J South India Medico-Legal Assoc. 2015;7:51-7
5. Praveen S, Harish S, Jayanth. Early adipocere in domestic setup: A case report. Ind Internet J Foren Med Toxicol. 2013;11:50-54

Fig 1: Showing complete adipocere formation

Fig 2: Showing complete adipocere formation in palm in dismembered limb

Table 1: Showing descriptive data for adipocere formation.

Case no.	Age (in year) and sex	Time req for adipocere format (in days)	Extent of adipocere formation	Place of recovery of body	Month
1	1/Male	3	Complete	Krishna River bank	June
2	45/Male	3-5	Complete	OPD terrace of hospital	July
3	50/ Male	3-5	Complete	Krishna River bank	August
4	25/Female	3-5	Complete	Well	October
5	55/Male	3-5	Complete	Krishna River	February
6	40/Male	4-6	Complete	Under-bridge	March
7	39/Male	3	Partial	Hut	May
8	20/Female	3	Partial	Under-bridge	July
9	25/Female	3-5	Complete	Under-bridge	July
10	50/Male	3-5	Complete	Krishna River bank	August
11	45/Female	3	Partial	Krishna River bank	August
12	50/Male	3-5	Complete	Krishna River	August
13	45/Female	4-7	Complete	Under-bridge	March
14	35/Male	5-7	Complete	Sugarcane farm	May

Table 2: Showing environmental condition of Sangli and Miraj area

Month	Average day temperature	Average night temperature	Average humidity	Average daily sunshine	Average rain fall	Average wind speed
January	28° C	15° C	50%	10 hours	--	7 km/ h
February	31° C	15° C	44%	11 hours	--	7 km/ h
March	35° C	18° C	45%	11 hours	--	8 km/ h
April	36° C	20° C	52%	11 hours	--	9 km/ h
May	38° C	21° C	63%	10 hours	--	13 km/ h
June	29° C	21°C	81%	4 hours	158 mm	15 km/ h
July	26° C	21°C	87%	1 hours	197 mm	15 km/ h
August	26° C	20°C	88%	1 hours	123 mm	13 km/ h
September	28° C	19°C	83%	3 hours	110 mm	9 km/ h
October	29° C	19°C	74%	7 hours	Drizzle	7 km/ h
November	29° C	17°C	61%	8 hours	Drizzle	8 km/ h
December	29° C	15°C	54%	10 hours	--	8 km/ h

Original Research Paper

Pattern of Injuries due to Fatal Road Traffic Accidents in and around Khammam

[1]Bharath Kumar Guntheti, [2]Uday Pal Singh

Abstract

The present study was carried out at the Dept of Forensic Medicine & Toxicology of a tertiary care teaching hospital, Khammam, for a period of one year from January 2016 to December 2016. The prime objective of present study was to know the incidence, types of road users involved in accidents, crash pattern of accidents, pattern of injuries due to RTA and contributing cause for accidents, mechanism of injury, cause of death and their preventive measures.

Of the768 medicolegal autopsies conducted during the study period,108 (14.1%) were of vehicular accidents. Majority of the victims were male, 97%, and the age group was 21-40 years, 56.5%.Highest number of cases occurred during day time, 49 (45.4%) and on the national highways, 60 (55.6%). We observed that maximum cases were during winter season, 60 (55.6%), and on weekends. The commonest type of crash pattern was 2 wheeler (2WH) to light motor vehicle (LMV), 62 (57.4%) cases. The commonest road users involved in accidents were2WH, followed by pedestrians.

At the time of accident, majority of the2WH victims were 'non-helmeted', 66 (61.1%) Fissured fracture was the commonest type of skull fracture. The commonest variety of intracranial hemorrhage was subdural. Human error was the most common cause of RTA. We found that83 (76.9%) victims died either 'on spot' or within 24 hours of the accident. Head injury was responsible for most of the deaths.

Key Words: Road Traffic Accidents, Road Users, Crash Pattern, Fatal Injuries.

Introduction*:*

A road traffic accident is defined as any vehicular accident occurring on a public road or highway and includes vehicular accidents where the place of occurrence is unspecified.[1]

It is one of the major preventable public health problems and is on the rise, which can be attributed to increase in the number of vehicles, life style changes, and risky attitude. Accidents occur not only due to ignorance but also due to carelessness, thoughtlessness and over confidence. Human, vehicular and environmental factors play role before, during and after a road traffic accidents.[1]The problem is so severe that by 2020,it is projected that road traffic disability-adjusted-life years [DALYs] lost will move from being the 19th leading cause of disability-adjusted life years lost to the 3rd leading cause in developing countries.[2]

Road traffic accidents kill an estimated 1.3 million people and injure 50 million people per year, globally. The magnitude of RTAs and fatalities in India is alarming. According to National Crime Records Bureau, 51 cases of RTAs took place every hour during 2015, wherein 16 persons were killed. During 2014, a total of 4, 50,898 cases of RTA were reported, which rendered 4, 77,731 persons injured and resulted in 1, 41,526 deaths. Deaths due to RTAs in the country have increased by 2.9% during 2014 [1, 77,526] over 2013 [1, 37,423].[3]These numbers translate into one road accident per minute and one road accident

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death every four minutes. However, this is an underestimate, as not all injuries are reported to the police. This indicates that the surveillance system of for vehicular accidents is not well established in India.[4]

Aims & Objectives:

The prime objective of present study was to know the incidence, types of road users involved in accidents, crash pattern of accidents, pattern of injuries due to RTA and contributing cause for accidents, mechanism of injury, cause of death and their preventive measures.

Materials & methods:

The present study was carried out at the Dept of Forensic Medicine of a tertiary care institution at Khammam. All the deaths due to road traffic accidents that occurred at MGH, Khammam, during the period Jan 2016-Dec 2016 were retrospectively analyzed. The detailed analysis of these cases was based on the inquest report, medical records, visiting scene of accident and evaluation of autopsy reports.

Only those cases were selected which had a definite history of road traffic accidents. A detailed analysis of the pattern and incidence various injuries sustained by RTA victims will be carried out. Besides, features pertaining to hosts [road users],day wise pattern of accidents, crash pattern, severity of injuries, duration of survival of victims, types of skull fractures sustained, types of intracranial hemorrhage involved and alcohol /drug abuse by person etc. will be studied.

Results and Discussion:

Of the total 768 of medicolegal autopsies conducted during the study period, 108 (14.1%) were of vehicular accident fatalities. The accidents are contributed for most of deaths due to RTA, two wheeler users and pedestrians have the highest rates of fatal injuries. These are similar to other studies[4,5].

The commonest vulnerable age group was 30-40 years, 37 (34.3%), followed by 20-30 years 24 (22.2%), and 11-20 years, 18 (16.7%). Extremes of age groups accounted for the least cases. Tendency of the age group of 20-40 years to show scarce attention to traffic rules & regulations and non-use of safety devices like helmets, seatbelts, restraints etc., can be a possible explanation for the same. This shows that the people of the most active and productive age group are involved in RTA, which poses a serious economic loss to the community. These are consistent with observations of authors.[3-6] **Fig 1**.

The incidence of injuries due to RTA was higher in males, the female to male ratio being 0:10.Males,being the main bread earners in the Indian families, spend lot of their time in travelling and various outdoor activities, greater exposure on streets, so they are prone to accidents. These are similar to studies conducted by others.[3-6] **Fig 2**

The peak time of occurrence of RTA was reported at 9 am to12 noon, 31cases (28.7%), followed by 6am to 9am, 18 (16.7%) cases. This is probably due to heavy and unequal distribution of incidents during rush hours. These are consistent with other studies.[6,12,13] **Fig 3**

We observed that the highest number of RTA, 60 (55.6%) took place on national highways, followed by state highways, 30 (27.8%) cases, and city roads, 10 (9.3%) cases. The reasons for high incidence of accidents on the highways might be these roads are busiest, with too much traffic unruly during peak hours, no traffic signals at junctions, and no strict enforcement of road safety rules. Our observations are similar to studies by authors.[8, 12] **Fig 4**

In the present study, higher number of accidents occurred on weekends [Fridays, Saturdays and Sundays] - 16 (14.8%), 21 (19.4%) and 28 (25.9%),respectively, when compared to week days. Similar results were observed by authors.[8,11] This could be due to soaring traffic density, traffic congestion, holiday mood, alcohol intake, urge to reach destination in time, high people movements to place & house and failure to follow traffic rules &laws, etc. **Fig 5**

We observed that maximum number of cases were occurring during winter season, 60 (55.6%), followed by summer, 30 (27.8%) and

least cases in rainy season, 18 (16.7%). This is consistent with authors.[6,10]The reason might be poor visibility in the early hours of day due to foggy weather conditions and slow reaction time due to extreme cold affecting both drivers and road users. **Fig 6**

As per the types of road users involved in accidents, maximum number of accidents, 66 (61.1%), were due to two wheeler users, followed by pedestrians, 26 (24.1%) cases. These observations are consistent with studies by authors.[8-16]Two wheelers are preferred mode of transportation for majority of Indians as they are cheaper, give better mileage, carry at least 2 to 3 persons, easy to park &maneuver in congested traffic. Two wheeler accidents contributed for more than half of the total RTA deaths; and two wheeler users and pedestrians have the highest number of fatal injuries. The reasons might vehicle vulnerability, poor road status, coupled with non-adherence of riders to road safety rules & traffic laws. **Fig 7** Further, it was observed that the majority of the two wheeler users did not wear helmets, 50 cases. We noticed that most of the victims who died because of fatal head injury were not wearing helmets, which proves that the safety helmet can be the lifesaving.[6,8,10,15.]**Fig 8**

According to crash pattern, majority of the cases were two wheeler to LMV crash, 62 (57.4%) cases, followed by LMV to LMV, 40 (37%) cases, and two wheeler to two wheeler, 24 (22.2%) cases. Other studies showed similar observations.[7,8,16] **Fig 9**

Again, 83 (76.9%) victims died either on the spot,39 (36.1%) or within one hour of the incidence, 44 (40.7%)and the rest survived up to two weeks. The time of survival of head injury victims varies as per the severity of trauma and also health care services provided to the patients. Similar observations are made by authors.[8,15-20] **Fig 10**

Skull vault was fractured in 28% of the cases, basilar fractures were seen in 40%, and in majority of thecases,52%, both the vault and base were fractured, especially in the thin areas of the Temporo-parietal bone. These are consistent with other studies.[12] Again, the commonest type of skull fracture found was fissured fracture, 53 (49.1 %) cases, followed by comminuted fracture, 28 (25.9%) cases, and depressed fracture, 8 (7.4%) cases, whereas in 6 (5.5%) cases, skull fractures were not present. These are consistent with studies by authors.[17-20]The most frequent bone fractured was the temporal bone, 62 (57.4%) cases .The probable reason for multiple skull bone fractures could be the high speed at which vehicles move on highways. Accidents which occur at high speeds cause a great impact on head when it strikes by forcible contact with a broad resisting surface.

The commonest variety of intracranial hemorrhage found was subdural hemorrhage, 91(84.3%) cases, followed by subarachnoid hemorrhage, 68 (63%) cases and the least was extradural hemorrhage, in 16.6% cases .Our observations tally with those of the others.[17-20]

As per the pattern of injuries, musculoskeletal injuries topped the list of injuries of RTA in all age groups of victims, while the percentage of head [93 (86.1%)], chest [32 (33.3%)] and abdominal[18 (16.7%)] injuries in motor cyclists were more frequent than other victims, due to severe trauma to unprotected bodies. These are consistent with other studies.[16,18] **Table 1,**We found multiple injuries of soft tissue & bony injuries among different types of road users. These were in combinations of abrasion, contusion, lacerations and fracture dislocations, seen majority of cases. Similar observations were madeby other authors.[6,12,13] **Fig11**

Multiple injuries to the pedestrians in vehicular accidents may be considered a Rule. Primary impact would lead to injuries to the limbs and pelvis, secondly, the victims would be thrown in air and to the ground, leading to more injuries; thirdly, the wheel of the vehicle may pass on the victim's body, adding more injuries.

We observed that human error was the commonest contributing factor to the accidents, which included non-helmet users, 50 (46.3%) cases, followed by rash driving, 24 (22.2%) cases, using mobile phones, 17 (15.7%) cases, etc. Too many factors [human, vehicular and roads] contributed to the vehicular accidents, and of these, human errors were responsible for many fatalities. **Fig 12**

Eight (7.4%) cases were due to alcohol intoxication. Driving a vehicle under intoxication

is a crime, because alcohol intoxication impairs driving ability of a person and level of impairment is directly related to blood alcohol concentration.[8,21]

RTA associated with head/neck injury, 38 (68.2%) cases, was the commonest cause of death in our study. Injury to multiple regions was also responsible for death in 22 cases. These are consistent with studies conducted by authors.[6,13,22] **Fig 13**

Recommendations:

Human error was responsible for accidents due to over speeding, rash driving, loss of control, and violation of traffic rules, alcohol intoxication, etc. A national wide computerized trauma registry is required to bring out the risk factors, circumstances, chain of events leading to the accidents.

Conflict Of Interest: None
Financial Asistance: None

References:

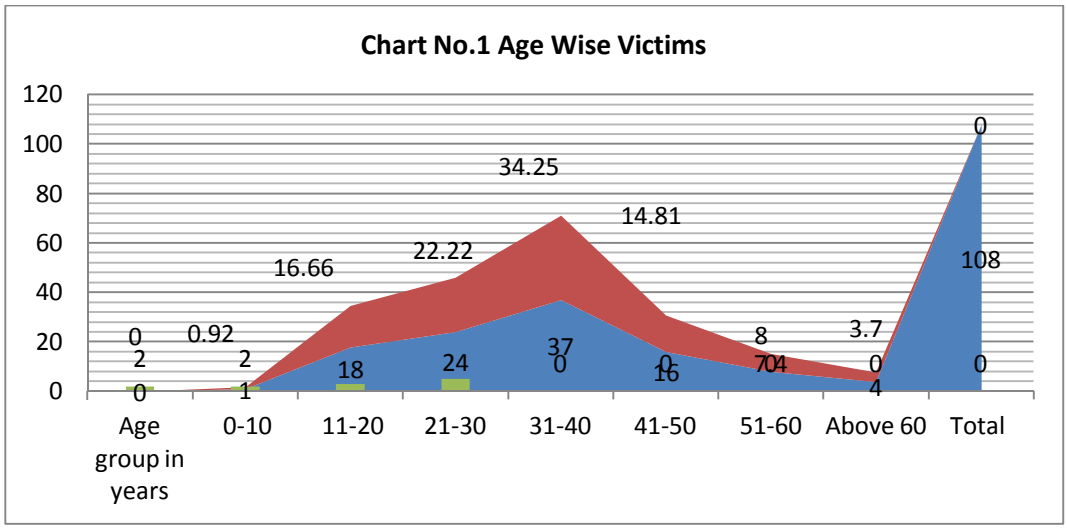
1. Singh R, Singh HK, Guptha SC, Kumar Y. Pattern, severity and circumstances of injuries in road traffic accidents: tertiary care hospital ï based study. Ind J Community Med.2014;39(1):30-4
2. Joshi AK, Joshi C, Singh M, Singh V. Road traffic accidents in hilly regions of northern india: what has to be done? World. J Emerg Med. 2014;5(2):112-5.
3. Accidental deaths &suicides in india [ADSI] 2015 Full report PDF: http:/ncrb.gov.in
4. Rajesh DR, Kaur B, Singh A, Venkateshan M, Aggarwal OP. Pattern of injuries due to fatal road traffic accidents in rural haryana: an epidemiological survey. J Ind Acad For Med 2012;34(3):229-32.
5. Kaul A, Sinha US, Pathak YK, Singh A, Kapoor AK, Sharma S, Singh S. Fatal road traffic accidents, study of distribution, nature type of injury. J Ind Acad For Med. 2005; 27(2):71-5.
6. Singh B, Palimar V, Arun M, Mohanty MK. Profile of trauma related mortality at Manipal. Katmandu University Medical Journal. 2008;23(6):393-8.
7. Pathak A, Desania NL, Verma R. Profile of road traffic accidents & head injury in Jayapur. J Ind Acad For Med. 2008; 30(1):6-9.
8. Singh D, Mouthy K, Singh SP, Goel S. Profile of road traffic fatalities in adults a 40 year study in chandigarh zone of north west india. J Ind Acad For Med.2014;36(1):47-51.
9. Reddy A, Balaraman R. Epidemiological study of two wheeler accident victims in rural south india. J Ind Acad For Med. 2016;38(1):32-5.
10. Akhade SP, Rohi KR, Parchake MB, Kachare RV. Socio-demographic profile of head injury victims of fatal vehicular accidents in semi urban region of Maharashtra. J Ind Acad For Med. 2015;37(2):119-23.
11. Kumar L, Agarwal S, Singh T, Garg R. Patterns of head injury at tertiary care hospital. Int J Scientific Study. 2014;5(5):5-8.
12. Shankar V, Venkateshan M. Pattern of injuries due to fatal road traffic accidents from rural Chennai. Online Int J Med Social Sci. 2015;1(2):30-6.
13. Katageri S, Sharma R, Govindaraju HC, Singh AK. Pattern of injuries in road traffic accidents at chitradurga karnataka: an autopsy based study. J Ind Acad For Med. 2015;37(2):172-5.
14. Surender J. Pattern of injuries in fatal road traffic accidents in Warangal area. J Ind Acad For Med. 2013;35(1):55-9.
15. Dandona R, Mishra A. Deaths due to road traffic crashes in hyderabad city in india. need for strengthening surveillance. Natl Med J Ind. 2004;17:74-9.
16. Singh YN, Bairagi KK, Das KC. An epidemiological study of road traffic accident victims in medico legal autopsies. J Ind Acad For Med. 2005;27(3):166-9.
17. Sharma D, Singh US, Mukherjee S. A study on road traffic accidents in anand - gujarat. Health Line. 2011;2(2):12-5.
18. Gopal BK, Ahamed A, Ahamed F, Tonse SB. Pattern of skull fractures due to blunt force. J Karnataka Assoc Medicolegal Scientists. 2015;24(2):27-31.
19. Kumar RR. An autopsy study of patterns of skull fractures in road traffic accidents involving two wheelers. J Karnataka Assoc Medicolegal Scientists. 2014;23(1):9-14.
20. Rupani R, Varma A, Rathore S. Pattern of skull fractures in cases of head injury by blunt force. J Ind Acad For Med. 2013;35(4):336-8.

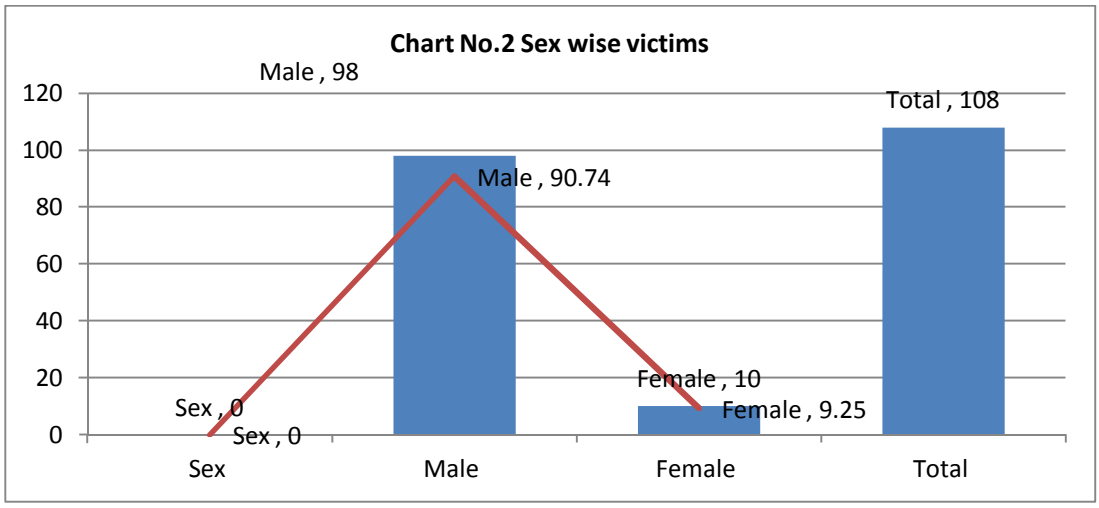
21. Ranjit M, Tandle A, Keoliya N. Patterns of head injuries in fatal road traffic accidents in a rural district of maharashtra ï autopsy based study. J Armed Forces Med Coll. 2011;33(3):171-6.

22. Garbarino S, Nobili L, Beelke M. The contributing role of sleepiness in highways vehicle accidents. Sleep. 2001;24:203-6.

Table no.1 - Pattern of Various Injuries Sustained in Vehicular Accidents

Victim Status Injured system	Pedestrians	Passengers	Drivers	Motor cyclist
Head injuries	26[24.07%]	5[4.62%]	2[1.85%]	60[55.55%]
Chest injuries	24[33.33%]	6[5.55%]	3[2.77%]	32[29.62%]
Abdominal injuries	18[16.66%]	7[6.48%]	2[1.85%]	25[23.14%]
Musculo skeletal System				
Fracture[exclude rib frac]	25[94.44%]	18[16.66%]	43.70%]	55[50.92%]
Several tendon injuries	16[14.81%]	1[0.90%]	1[0.90%]	2[1.85%]
Lacerated wound	20[24.07%]	2[1.85%]	1[0.90%]	40[37.03%]
Limb amputation	10[9.25%]	1[0.90%]	-	2[1.85%]





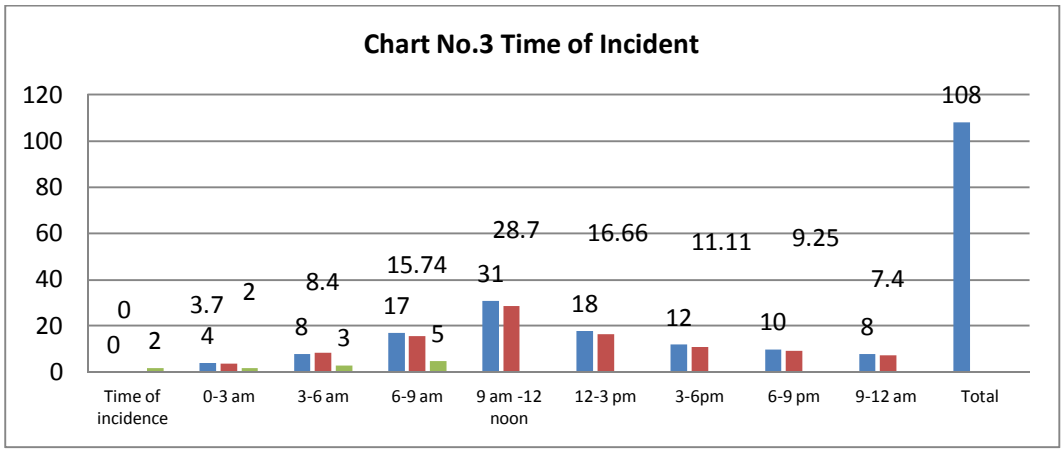


Chart No.3 Time of Incident
120
100
80
60
40
20
0
0
2
3.7
4
2
8.4
8
3
15.74
17
5
28.7
31
16.66
18
11.11
12
9.25
10
7.4
8
108
Time of incidence
0-3 am
3-6 am
6-9 am
9 am -12 noon
12-3 pm
3-6pm
6-9 pm
9-12 am
Total

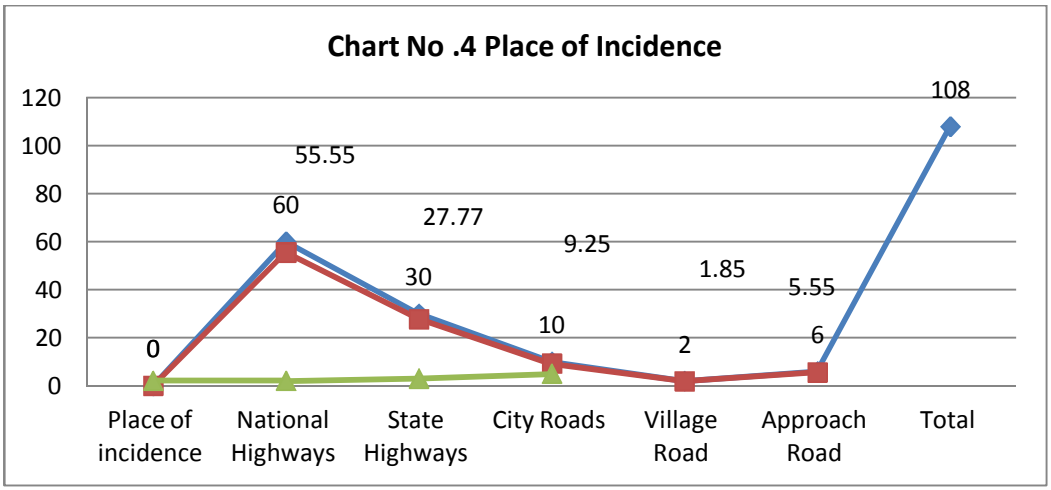


Chart No .4 Place of Incidence
120
100
80
60
40
20
0
0
60
55.55
30
27.77
10
9.25
2
1.85
6
5.55
108
Place of incidence
National Highways
State Highways
City Roads
Village Road
Approach Road
Total

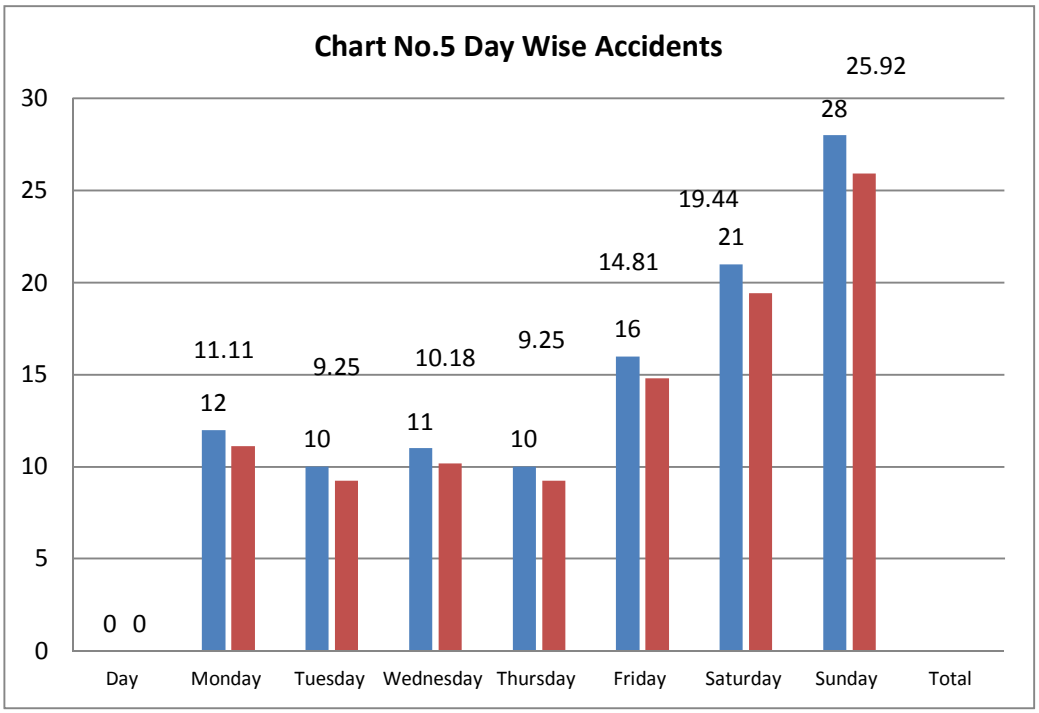


Chart No.5 Day Wise Accidents
30
25
20
15
10
5
0
0
0
12
11.11
10
9.25
11
10.18
10
9.25
16
14.81
21
19.44
28
25.92
Day
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Total

Chart no.6 Seasonal Variation

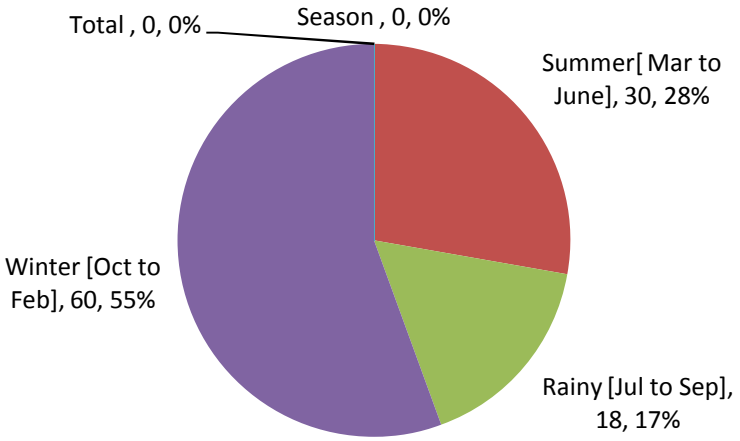


Chart No.7 Types of Road Users Involved in Accidents

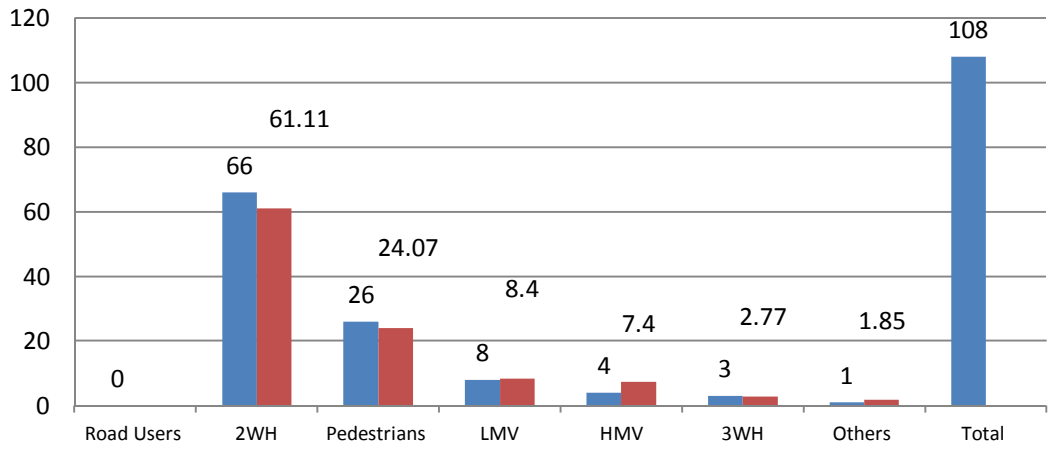
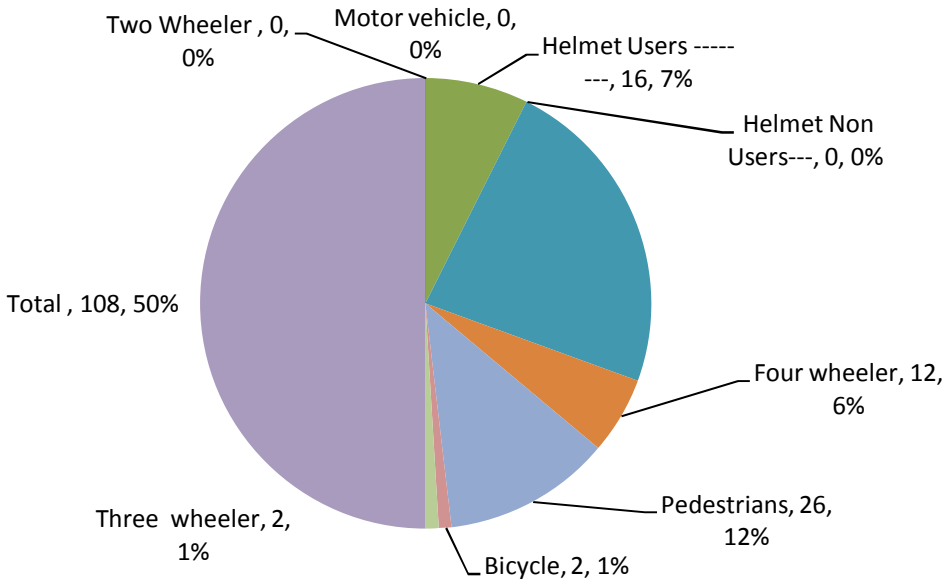


Chart No. 8 - Evidence of Using Helmets Among Riders



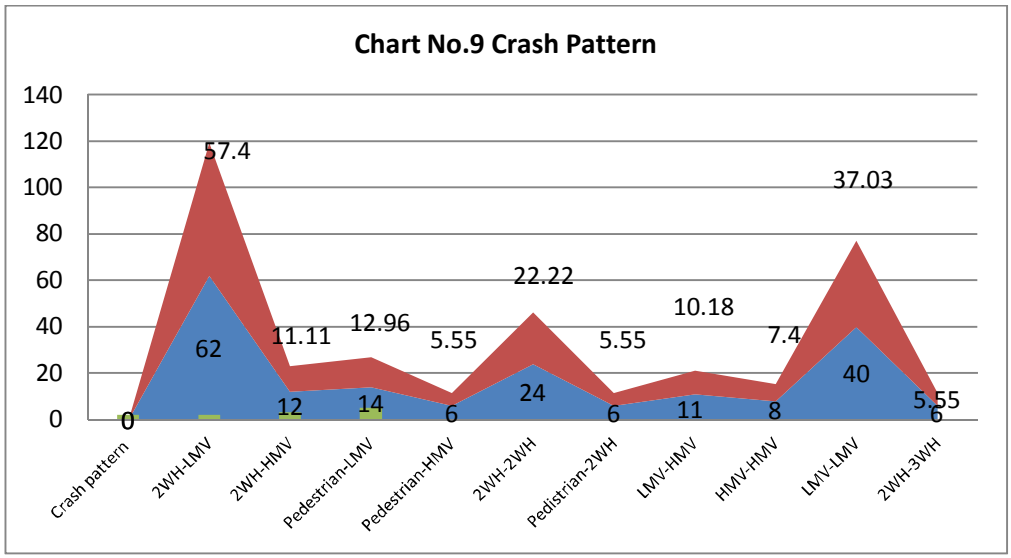


Chart No.9 Crash Pattern
140
120
100
80
60
40
20
0
57.4
37.03
22.22
10.18
11.11
12.96
5.55
5.55
7.4
62
12
14
6
24
6
11
8
40
0
6
Crash pattern
2WH-LMV
2WH-HMV
Pedestrian-LMV
Pedestrian-HMV
2WH-2WH
Pedistrian-2WH
LMV-HMV
HMV-HMV
LMV-LMV
2WH-3WH

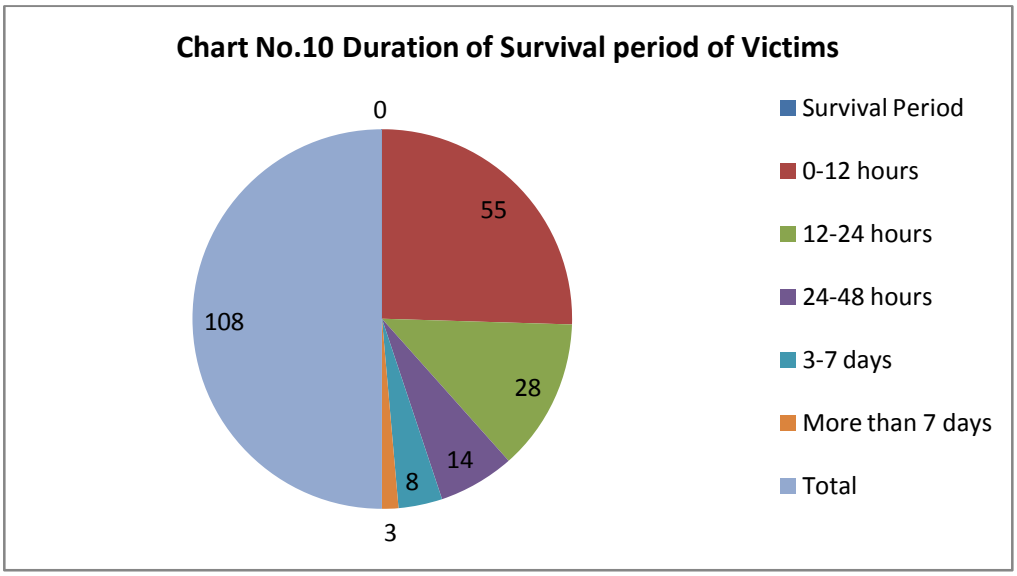


Chart No.10 Duration of Survival period of Victims
0
55
28
14
8
3
108
Survival Period
0-12 hours
12-24 hours
24-48 hours
3-7 days
More than 7 days
Total

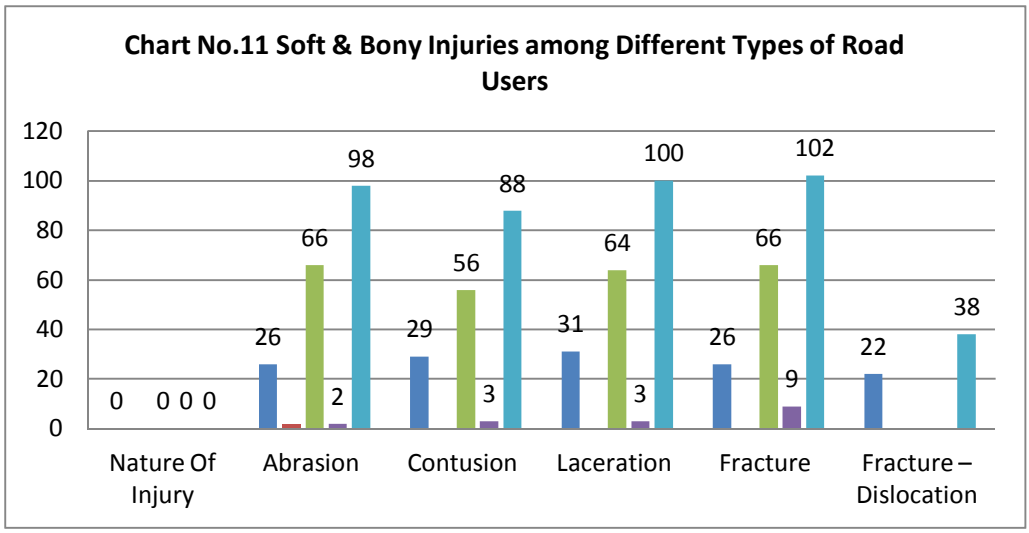


Chart No.11 Soft & Bony Injuries among Different Types of Road Users
120
100
80
60
40
20
0
0
0 0 0
26
66
2
98
29
56
3
88
31
64
3
100
26
66
9
102
22
38
Nature Of Injury
Abrasion
Contusion
Laceration
Fracture
Fracture – Dislocation

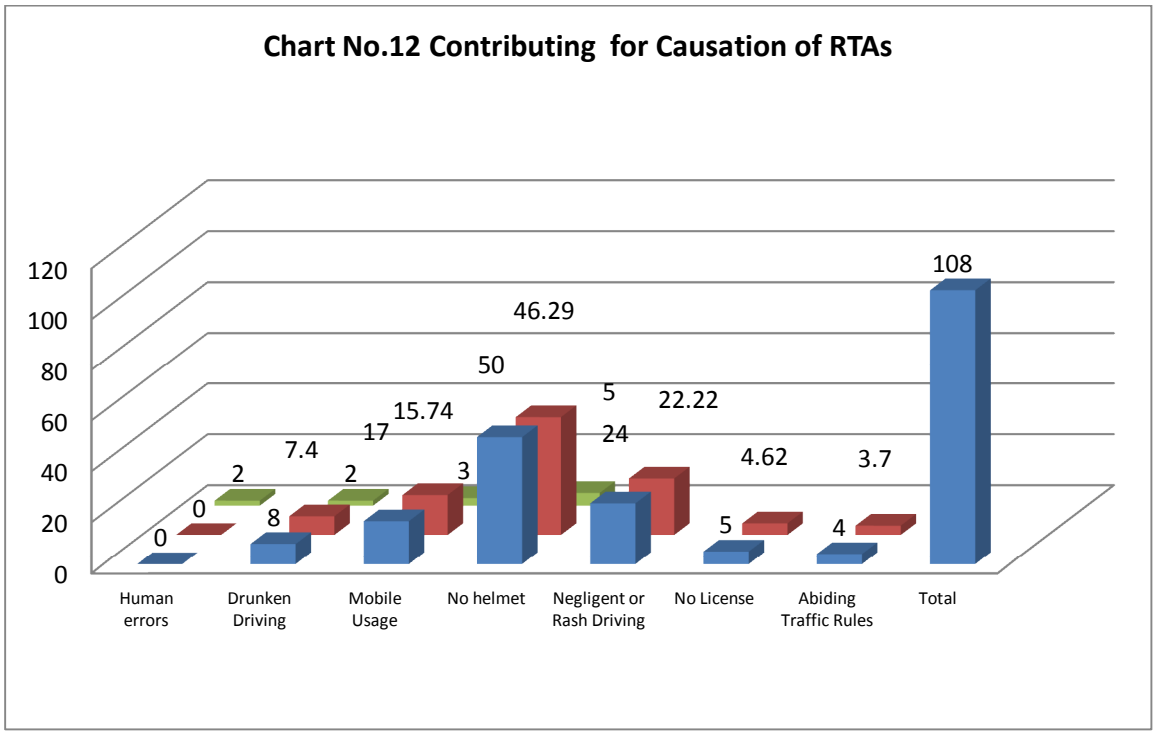


Chart No.12 Contributing for Causation of RTAs
120
100
80
60
40
20
0
0
0
2
8
7.4
2
17
15.74
3
50
46.29
5
24
22.22
5
4.62
4
3.7
108
Human errors
Drunken Driving
Mobile Usage
No helmet
Negligent or Rash Driving
No License
Abiding Traffic Rules
Total

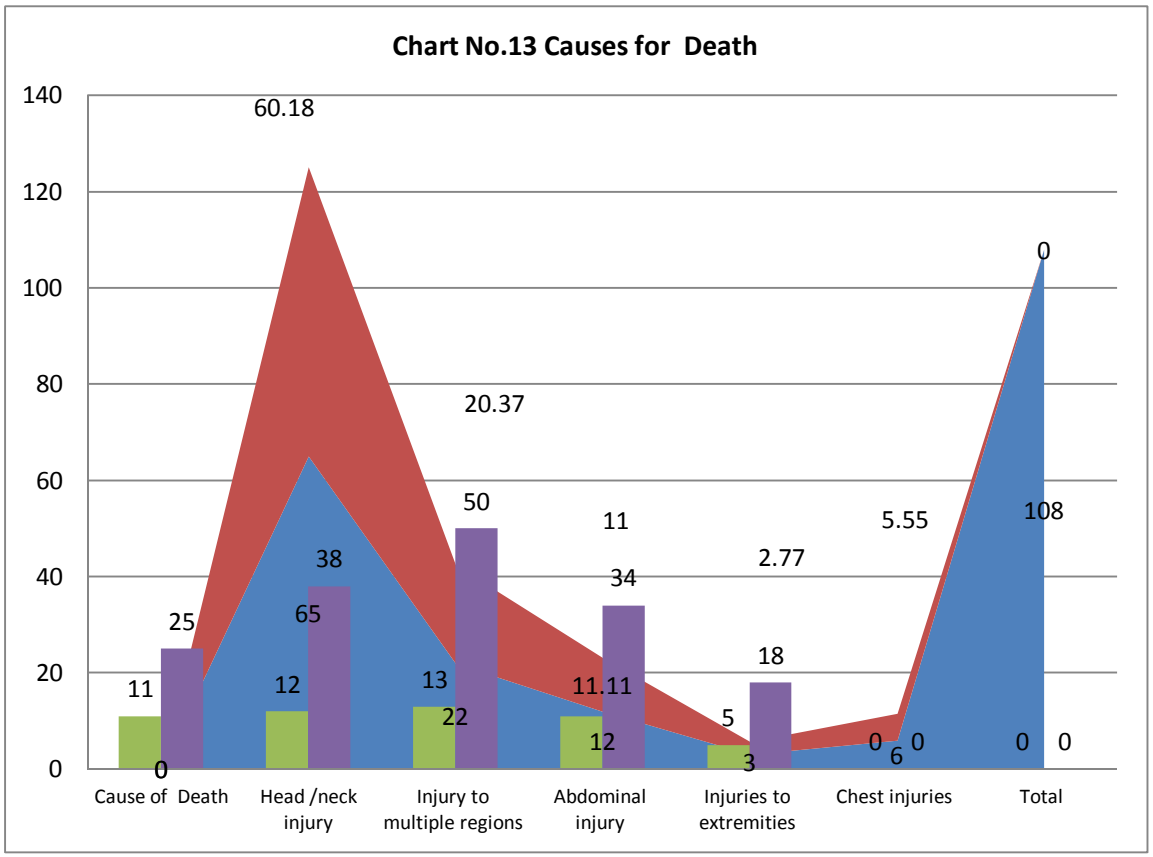


Chart No.13 Causes for Death
140
120
100
80
60
40
20
0
11
25
0
60.18
12
65
38
13
22
50
20.37
11
11.11
34
5
3
18
2.77
0
6
0
5.55
0
0
108
0
0
Cause of Death
Head /neck injury
Injury to multiple regions
Abdominal injury
Injuries to extremities
Chest injuries
Total

Original Research Paper

Perception of Undergraduate Medical Students on Medicolegal Autopsy Demonstrations as Teaching-Learning Medium in Second Professional MBBS Curriculum

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Abstract

Forensic Medicine is a part of the MBBS curriculum for Second Professional (3rd to 5th Semester) Exam. Learning of the concept & technique of postmortem examination is imparted to medical students during autopsy demonstrations. Every government medical officer/ Registered Medical Practitioner is obliged to perform medico-legal autopsy, if the same is requisitioned of him by the police. Present study was undertaken to study the perception of UG medical students on educational outcome & suggested improvements on medicolegal autopsy demonstrations to the students. More than 75% students agreed that protocol of autopsy & standard operating procedures for mortuary were explained & learning objectives made clear, before being taken to mortuary. The teacher had briefed them regarding the case before starting autopsy & adequately demonstrated & emphasized the need to communicate skillfully with relatives of the deceased. The case was also discussed after completion of autopsy with respect to formulation of opinion; enough opportunity/ encouragement was given to satisfy their queries & the teacher adequately emphasized on the necessity, purpose, protocol & procedure of viscera & other article preservation after autopsy and feedback was taken on the case after autopsy. However, 47% & 54% believed that adequate opportunity & exposure was available to observe/ learn procedure of autopsy in mortuary & sufficient time given to the case to enable learning by the beginners, respectively. 87% participants in present study termed the level of hygiene & cleanliness in mortuary as poor. Students recognised the importance of autopsy demonstrations as a teaching learning method in MBBS curriculum.

Key Words: Postmortem Demonstration, MBBS Curriculum, Forensic Medicine

Introduction:

As per present Medical Council of India guidelines, a minimum of ten autopsies must be demonstrated to undergraduate medical students.[1] Presently, Second MBBS students at our institute are taken to mortuary for demonstrating autopsies in three batches (30 students per batch). They are expected to record minimum 10 autopsies in their practical journals, which are checked from time to time by the teacher in-charge. They submit journals on day of university practical examination in the department; which is a part of the practical internal assessment.[2]

At the end of Second MBBS, students are expected to be able to perform medico-legal autopsies, formulate proper opinion and prepare autopsy report (as Forensic Medicine posting in Internship is optional & students are not exposed to postmortem work during rest of their undergraduate study). They should be able to understand objectives, pre-requisites, precautions, protocol and standard procedure of autopsy. Also, they need to be able to collect

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appropriate biological and physical samples, preserve them as per prescribed norms and dispatch them to appropriate laboratories.[3]

It is a well recognized fact that most of the private medical colleges (even some government ones like in Uttar Pradesh) don't have permission and sanction to undertake (hence no autopsies are conducted by faculty) autopsies. Therefore, significant population of medical students pass out MBBS without even watching single autopsy (leave aside performing). They simply manage to get affiliation from nearby recognized autopsy center, which hardly very few students ever happen to pay a visit.

Every Government medical officer/ Registered Medical Practitioner (eligibility qualification is MBBS) is obliged to perform medico-legal autopsy, if the same is requisitioned of them by the police.[3] Complex and sensitive medicolegal autopsies are a challenge for a fresh medical graduate taking independent charge of a peripheral health centre. Keeping, the importance of medico-legal autopsies in investigation of various crimes in mind, every medical graduate must be proficient in conducting medico-legal autopsies and formulating proper, clear & as for as possible, definitive opinion. There are several independent reports & court orders & strictures expressing concern over poor postmortem reports issued by medical practitioners & the need for improvement in this regard.[4,5]

Very few studies have been undertaken in India to ascertain the perspective of students to teaching & learning of postmortem skills and their opinion on scope & means for improvement in this regard. Present study therefore undertaken to study perception of undergraduate medical students of on educational outcome & suggested improvements on medicolegal autopsy demonstrations to students.

Aims & Objectives:

- To determine the perception of undergraduate medical students regarding:
  - Current scenario & practice of practical teaching & demonstration of medicolegal autopsies
  - Need for necessary changes & suggested improvements in practical teaching & demonstration of medicolegal autopsies

Methodology:

Study Design **:** Cross sectional Study

Duration **:** 4 Months (October 2015-February 2016)

Study site **:** S. S. Medical College, Rewa (MP)

Study Group :

Inclusion Criteria**:** Undergraduate students of Second Professional (3rd semester- 72 students & 5th semester - 70 students) MBBS & 24 Interns reporting to the department of Forensic Medicine for seeking No Dues certificate towards completion of rotatory internship.

Exclusion Criteria: Not willing to participate, having witnessed less than 2 autopsies

Data Collection**:** After seeking permission from Institutional Ethical Committee, structured questionnaire was validated by faculty members of the Department Forensic Medicine (internal) & three other medical colleges (external).[6-8] Questionnaire was explained to the students. Verbal consent was obtained from students to participate in the study. They were also informed that the feedback would have to be submitted anonymously. Questionnaire included 27 questions, of which 25 were close ended and 2 were open ended.

Discussion:

Medical graduates are obliged to perform medicolegal autopsies independently as medical officers, as per the Medical Manual.[3] Hence, adequate practical training of medical students in this aspect is unquestionably essential. A good autopsy report is vital for methodical & effective criminal investigation. Large share (more than 90%) of such autopsies is conducted by non forensic medicine specialist graduate doctors. Owing to its sensitive but very important nature of work, it particularly poses a difficult challenge to a fresh graduate doctor. Internship posting in Forensic Medicine is optional & it has been found that most interns

don't opt for this posting. Therefore, practically, the practical skills in postmortem examination are learnt during Second Professional MBBS (3rd to 5th semester) only.

All students participating in the present study realized that postmortem demonstration is mandatory as a method of learning, as also favored in the study by Jadav, et al[7] & S K Verma.[9] Interestingly, 10% students opined in favor of PM demonstrations being scrapped from medical curriculum. 96.5% students in the study by Jadav, et al[7] & 80.7% in Rautji, et al's study[6] agreed that this exercise is necessary for medical education. 86.75% participants in the present study termed the level of hygiene & cleanliness in mortuary as poor. Similarly 90.4% & 84.9% did not agree that infrastructure in mortuary is adequate for PM demonstration & that variety of cases is satisfactory for learning. 85.5% felt that real cadavers have to be preferred over virtual alternatives. 55.4% considered the present pattern of postmortem demonstrations to be effective in achieving desired outcomes. Majority (60-80%) rated the competence & confidence to undertake autopsy independently from 2-3 on a scale of 0-5. Over 80% second professional participants thought that 9th semester is the optimum time of introducing PM demonstration, while 87.5% interns considered it to be at rotatory internship stage only.

The observation of autopsies is elective in some medical schools in the world because of religious & cultural reasons.[7] Based on this, some students may complete their training in these centers without observing even a single autopsy.

In the present study, 83% interns had witnessed 10 or more autopsies, 87% 5th semester students had witnessed 5-10 autopsies, while 90.3% students of 3rd semester students have witnessed 2-5 autopsies. As per the study by Rautji, et al,[6] all students had witnessed 10 autopsies each. In the present study, 84% felt the present number of demonstrations was insufficient for effective learning. Such opinion was also expressed in studies by Rautji, et al[6], Jadav, et al[7] and Ekanem, et al[11] by 28%, 74% & 88% participants, respectively.

In present study, more than 75% students agreed that the protocol of autopsy & standard operating procedures for mortuary was explained & Learning objectives made clear before being taken to mortuary, that the teacher briefed them regarding the case before starting autopsy & adequately demonstrated & emphasized need to communicate skillfully with relatives of the deceased, that the case was discussed after completion of autopsy with respect to formulation of opinion, and enough opportunity/ encouragement was given to satisfy their queries & that the teacher adequately emphasized on the necessity, purpose, protocol & procedure of viscera & other article preservation after autopsy and feedback was taken on the case after autopsy. However, only 47% & 54% believed that adequate opportunity & exposure was available to observe/ learn the procedure of autopsy in mortuary & sufficient time given to the case to enable learning by beginners. This could be explained by lack of proper learning ambience/ infrastructure (quality of equipments, non availability of standard well type demonstration rooms, inadequate illumination, poor hygiene, inadequate ancillary staff etc) available, heavy workload etc.

84.9% participants in the present study suggested that the students should actively participate in performing autopsies than being mute spectators, which is also echoed in the study by Rautji, et al[6] and Ekanem, et al[11] (55.3% & 76%, respectively). 74% students in the study by Rautji, et al[6] expressed the need for better equipments for postmortem demonstration.

In the present study, 60.8% students reported that they were slightly uncomfortable on the first autopsy demonstration, 7.8% very uncomfortable while the figure was 38% & 32% respectively, in the study by Jadav, et al[7] & Ekanem, et al.[11] 30.6% of our participants reported feeling comfortable on first exposure to autopsy.

Mere 12% of our participants opined that they won't attend autopsies if given a free choice; in contrast this was the opinion of 32% participants in the study by Jadav, et al[7]. Only 55.4% students came forward with their responses for open ended questions.

Conclusion:

As medical graduates get to perform medicolegal autopsies independently as medical officers, as per the medical manual, adequate practical training of medical students in this aspect is unquestionably important. A good autopsy report is vital for methodical & effective criminal investigation. As MCI strives hard to make undergraduate medical curriculum more learner centric, the perception & aspirations of important stakeholders i.e. learners needs to be taken into consideration in decision making. It is amply clear from available information and present study that students appreciate the importance of autopsy demonstrations as a teaching learning method, however they generally feel that there is immense scope for improvement with regards to infrastructure, timing & active participation of students.

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References:

1. http://www.mciindia.org/RulesandRegulations/GraduateMedicalEducationRegulations1997.aspx [accessed on 02/10/2016]
2. http://www.ssmcrewa.com/Forensic_Medicine.aspx [accessed on 02/10/2016]
3. www.health.mp.gov.in/ha/medical-manual-ha.pdf [accessed on 02/10/2016]
4. http://iafmonline.in/data/Summary-WP-4974-2012.pdf [accessed on 02/10/2016]
5. http://medind.nic.in/jal/t05/i4/jalt05i4p252.pdf [accessed on 02/10/2016]
6. Rautji R, Kumar A, Behera C. Attitudes of medical students towards medico-legal/clinical autopsy. J Ind Acad Foren Med. 2013;35(4): 358-61.
7. Jadav JC, Patel BN, Shah KA, Tandon RN. Knowledge and attitude of medical students on forensic autopsy in ahmedabad city. J Ind Acad Foren Med. 2013;35(1):26-8.
8. Mc Namee LS, O'Brien FY, Botha JH. Student perceptions of medico-legal autopsy demonstrations in a student-centred curriculum. Med Edu. 2009:43:66-73.
9. Verma SK. Teaching students the value of autopsies. Acad Med. 1999;74:855
10. Ekanem VJ, Akhigbe KO. Attitudes of nigerian medical students to autopsy. Turk J Med Sci 2006; 36:51-6.

Table-1 Distribution of students

Semester	Total No of students	No of students willing to participate & given questionnaire	No of students actually participated
3rd Semester	87	83	72
5th Semester	75	72	70
Intern	42	37	24

Table-2

SN	Question	3rd Semester% (72)		5th Semester% (70)		Intern % (24)		Total (166)	
		Yes	No	Yes	No	Yes	No	Yes	No
1	Total number of autopsies witnessed	2-5 (90.28%) n=65		5-10 (87.14%) n=61		≥10 n=20 (83.33%)			
2	adequate opportunity & exposure was available to observe & learn procedure of autopsy in mortuary	(39) 16.17%	(33) 45.83%	(33) 47.15%	(37) 52.85%	(16) 66.67%	(08) 33.33%	(88) 53.01%	(78) 46.99%
3	protocol of autopsy & standard operating procedures for	60 (83.33%)	12 (16.67%)	54 (77.1%)	16 (22.8%)	21 (87.5%)	03 (12.5%)	135 (81.33%)	31 (18.67%)

	mortuary explained before being taken there								
4	Learning objectives were made clear before being taken to mortuary	60 (83.33%)	12 (16.67%)	54 (77.1%)	16 (22.8%)	19 (79.1%)	05 (20.8%)	133 (80.12%)	33 (19.88%)
5	Sufficient time given to the case to enable learning by beginners	30 (16.67%)	42 (58.33%)	31 (44.29 %)	39 (55.71 %)	15 (62.5%)	09 (37.5%)	76 (45.78%)	90 (54.22%)
6	Teacher briefed regarding the case before starting autopsy	60 (83.33%)	12 (16.67%)	53 (73.6%)	17 (26.3%)	21 (87.5%)	03 (12.5%)	134 (80.72%)	32 (19.28%)
7	Level of hygiene & cleanliness in mortuary	Poor 64 (88.89%)		Poor 56 (80%)		Poor 24 (100%)		Poor 144 (86.75%)	
8	Teacher adequately demonstrate & emphasize need to communicate skillfully with relatives of the deceased	57 (79.17%)	15 (20.83%)	54 (77.1%)	16 (22.8%)	18 (75%)	06 (25%)	129 77.71%)	37 (22.29%)
9	Case discussed after completion of autopsy with respect to formulation of opinion	59 (81.94%)	13 (18.06%)	55 (78.5%)	15 (21.4%)	19 (79.1%)	05 (20.8%)	133 (80.1%)	33 (19.88%)
10	Enough opportunity/ encouragement given to satisfy queries by the teacher	64 (88.89%)	08 (11.11%)	56 (80%)	14 (20%)	20 (83.3%)	04 (16.6%)	(140) 84.3%	26 (15.66%)
11	Infrastructure in mortuary adequate for PM demonstration to students	14 (05.56%)	68 (94.44%)	07 (10%)	63 (90%)	05 (20.8%)	19 (79.1%)	16 (09.6%)	150 (90.36%)
12	The teacher adequately emphasize on the necessity, purpose, protocol & procedure of viscera & other article preservation after autopsy	64 (88.89%)	18 (11.11%)	56 (80%)	14 (20%)	20 (83.3%)	04 (16.6%)	140 (84.34%)	26 (15.66%)
13	Feedback taken on the case after autopsy	63 (87.5%)	19 (12.5%)	64 (91.4%)	06 (08.5%)	22 (91.6%)	02 (08.3%)	149 (89.76%)	17 (10.24%)
14	At what stage of curriculum	9th sem 59 (81.94%)		9th sem 56 (80%)		Intern 21 (87.5%)			

	postmortem demonstration should be placed								
15	Rating of competence & confidence to perform autopsy independently on completion of second professional on a scale of 1-5	Zero-nil n=12- 16.67% n=45- 62.5% n=08- 11.11% n=05- 06.94% nil		Zero-nil n=02- 02.86% n=26- 37.14% n=39- 55.71% n=05- 07.14% nil		Zero-nil nil n=20- 83.33% n=04- 16.67% nil nil			
16	Variety of cases is satisfactory for learning	12 (16.67%)	60 (83.33%)	10 (22.8%)	70 (77.1%)	13 (54.1%)	11 (45.8%)	15 (15.06%)	141 (84.94%)

Table-3 Things liked/appreciated by participants regarding postmortem demonstrations

1	Readiness of teachers to explain & satisfy queries
2	Disciplined & systematic working
3	Transparency in working
4	Sympathetic attitude towards relatives of deceased

Table-4 Suggestions for improvement in future

1	Smaller batches be taken to mortuary
2	Better hygiene
3	Improvement of facilities—equipments etc
4	Proper seating arrangement for students
5	Availability of audiovisual aids
6	Availability of student lockers
7	Drinking water facility

Original Research Paper

Medico-legal Profile of Fatal Thermal Burn Cases at Rural Government Medical College in Maharashtra

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Abstract

Background: Burns have tremendous medico-legal importance as they are considered to be among the common causes of unnatural deaths in India.

Method: Prospective analysis of 90 cases of fatal thermal burns which were brought for medico-legal post-mortem at Rural Govt. Medical College & Hospital during the one year period was studied. The data was complied, tabulated and analyzed statistically.

Results: Fatal burns contributed to 20% of total post-mortems performed. Most common age group involved was 21-30years. Married Hindu females were mostly affected. Maximum (71.1%) cases showed total body surface area involvement between 71-100% and most of the cases (34.4%) survived for 7 days or more. Septicaemia was the cause of death in 58.9% cases. Accidental burns accounted for 55.6% cases. Mass education, elimination of poverty and adopting safe cooking habits will reduce the incidence of fatal thermal burn cases.

Key Words: Fatal Thermal Burns, Post-Mortems, Accidental Burns, Homicidal Burn, Married Females

Introduction:

Fire was perhaps manôs first double-edged sword, evidenced throughout history; it has served as well as destroyed mankind.[1] Burn is an injury which is caused by application of heat or chemical substance to the external or internal surface of the body, which causes destruction of tissues. The minimum temperature for producing burn is about 44^{o}C for an exposure of about 5 to 6 hours.

At 65^{o}C, two seconds are sufficient to produce burns and full thickness destruction of skin occurs within seconds above 70^{o}C.[2] Often, the circumstances of burns are enveloped in mystery, obscurity and unreliable statements. The reason behind this action may be personal, domestic, occupational or social tragedy and more recently dowry death.[3] According to WHO (2000) report, 2,38,000 individuals died of fire related deaths and 95% of these deaths occurred in low and middle income countries.[4] A significant number of deaths in India occur due to burns every year and over 10 lakh people are moderately or severely burnt every year in this country.[5]

The aim of the present study was to assess the magnitude of mortality due to thermal burns and to study the various medico-legal aspects of fatal thermal burn cases.

Material and Method:

This study is a prospective analysis of 90 cases (out of total 449 post-mortems performed during the study period) in which antecedent cause of death was thermal burns, which were brought for medico-legal post-mortem examination at Department of Forensic Medicine and Toxicology, S. R. T. Rural Govt. Medical College & Hospital, Ambajogai Dist. Beed, Maharashtra. The duration of the study was from 1st September 2015 to 31st August

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2016. Proforma for study was prepared and various information and findings were collected like age, sex, marital status, religion, and percentage of thermal burn, survival period after sustaining thermal burn, cause of death and manner of death. The information was complied, tabulated and analyzed statistically.

Observations and Results:

- During the study period, a total of 449 autopsies were conducted by the department, of which, 90 cases (20%) were fatal thermal burn cases. (**Table 1**)
- The youngest victim was 14 months old and the oldest case was of 85 years. The most affected age group in this study was between 21-30 years, 28 cases (31.1%), followed by 31-40 years, 21 cases (23.3%). Extremes of ages i.e. age group 1 to 10 years and 81 to 90 years showed 2 cases each. (**Table 2**)
- There was a predominance of females with 68 cases (75.6%) and Male: Female ratio was 1:3.1 (**Table 3**)
- It was observed that 68 cases (75.6%) belonged to Hindu religion. (**Table 5**)
- Majority of victims, 82 cases (91.1%) were married. (**Table 6**)
- Maximum cases, 64 (71.1%), showed total body surface area involvement of burns between 71-100%, followed by 28.8% cases with 31-70 total body surface area involvement of burns. No case was recorded with total burn surface area less 30%. (**Table 7**)
- It was observed that 79 cases (87.8%) were hospitalized while 11 cases (12.2%) were brought dead. Among hospitalized cases, majority, 31 cases (34.4%) died after 7 days of hospitalization; 22 cases (24.4%) died between 3-7 days, 16 (17.8%) within 24 hours and 10 (11.1%) from 24 hours up to 72 hours of hospitalization. (**Table 8**)
- All the cases who sustained 31-70% total body surface area burns died after 72 hours of hospitalization. All brought dead cases had 71-100% total body surface area burns. (**Table 9**)
- It was observed that majority of the cases died due to septicaemia, 53(58.9%), followed by shock (neurogenic and hypovolemic), 37 (41.1%). (**Table 10**)
- Most of the cases (55.6%) were accidental in nature. About 36.7% cases were suicidal in nature and 7.8% cases were homicidal and all the homicidal cases were females. (**Table 11&12**)

Discussion:

- We observed a predominance of female cases and most of them were in the age group 21-30 years, which is similar to the findings of other studies.[6-11] The age group 21-30 years is the common age for marriage in this area.
- Most of the victims were female and Hindus. Others also observed similar findings.[7,12.] In contrast, Memchoubi, et al,[13] reported slight male preponderance in their study. Female predominance is due to their involvement in cooking, especially after marriage. The reason for the Hindu predominance is that most of the population is Hindu.
- Majority of the victims were married, as also observed by others.[9,11]
- Again, most of the victims sustained 71 to 100% of total body surface area burn, similar to the observations by Buchade D,[6] Mazumdar A,[7] Zanjad P,[14] and Bhore DV.[15]
- Most of the victims survived for 7 or more days. Similar results were observed by Buchade D[6] and Bhore DV.[15] In contrast, 60.8 % of cases in Kumar V,[16] 59% in Mishra PK,[8] and 58% in Ragheb SA[17] studies died within a week.
- Shock was found to be the immediate cause of death in 41.1% cases, which is similar to studies by others.[7,8] Deaths due to Shock (neurogenic, hypovolemic) occurs in up to 3 days of hospitalization. Septicaemia was the cause of death in which there was hospitalization for 3 or more days. Similar results were noted by Buchade D,[6] Bhore DV,[15] and Dasari H.[18]
- We observed that most of the cases were accidental in nature. Similar results were noted by others.[6,7,14,15,19]

Conclusion:

Incidence of fatal thermal burn cases was 20%. Age group 21 to 30 years is

commonly affected. Married Hindu married females were mostly involved. Fatality increases as total body surface area of burn increases. Septicaemia accounted for most of the deaths.

As septicaemia accounted for majority deaths, infection control programmes in burn wards are necessary. Safety precautions and avoiding contamination will reduce the incidence of septicaemia while treating the cases of burns. As accidental deaths were most common mass education, elimination of poverty and adopting safe cooking habits will reduce the incidence of fatal thermal burn cases. Results from similar studies from different parts of India will provide necessary information to planning thereby reducing occurrences of fatal burns.

Conflict of interest: None

Financial Assistance: None

References:

1. K. Mathiharan, Amrit K Patnaik. Modi's Medical Jurisprudence and Toxicology, 23rd edition. Lexis Nexis publication pp-629
2. Reddy KSN, Murty OP. Thermal Deaths. The essentials of forensic medicine and toxicology. 33rd ed.: Jaypee Brothers Medical publishers (P) Ltd, New Delhi; 2014: p320.
3. Mohanty MK, Arun M, Monteiro FN, Palimar V. Self inflicted Burn Fatalities in Manipal. Medicine Science Law: 2005; 45: 27-30.
4. WHO Report 2000. Available from: http://www.who.int/whr/2000/en/. Last accessed Sep 10 2016.
5. Burns. World health Organization. Available from:http://www.who.int/mediacentre/factsheets/fs365/en/. Last accessed Nov 11 2014.
6. Buchade D, Kukde H, Dere R, Savardekar R. Pattern of burn cases brought to morgue, sion hospital mumbai, a two year study. J Ind Acad Foren Med. 2011;33(4):309-10.
7. Mazumder A, Patowary A. A study of pattern of burn injury cases. J Ind Acad Foren Med. 2013;35(1):44-6.
8. Mishra PK, Tomar J, Sane MR, Saxena D, Yadav A. Profile of death in burn cases: a post-mortem study. J Ind Acad Foren Med. 2016;38(1):8-10.
9. Vaghela PC, Ahir GN, Patel MH. Epidemiology of fatal burn cases in gk general hospital, bhuj. National J Community Med. 2012;3(2):326-29.
10. Subrahmanyam M. Epidemiology of burns in a district hospital in western India. Burns. 1996;22:439-42.
11. Th. Meera, Pabitramala Nandeibam, Daunipaia Slong, H. Nabachandra. Burn deaths: a study on female victims in manipur. J Ind Acad Foren Med. 2015;37(4):358-60.
12. Singh P, Harish D. Incidence of post burn septicaemia in a tertiary care hospital, J Ind Acad Foren Med. 2011;33(4):317-20.
13. Memchoubi, H. Nabachandra. A study of burn deaths in imphal. J Ind Acad Foren Med. 2007;29(4):131-5.
14. Zanjad NP, Godbole HV. Study of fatal burn cases in medico-legal autopsies. J Ind Acad For Med.2007;29(3):42-9.
15. Bhore DV, Nanandkar SD, Bhise SS. A study of medico legal profile of fatal burn cases in mumbai region. J Ind Acad Foren Med. 2016;38(2):209-12.
16. Kumar V, Mohanty MK, S Kanth. Fatal burns in manipal area: A 10 year study. J Fore Legal Med. 2007;14:3-6.
17. Ragheb SA, Qaryoute S, El-Muhtaseb H. Mortality of burn injuries in Jordan. Burns. 1984;10:439-43.
18. Dasari H, Kumar A. Burn septicemia - the leading cause of burn mortality. J Punjab Acad. For Med Toxicol 2008;8(2):10-6.
19. Usama B. Ghaffer, Husain M Rizvi J S. Thermal burns: An epidemiological prospective study. J Ind Acad Foren Med. 2008;30(1):10-14.

Table 1-Total Number post-mortem examinations & number of fatal thermal burn cases during the study period

Total Number post-mortems performed during the study period	449
Number of fatal thermal burn cases	90
Percentage of fatal thermal burn cases	20.04

Table 2-Age wise distribution of fatal thermal burn cases

Age(in years)	No. of fatal thermal burn cases	Percentage
1-10	02	02.22
11-20	12	13.33
21-30	28	31.11
31-40	21	23.33
41-50	12	13.33
51-60	05	05.55
61-70	05	05.55
71-80	03	03.33
81-90	02	02.22
Total	90	100

Table 3- Sex wise distribution of fatal thermal burn cases

Sex	No. of fatal thermal burn cases	Percentage
Male	22	24.44
Female	68	75.56
Total	90	100

Table 4- Age and Sex wise distribution of fatal thermal burn cases

Age group	MALE		FEMALE		Total
	No. of cases	%	No. of cases	%	
1-10	1	04.54	01	01.47	02
11-20	2	09.09	10	14.70	12
21-30	4	18.18	24	35.29	28
31-40	3	13.63	18	26.47	21
41-50	5	22.72	07	10.29	12
51-60	3	13.63	02	02.94	05
61-70	2	09.09	03	04.41	05
71-80	1	04.54	02	02.94	03
81-90	1	04.54	01	01.47	02
Total	22	100	68	100	90

Table 5- Religion wise distribution of fatal thermal burn cases

Religion	No. of fatal cases	%age
Hindu	68	75.55
Muslim	09	10.00
Buddhist	13	14.45
Total	90	100

Table 6- Marital status wise distribution of fatal thermal burn cases

Marital status	No. of fatal cases	Percentage
Married	82	91.11
Un-married	08	08.89
Total	90	100

Table 7- Total Body Surface Area Burn wise distribution of fatal thermal burn cases

Total Burn Surface Area	No. of fatal thermal burn cases	%age
1-30%	0	0
31-70%	26	28.88
71-100%	64	71.12
Total	90	100

Table 8- Survival period wise distribution of fatal thermal burn cases

Survival period	Total	%age
Brought dead	11	12.22
<24hours	16	17.77
24 to <72 hours	10	11.11
72 hours to <7 days	22	24.44
7 days and more	31	34.44
Total	90	100

Table 9- Survival period and Total Burn Surface Area wise distribution of fatal thermal burn cases

Survival period	Total Burn Surface Area				Total
	31-70%		71-100%		
	No. of cases	%	No. of cases	%	
Brought dead	0	0	11	17.1	11
<24hrs	0	0	16	25.0	16
24 to <72 hrs	0	0	10	15.6	10
72 hrs to <7 days	10	38.4	12	18.7	22
7 days and more	16	61.5	15	23.4	31
Total	26	100	64	100	90

Table 10- Cause of death wise distribution of fatal thermal burn cases

Cause of death	No. of fatal cases	%age
Shock	37	41.11
Septicaemia	53	58.89
Total	90	100

Table 11- Manner of death wise distribution of fatal thermal burn cases

Manner of death	No. of fatal thermal burn cases	%age
Accidental	50	55.56
Suicidal	33	36.66
Homicidal	07	07.78
Total	90	100

Table 12- Manner and sex wise distribution of fatal thermal burn cases

Manner of death	MALE		FEMALE		Total
	No. of cases	%	No. of cases	%	
Accidental	13	59.1	37	54.4	50
Suicidal	09	40.9	24	35.3	33
Homicidal	00	0	07	10.3	07
Total	22	100	68	100	90

Original Research Paper

Retrospective Profile of Road Traffic Accident Victims brought to the Emergency Department of a Teaching Hospital in Northeast India

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Abstract

Road traffic accidents can occur suddenly and unexpectedly. As our population increases, the number of vehicles increases consequently, leading to more vehicular accidents, which have become a major public health issue. This five year retrospective study conducted between January 2010 and December 2014 include all cases of road traffic accidents brought to the Emergency Department of our institute. Of the 60,515 cases attending the Emergency Department during the study period, 1532 comprised victims of road traffic accidents. Most of the accidents occurred in the afternoon hours between 12.01 pm to 6.00 pm, the most common affected persons were in the age group of 21-30 years. Head and neck region, 40.7%, was the most common part of the body involved in road traffic injury.

Key Words: Road Traffic Accident, Emergency Department, Injuries.

Introduction:

A road traffic accident is any vehicular accident occurring on the roadway that is originating on, terminating on, or involving a vehicle partially on that roadway.[1] It can occur suddenly, unexpectedly and inadvertently under unforeseen circumstances, causing injuries to or death of the involved individuals. The morbidity and mortality burden due to accidents is increasing in developing countries**.** Death from road traffic injuries have been characterized worldwide as a hidden epidemic which affects all sectors of society.[2,3] The World Health Organization predicts that such injuries would become the sixth commonest cause of death by the year 2020 and the fifth by 2030.[4]

In India, the number of vehicular accidents during 2013 was 4,86,476, resulting in 1,37,572 deaths and 4,94,893 injuries.[5] The leading causes for such accidents in the country were observed to be a rapid increase in personalized modes of transport, a mixture of slow and fast moving vehicles, lack of road discipline, drunken driving and the use of mobile phones while driving. A study shows that lack of awareness on the part of public, poor road conditions, increasing consumption of alcoholic beverages along with lack of sufficient medical facilities account for a majority of deaths in these cases.[6]

The victims of road traffic accidents sustain a variety of injuries both externally and internally. Studies to analyze the pattern of injuries caused in such events have not been carried out extensively in the northeast in general and Shillong in particular. Therefore, the present study is an attempt to portray and highlight various factors and indicators pertaining to the victims involved in road traffic accidents who are subsequently brought to the Emergency Department for medical attention.

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Materials and Methods:

This retrospective observational study was conducted in a tertiary care teaching hospital in Meghalaya during a period of 5 years from January 2010 to December 2014. All the cases of road traffic accident attending the Emergency Department during the study period were included in this study. Cases which were brought dead were excluded from the study. Data were extracted from the medicolegal case (MLC) register and case notes maintained in the Medical Records Department (MRD), following the approval of the Medical Superintendent of the hospital. The parameters considered were the demographic profile of the victims, time of occurrence, type of road user (driver, passenger or pedestrian), characteristics of injuries sustained and outcome of road traffic accident among victims brought to the Emergency Department of the hospital for treatment. The data collected were analyzed using Microsoft Office Excel 2007. The permission to conduct the study was obtained from the Institutional Ethics Committee (IEC).

Results

During the study period, 60,515 patients attended the Emergency Department, out of which 1532 (2.5%) comprised victims of Road Traffic Accidents (RTA).

It was observed that most of the victims of RTA belonged to the age group 21-30 years (35.3%), followed by the age group 11-20 years (19.3%). The least affected were those above 60 years of age (2.7%). It was also seen that the males outnumbered the females in a ratio of 4.1:1. This male predominance was seen in all the age groups. (**Table 1**)

In relation to the time of incidence, it was observed that RTA occurred mostly in the afternoon hours, between 12.01pm and 6.00pm (41.58%) and least in the early hours i.e. between 00.01am to 6.00 AM (7.8%) as shown in **Table 2**.

The monthly distribution of the cases, **Fig 1**, showed a somewhat constant trend throughout the year with slight increased in the month of August (10.2%).

The victims of RTA were mostly occupant of vehicles (passengers/ pillion rider) or drivers, constituting 40.2% and 35.7% of the cases, respectively. In 24.2% cases, the victims were pedestrians (**Table 3**).

Among the victims, 547 were drivers, of which 333 (60.9%) were 2 wheeler riders (bikes, scooters, bicycles). Other drivers comprised of 4 wheeler drivers (motorized), 176 cases (32.2%); 6 wheeler drivers (tankers, trucks, buses), 29 cases (5.3%) and 3 wheeler drivers (auto-rickshaws), 9 cases (1.7%). (**Fig 2**)

As regards the offending vehicle, (**Fig 3**), the total number of vehicles involved in RTA was 1181. The most commonly involved vehicles were the four wheelers (46.9%), followed by two wheelers (37.9%), six wheelers (12.3%) and three wheelers (2.9%). The total number of injuries sustained by the victims of road traffic accidents was 2359. The head and neck part of the body was the commonest site of injury, with 40.7% injuries, followed by the lower limbs (30.4%). (**Table 4**)

As shown in **Table 5**, a majority of the victims were discharged (66%) after initial treatment. In this study, 6 victims (0.9%) died on arrival at the emergency department.

Discussion

In the present study, a majority of the victims were males (80.5%) and the most affected age group was 21-30 years (35.3%). This could be due to the fact that this age group is the most active period in life and thereby exposing oneself to the hazards of roads by spending more time outdoor. This male predominance was also observed by Singh P & Verma SK[7] (79.9%), Reddy SP & Kumar HN[8] (81.77%) and Chanchlani R, et al[9] (81.8%). Similarly, Yerpude PN and Jogdand KS[10] (34.18%) and Pathak SM, et al[11] (34.62%) noted that the most vulnerable age group was 21-30 years.

As reported by Sah BK, et al[12] (34.9%) and Siddaramanna TC and Kumar D[13] (44.4%), a majority of Road Traffic Accidents happened between 12 noon and 6 pm (41.58%).

In our study, the month of August (10.2%) accounted for the highest number of accidents which can be attributed to the monsoon, which causes impaired visibility, judgment and skidding of vehicles. Jha N, et al,[14] observed that most of the RTA occurred during

the month of January (12.9%), followed by August and October (9% each).

The victims in our study were mostly passengers (40.15%), drivers (35.70%) and pedestrians (24.15%) which is in conformity with the findings of Jha N, et al.[14]

Among the drivers, 2 wheelers riders (60.9%) constituted the majority of the victims, which was similar with the observations by Singh P & Verma SK[7] (59.9%) and Sah BK, et al[12] (58%). This can be attributed to easy accessibility and affordability of two wheelers. Other factors like traffic congestion, less stability and hilly terrain also contributed to increase in accidents by 2 wheelers.

In the present study, light motor vehicles (46.9%) and two-wheelers (37.9%) were the common vehicles involved in RTA, which reflected the vehicle preference of the general population in this part of the country. A similar finding was also observed by Ganveer GB &Tiwari RR[15] (light motor vehicles - 43.02% and two-wheelers - 31.2%). The common sites of injury in RTA were head and face (40.7%) followed by the lower limbs (30.4%). Similarly, Monga S, et al[16] and Rao D & Mukerjee S[17] observed that the head (45.52% & 34.64% respectively) and lower limbs (17.10% & 25.2% respectively) were the frequent sites of injury, in their studies.

In this study, a majority of the victims of RTA were discharged (66%) after receiving initial treatment which is consistent with the observation of Singh P & Verma SK[7] (67.1%).

Conclusion

The present study revealed that the victims of RTA were mostly males and belonged to a younger age group. A majority of these accidents happened between 12 noon and 6 pm and four wheelers were the common vehicles involved. Most of the victims were passengers and head was the frequent site of injuries. The outcome in most cases was good and only few died on arrival at the emergency department. Considering the magnitude of the problem caused by RTA, a strict implementation of the various safety measures like wearing seat belts and helmets, avoid using mobile phones while driving etc will greatly reduce the incidence of Road Traffic Accidents.

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References:

1. WHO. ICD-10 International Statistical Classification of Diseases and Related Health Problemsô 10th revision. Volume 1. Geneva: World Health Organization; pg1670. [cited 2015 Mar 17]; Available from: https://www.cdc.gov/nchs/data/dvs/2e_volume1_2013.pdf
2. A 5-year WHO strategy for road traffic injury prevention. Department of Injuries and Violence Prevention, World Health Organization.2001. [cited 2015 Jun 23]; Available from: http://www.who.int/violence_injury_prevention/media/en/156.pdf
3. Global Road Safety Crisis. Report of the Secretary-General (A /58/228). United Nations. New York. 2003. [cited 2015 Jun 23]; Available from:
4. https://www.unece.org/fileadmin/DAM/trans/roadsafe/docs/SG_report_e.pdf
5. World Report on Road Traffic Injury Prevention: Summary. Geneva: World Health Organisation; 2004. [cited 2015 Mar 7]; Available from:
6. http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/summary_en_rev.pdf
7. Road Accidents in India, 2013. Transport Research Wing, Ministry of Road Transport & Highways, Government of India, New Delhi.[cited 2015 Mar 17]; Available from: http://revista.dgt.es/images/informe-accidentes-India-2013.pdf
8. Tirpude BH, Naik RS, Anjankar AJ, Khajuria BK. A study of the pattern of cranio-cerebral injuries in road traffic accidents. Jour Ind Acad For Med. 1998;20(1):9-12.
9. Singh P, Verma SK. Profile of road traffic accidents in rural area of south-west madhya pradesh. Ind Jour For Med Toxicol. 2015;9(1):122-7.
10. Reddy SP, Kumar HN. Retrospective study of road traffic accident cases at harsha hospital nelamangala, bangalore rural. Ind Jour For Med Toxicol. 2013;7(1):193-5.

11. Chanchlani R, Krisnanand P, Sinha U. External injury pattern of road traffic accidents-an epidemiological study in a tertiary care setting, Bhopal. Jour Evolution Med & Dent Sci. 2013;2(32):6050-5.
12. Yerpude PN, Jogdand KS. An epidemiological study of road traffic accident cases admitted in a tertiary care hospital in andhra pradesh. Ind Jour For Med Toxicol. 2013;7(1):157-60.
13. Pathak SM, Jindal AK, Verma AK, Mahen A. An epidemiological study of road traffic accident cases admitted in a tertiary care hospital. Med J Armed Forces Ind. 2014;70(1):32-5.
14. Sah BK, Narasannavar A, Mallapur MD, Yadav SK. Morbidity and mortality among the RTA casualties attending in a tertiary care hospital, Belgaum-a retrospective study. Ind Jour For Med Toxicol. 2014;8(2):130-3.
15. Siddaramanna TC, Kumar D. Retrospective study of pattern of external injuries in road traffic accidents. Int J Biomed Advance Res. 2014;5(9):451-3.
16. Jha N, Srinivasa DK, Roy G, Jagdish S, Minocha RK. Epidemiological study of road traffic accident cases: A study from south india. Ind Jour Community Med. 2004;29(1):20-4.
17. Ganveer GB, Tiwari RR. Injury pattern among non-fatal road traffic accident cases: A cross-sectional study in Central India. Ind Jour Med Sci. 2005;59(1):9-12.
18. Monga S, Gupta S, Arora H. A study of morbidity and mortality profile of 500 road traffic accident cases in Malwa region of Punjab. Int Arch Integrated Med. 2015;2(1):44-9.
19. Rao D, Mukerjee S. A study of pattern of injuries in road traffic collisions. Jour Punjab Acad For Med Toxicol. 2010;10(1):14-6.

Table 1: Age and Sex distribution

Age(yrs)	Male	Female	Total	%
0 - 10 yrs	84	45	129	8.42
11 - 20 yrs	237	58	295	19.25
21 - 30 yrs	465	75	540	35.25
31 - 40 yrs	238	46	284	18.54
41 - 50 yrs	117	34	151	9.85
51 - 60 yrs	69	23	92	6.01
> 60 yrs	23	18	41	2.68
Total	1233	299	1532	100.00

Table 2: Time of Incidence

Time of Incidence	No. of cases	%
00.01 AM - 6.00AM	119	7.77
6.01AM - 12 NOON	359	23.43
12.01 PM - 6.00PM	637	41.58
6.O1PM - 00.00AM	417	27.22
Total	1532	100.00

Table 3: Type of victims

Type of victims involved	No. of cases	%
Driver	547	35.70
Passenger	519	33.88
Pedestrian	370	24.15
Pillion rider	96	6.27
Total	1532	100.00

Fig 1: Monthly distribution

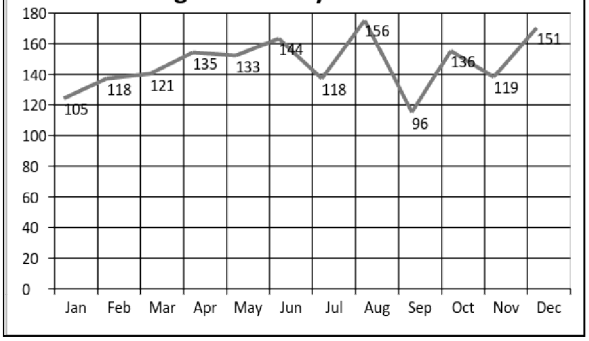

Table 4: Site of injury

Site of Injury	No. of cases	%
Head & Neck	959	40.65
Chest	97	4.11
Abdomen	50	2.12
Upper limbs	449	19.03
Lower limbs	717	30.40
Back	87	3.69
Total	2359	100.00

Table 5: Treatment outcome

Outcome	No. of cases	%
Discharged	1011	66.00
Admitted	492	32.11
Referred	23	1.50
Expired	6	0.39
Total	1532	100.00

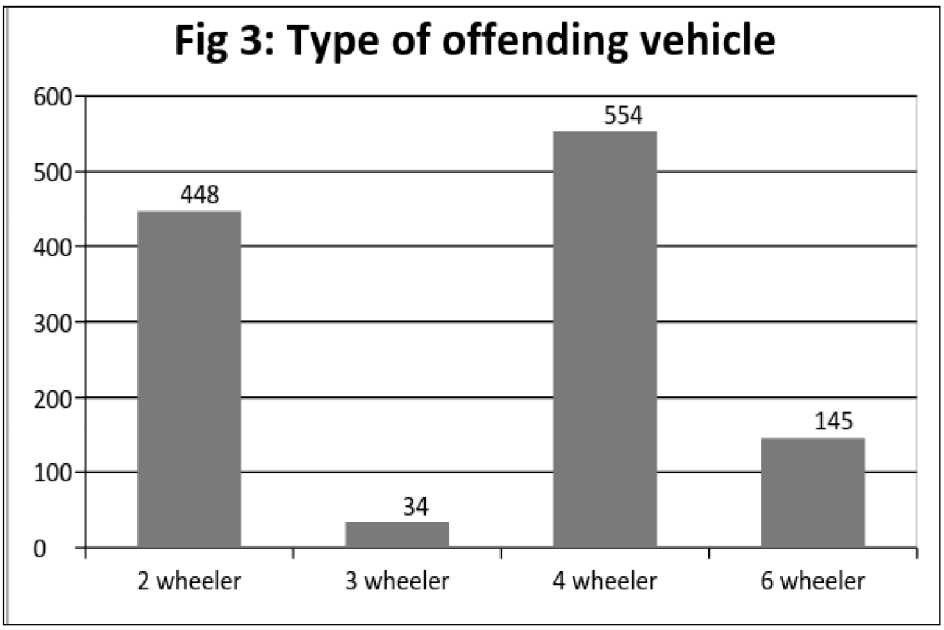
Fig 3: Type of offending vehicle
600
500
400
300
200
100
0
448
34
554
145
2 wheeler
3 wheeler
4 wheeler
6 wheeler

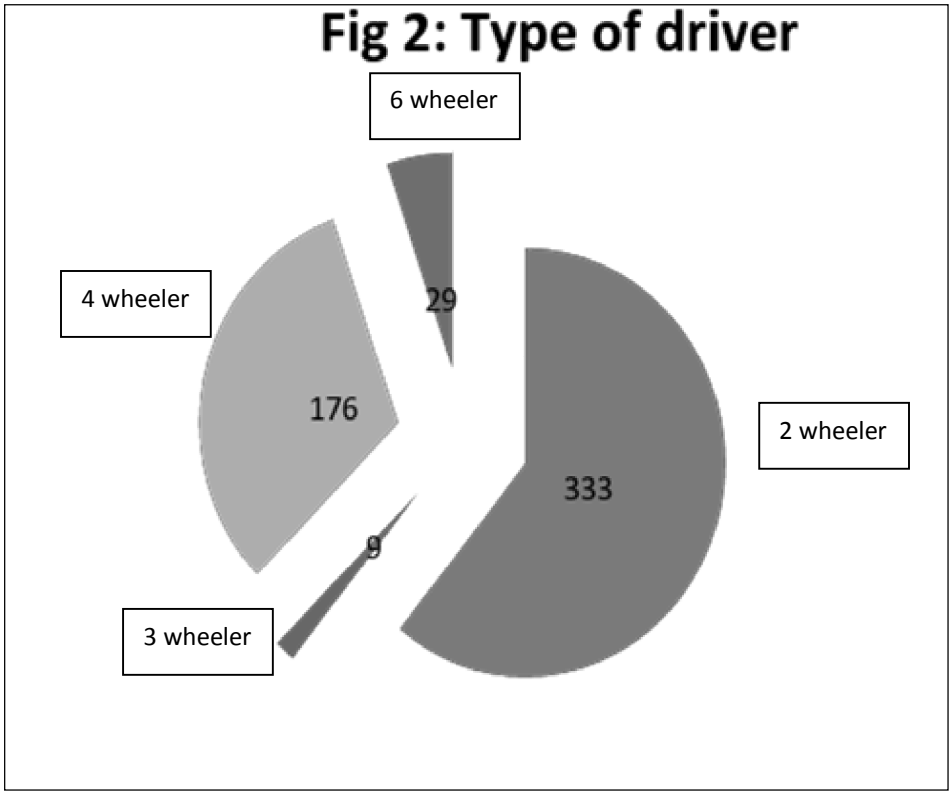
Fig 2: Type of driver
6 wheeler
4 wheeler
2 wheeler
3 wheeler
29
176
333
9

Original Research Paper

A study of pattern of sudden natural deaths: A JNIMS Experience

[1]G. Angam, [2]Saka Koko Maring, [3]Kh Pradipkumar Singh, [4]L.Fimate

Abstract

Sudden Death often raises a lot of questions and allegations. In the present study, 49 cases of sudden, natural deaths, the post mortem examination of which were conducted during the period 2010 to 2014, were analysed. Male outnumbered female deaths 47: 2. Fifty three percent of the victims were in the 4th to 6th decade. Meiteis suffered the highest number of casualties, comprising of 32%. Eighty six percent of the victims belonged to urban location. Most of the cases occurred during morning, followed by night. Cardiovascular system (CVS) was involved in 45% of the cases, pulmonary system 28%, Gastro-intestinal system 22% and Neurological system 5%. Among the CVS causes, Ischemic heart disease was the predominant cause. The need to understand the pattern of sudden natural deaths in Imphal arises.

Key Words: Sudden Death, Natural Death, Ischemic Heart Disease

Introduction:

An apparently healthy person dying in a sudden and unexpected circumstance raises a lot of question as to whether there was any foul play which led to the death. Even when the death was natural i.e. due to a disease process, these sets of deaths are quite intriguing and often pose challenge as well as curiosity as to what really happened. Sudden natural death is defined as the sudden or unexpected termination of life of an apparently healthy individual, from some

The emphasis is on the unexpected character rather than the suddenness of the death. ñNatural deathò means the death was entirely due to natural disease, and it was not caused by trauma or poisoning. A significant percentage of all deaths are sudden, unexpected, natural deaths. What are the causes of these sudden natural deaths? Analyses of these deaths will help in understanding the nature of these diseases which will help in allaying the suspicion of foul play as well as help in preventing the disease through health education. A thorough post mortem examination backed up by detailed histopathological examination will help shed light on the causes of these deaths. The main objective of this study was to determine the causes and population vulnerability of sudden natural deaths.

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Materials and Methods:

This study was a retrospective study of all sudden natural deaths who were brought to Jawaharlal Nehru Institute of Medical Sciences (JNIMS), Porompat, Manipur, for postmortem examination from the year 2010 to 2014. The Postmortem reports, along with the histopathological reports were analysed. A master chart was prepared and analysed systematically. All natural deaths occurring within 24 hours (WHO)[2] from the onset of signs and symptoms were considered. Cases involving trauma, drugs, poison, asphyxia,

decomposition were excluded and the cases were analysed with regard to age, sex incidence, place, caste and cause of death.

Results and Observations:

Of the 824 medico-legal autopsies performed during the study period, 49 cases were cases of sudden natural deaths. Of these, males were 47(96%) (**Chart 1**). Regarding the age group of the victims, most of them belonged to the 4th to 6th decade of life, with 26.5% in 31-40 years, 24.5% in 41-50 years and 22.5 % in the age group 51-60 years, as shown in **Table-1**. Majority of the victims were Meiteis, (49%) followed by Non-Manipuri subjects, (17%) as shown in **Chart 2**. Again, majority of the victims belonged to urban area, 86% (**Chart 3**).

There was no great seasonal variation in the present series, as depicted in **Chart 4**. Most of the deaths occurred in the morning (**Table-2**). Cardiovascular pathology accounted for the maximum number of deaths i.e. 22 cases, followed by Pulmonary causes, 14 cases. Of the different types of cardiovascular causes, majority were due to Myocardial Infarction (9 cases), followed by Atherosclerosis (8 cases) (**Table-3**).

Discussion:

The study was undertaken to know the pattern and causes of sudden natural deaths in cases brought to JNIMS, Imphal. In this study, 96% of the cases were male and only 4% were female. Similar male preponderance was also found in various studies.[2-5] In Manipur, women do almost all the physical work, right from household chores to shopping to even manual work while a big percentage of the male folks are confined to their office seats, and often resort to deleterious habits like drinking, smoking etc., with their peers. This lifestyle difference makes male population more vulnerable to lifestyle diseases like atherosclerosis, hypertension, Diabetes etc. Besides, the role of oestrogen in protection against heart diseases has been well proven.

Again, 71% of the victims of sudden, natural deaths were in the age group 31-60 years, with maximum of 26.5% in age group 31-40 years. A 4-year prospective study conducted in Bangalore by Rao D, et al. also found the modal age group to be 50-60 yrs, which accounted for 62.2% of all the cases.[4] Similar studies conducted by Deo R and Albert CM and Kumar V, et al also found an increasing trend with age irrespective of sex or race. The increased incidence in the advancing years may be attributed to the lack of reparative mechanisms of the human body, the cumulative effect of all the habits and lifestyle as well as lack of physical activity in this age group.[6,7] The majority (89%) of the victims belonged to urban location while only 11% were from rural location. This finding is also related with the lifestyle, food habit and physical activities.

Meiteis subjects were the most affected group in this study. Meitei, being the dominant caste, the number of cases is maximum as compared to other community. However, Non-Manipuris who are generally not as numerous as Nagas or Kukis in Manipur, constituted a significantly high number of sudden, natural deaths in this study. Possibly, this is related to the oily food habits as well as genetic predisposition.

Cardiovascular system accounted for the maximum number of deaths, 22 cases (44.8%), followed by respiratory system, 14 cases (28.6%). Of the different types of cardiovascular causes, the maximum number of occurred due to myocardial infarction (18.4%), followed by atherosclerosis (16.4%). In most of the studies on sudden, natural deaths conducted in different parts of the world, cardiovascular deaths has been found to be the most common cause. In a study conducted by Zhao P, et al. in Victoria Hospital, Seychelles cardiovascular deaths accounted for 78.5%,[5] 64.9% in a study conducted in Kuala Lumpur by Kumar V, et al,[8] 56.4%. in Australia by Puranik R, et al,[9] 55% in Turkey by Amzak AD[11] and 30.2% in Nigeria by Nwafor CC, et al.[7]

Among the CVS deaths in our study, Ischemic Heart Disease accounted for the maximum number (17), which is in agreement with the studies done by the aforementioned researchers. Of the 14 cases of respiratory causes, Bronchopneumonia accounted for maximum number of deaths (6 cases). Pneumonia affects approximately 450 million people globally per year and results in about 4 million deaths.[11] Amongst the 11 cases of gastrointestinal deaths, maximum number of

death was due to acute pancreatitis (6 cases), followed by Liver cirrhosis in 5 cases. In a study on deaths due to Acute Pancreatitis, patients died much earlier than a control autopsy population of 38,259 patients.[12]

Conclusion:

Sudden deaths are a common occurrence in any parts of the world. The suddenness of these deaths led to suspicious as to the nature of death to the victim family. The need to know what the predominant causes are in a particular region is important to customise the health care priorities and planning for the particular region with special reference to primary prevention strategies. This study re-emphasises the need to bring health awareness regarding the preventive aspects of cardiovascular diseases in Manipur. Documentation of autopsy-based data such as these is important in the planning of medical services in a developing country.

Conflict of interest: - **None**.

Source of funding: - **None.**

References:

1. International classification of diseases (ICD-10). Geneva, World Health Organization, 2005. Available from:http://www.who.int/classifications /icd/ICD10Volume2_en_2010.pdf. Accessed on 10th August 2016
2. Yamaguchi J, Shikano Y, Sato S, Shimamoto K. A clinical and pathological study of 46 cases of sudden and unexpected death. Nihon Ronen Iggakai Zasshi. 1995;32(11):722- 7. Available from:https://www.ncbi.nlm.nih.gov/pubmed/8598627?dopt=Abstract. Accessed on 10th August 2016
3. Hugar BS, Shetty H, Girishchandra YP, Hosahally JS. Sudden neuropathological deaths: autopsy study. Med Sci Law. 2015;55(3):223-7.
4. Rao D, Sood D, Pathak P, Dongre SD. A cause of sudden cardiac deaths on autopsy findings; a four year report. Emerg(Tehran) 2014;2(1):12-7.
5. Zhao P, Wang JG, Gao P, Li X, Brewer R. Sudden unexpected death from natural diseases: fifteen years experience with 484 cases in seychelles. J For. Leg Medicine 2015;37:33-8.
6. Deo R, Albert CM. Epidemiology and genetics of sudden cardiac death. Circulation. 2012;125(4):620-37
7. Nwafor CC, Igbe AP, Akhiwu WO. Study of natural causes of death in medicolegal autopsies seen in university of benin teaching hospital. Niger Postgrad Med J. 2014;21(4):305-10.
8. Kumar V, San KP, Idwan A, Shah N, Hajar S, Norkahfi M. A study of sudden natural deaths in medicolegal autopsies in university malaya medical centre(ummc), kuala lumpur. J Forensic Leg Med. 2007;14(3):151-4.
9. Puranik R, Chow CK, Duflou JA, Kilborn MJ, McGuire MA. Sudden death in the young. Heart Rhythm. 2005;2(12):1277-82.
10. Azmak AD. Sudden natural deaths in edirne, turkey, from 1984 to 2005. Med Sci Law. 2007;47(2):147-55.
11. Osler W. Principles and practice of medicine, 4th Edition, New York: D Appleton and Company; 1901, p. 108. Available from: https://ia600201.us.archive.org/10/items/cu31924012509893/cu31924012509893.pdf. Accessed on 10th August 2016
12. Renner IG, Savage WT, Pantoja JL, Renner VJ, Deaths due to acute pancreatitis. a retrospective analysis of 405 autopsy cases. Dig. Dis Sci. 1985;30(10):1005-18.

Chart 1: Showing Male-Female Distribution in Sudden Natural death Victims

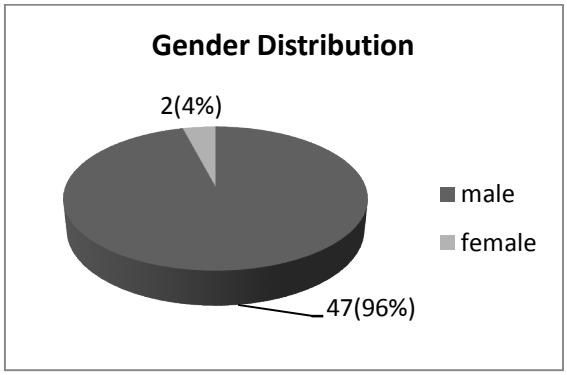

Table-1: Showing Age Distribution of Sudden Natural death victims

Age interval (Years)	Number of cases
0-10yrs	0
11-20yrs	3(6.1%)
21-30yrs	7(14.3%)
31-40yrs	13(26.5%)
41-50yrs	12(24.5%)
51-60yrs	11(22.5%)
>60yrs	3(6.1%)
Total	49 (100%)

Table 2: Showing frequency of Sudden Natural Death during different time of the day

Time	Frequency
Morning (4am to 12 pm)	16
Afternoon (12pm to 4pm)	12
Evening(4pm to 9pm)	7
Night(9m to 4am)	14

Chart 2: Showing Caste Distribution of Sudden Natural Death Victims

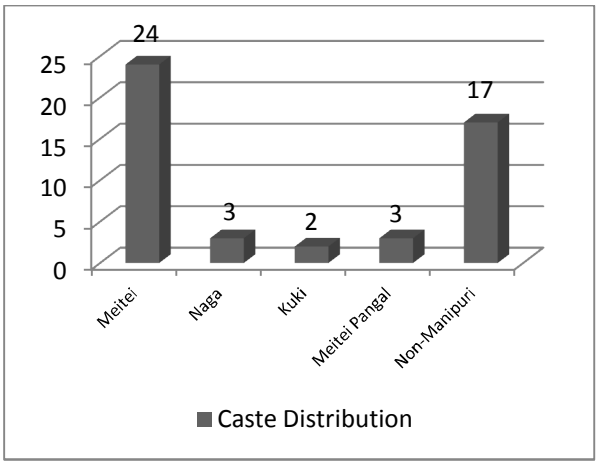

Chart 3: Showing Urban/Rural distribution of Sudden Natural Death Victims

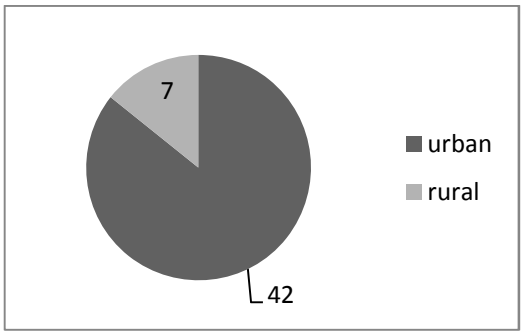

Chart 4: Showing Seasonal Variation of Sudden Natural death cases

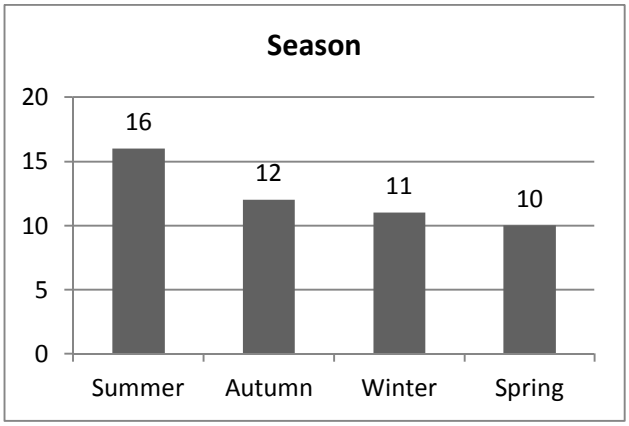

Table-3: Showing different causes of death and their distribution in Sudden Natural death victims

System	Diseases	Number of case
Cardiovascular(22 cases)	Myocardial Infarction	9(18.4%)
	Atherosclerosis	8(16.4%)
	Myocarditis	3(6.2%)
	Restrictive Cardiomyopathy	1(2%)
	Disseminated Intravascular Coagulation	1((2%)
Respiratory (14 cases)	Bronchopneumonia	6 (12.2%)
	Pulmonary TB	6(12.2%)
	Ca. Bronchus	1(2%)
	Pulmonary Edema	1(2%)
GIT (11 cases)	Acute pancreatitis	6(12.2%)
	Liver Cirrhosis	5(10.2%)
Neurological (2 cases)	Stroke	2 (4.2%)

Original Research Paper

Study of Acute Poisoning Cases in a Tertiary Care Hospital of South-Eastern Odisha

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Abstract

Periodic epidemiological studies are necessary to understand the pattern of poisoning in each region. Studies of this nature will act as a useful planning tool for providing healthcare facilities to reduce the poisoning associated mortality rate.

This is a prospective study in which all acute poisoning cases admitted to a tertiary care centre of South-eastern Odisha (Bhubaneswar) during the period from 1st October 12 to 30th September 14 were included and evaluated. A total of 110 cases of acute poisoning were admitted during the study period and all of them are part of this study. Majority of the patients were seen in the age group of 21-30 years, in both males as well as females (n=50, 45.5%). As per the type of poisoning, the largest number of cases - 41(37.3%) were of insecticide and pesticide poisoning. Although there is already a legal framework for safety and controlled sale of these chemicals, there is a need for strict implementation of these measures. Most of the cases were of intentional (suicidal) poisoning. All these cases must undergo psychiatric evaluation during their stay in the hospital. This will minimize the risk of next attempt of self-harm.

Key Words: Acute Poisoning, Insecticides, Pesticides, Poisoning Prevalence, Poisoning Outcome, Poisoning Pattern, Poisoning Prevention

Introduction:

Poisons have played a large role in history, in romance as well as self-destruction or in criminal imposition or accidental infliction, since the pre-historic era. The toxic effects of poison and death due to poisoning have interested and been studied by mankind since ages. Poisoning is a common problem all over the world, although the nature of poisoning and associated morbidity and mortality varies with the location (country to country), demography (age, sex etc.), socio-economic status and the available treatment. Among the various emergency cases in medical practice, poisoning cases form a substantial proportion. In advanced countries, it has been observed that poisoning deaths are mainly due to medicinal drug abuse (analgesics, tranquillizers, antidepressants etc.), cleansing agents, detergents, and cosmetic products.[1,2]

In India, as agriculture is the main occupation, insecticides and other agrochemical fertilizers are used to a greater extent and the poisoning with such products are more common.[3] Poisoning accounted for 7.5% of all causes of unnatural deaths in the year 2007, as per data obtained from National Crime Bureau of India.[4] In 2004, 346,000 people died worldwide from unintentional poisoning, of which 91% occurred in developing countries, according to World Health Organization (WHO) estimates.[5]

Periodic epidemiological studies are necessary to understand the pattern of poisoning in each region. Studies of this nature will act as a useful planning tool for providing

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healthcare facilities to reduce the poisoning associated mortality rate. This study was designed to assess the pattern of poisoning in various aspects in an area of South-eastern Orissa (Bhubaneswar) which will assist the health care professionals and policy-makers.

Materials and Methods:

This is a prospective study in which all acute poisoning cases admitted to Pradyumna Bal Memorial Hospital and Kalinga Institute of Medicial Sciences (KIMS), Bhubaneswar during the period from 1st October 2012 to 30th September 2014 were included and evaluated. A total of 110 cases of acute poisoning were admitted during the above mentioned period and all of them are part of this study. The clinical diagnosis of the nature of the poison consumed was based on reliable history, presentation of the remaining stuff/ container from which the poison had been consumed, gastric aspirates (vomitus) and suggestive clinical picture; and confirmation of the nature of poison as per the laboratory reports. Data was also collected from case sheets (Indoor Patient Records), hospital records, records of medico-legal cases ï Prayumna Bal Memorial Hospital and various other material.

Observations and Results:

A total of 6875 patients were admitted through the casualty department during the 2 year study period from October 2012 to September 2012, of which 110 cases were of acute poisoning, comprising 1.6% (**Table - I**). The number of female patients of poisoning were more, (n=60, 54.5%) as compared to males (n=50, 45.5%) (**Table-II**) . The highest number of patients were in the age group of 21-30 years, in both males as well as females (**Table- III**). Also, a large number of females, 22 (36.7%), were in the adolescent age group, i.e., 11-20 years. The number of males in the remaining age groups showed an almost even distribution, whereas there were no female patients above 50 years (**Table - III**).

As per the type of poisoning, the largest number of cases - 41(37.3%) were of insecticide and pesticide poisoning (**Table - IV**), followed by 24 (21.8%) cases of poisoning due to drugs. The type of poison was unknown in 4 (3.6%) cases. In majority of the cases ï 92 (83.7%), the manner was suicidal (**Table - V**). In 13 (11.8%) cases, the nature of poisoning was accidental and in 5 (4.5%), homicidal in nature. In majority of the cases ï 102 (90.5%), the route of intake of poison was ingestion and in the remaining, it was parentral (**Table - VI**). In more than one-third cases (40%, n=44), the duration of hospital stay was 1-3 days. In 36 (32.7%) cases, the duration of hospital stay was 3-7 days; and in only 3 (2.7%) cases, it was greater than 14 days (**Table - VII**). Two (1.8%) cases died during the treatment and the rest 108 (98.2%) cases showed improvement with treatment (**Table – VIII**).

Discussion:

In our study, there is a female preponderance in the incidence of poisoning cases, with 54.5% cases and a Male-to-Female ratio of 1:1.2. Khadka& Ale[6] also found a higher incidence in females (52.3% cases), with Female-to-Male ratio to be 1.09:1. Pokhrel, et al[7] also reported a preponderance of females in their study with 51.4 % cases. Our observations also correspond with those of Marahatta, et al,[8] who reported a female-to-male ratio of 1.34:1. Similarly, Baral, et al[9] and Banerjee, et al[10] observed that females clearly outnumbered males in the incidence of poisoning with 59.8% cases and 64.62% cases, respectively.

However, majority of the authors with similar studies have reported higher incidence of poisoning in males as compared to females in India. Gupta, et al[11] reported that 71.8% patients were males. Howlader, et a[12] observed that 64% cases were male. Shoaib, et al[13] found a male preponderance with 59.6% cases. Similarly, the findings of this study are not consistent with the findings of Maharani and Vijayakumari,[14] Maskey, et al[15] and Kumar, et al,[16] who have also reported a higher incidence of poisoning in males as compared to females. The higher incidence in females could be due to their being more exposed to stress and strain.

In relation to the age-group, this study correlates with the study of Gupta, et al[11] who reported maximum number of cases, 42.7% from 20-29 yrs age group. Pokhrel, et al[7] observed that 49% of cases were in the age group of 14-25 years. Ramesha, et al[17] also found highest incidence in 20-29 yrs age group, (31.2%) followed by 12-19 yr age group (30.2%). Shoaib, et al[13] reported a higher incidence of poisoning during the third decade of life. The findings of this study are also consistent with the studies of other workers.[15-21] The higher incidence of poisoning during the third decade can be explained by the fact that it is this period that an individual tries to search or establish his place in the society. Insecurity issues with respect to career and income, failure in love or marriage and inability to bear the life stresses can lead to irrational act resulting in fatal outcome.

The findings w.r.t route of intake correlate with the study of Gupta, et al[11] who also reported poisoning by ingestion as the most common route (89.5%), others[14,18,20,21]also observed that all the patients consumed poison orally. Oral route is an easy route to consume or administer poison as compared to other routes of administration; also, many people are not aware of other routes of intake of poison.

As per the type of poison, Gupta, et al[11] have reported similar findings in their study. Ramesha, et al[17] reported that majority of the poisoning cases (36%) were due to organophosphorus compounds (OPC), followed by snake bite (16.2%), drugs (11.0%), rat poison (7.3%) and others. Jesslin, et al[18] observed the following poisoning agents - pesticides: 39.5%, medicines: 26.1%, house-hold products: 22.1%, environmental: 12.1%, heavy metals: 0.2%. Maskey, et al[15] aslo found that majority of poisoning cases (41.9%) were due to OPC, followed by rodenticides and snake bite. Vaidya and Hulke[19] also reported OPC as the most common poisoning agent (35.5%). Similarly, the findings of the present study are consistent with studies of others.[14,20,22,23] Insecticide and pesticide poisoning is very common in India, as reported by many other authors with similar studies. India, being an agricultural country, these insecticides and pesticides form common household products because of their easy availability. An increasing trend is seen in poisoning due to drugs, as reported by other authors also in the above mentioned studies. Many people on medications prescribed for therapeutic purposes, consume them in higher doses intentionally in an attempt to end their suffering

As far as the manner is concerned, the present study correlates with the study of others[7,10,11,13,15,17-22] who confirm that self poisoning was the most common. Self-poisoning is one of the oldest known method to commit suicide. Accidental cases are mainly due to snake-bites or in children. In homicidal cases, the motive was to carry out robbery and dacoity.

The findings of duration of hospital stay are consistent with the study of Ramesha, et al[17] who found that median hospital stay was 4 days. Ramanath and Kumar[22] also reported that maximum numbers of poisoning cases stayed for a period of 2-7 days (39.7%). The findings also correspond with the study Karki and Risal[20] who observed that in majority (62%) of the cases, the duration of hospital stay was between 1-4 days, followed by 5-7 days in 20% cases. Vaidya and Hulke[19] reported that duration of hospital stay varied from 1 to 5 days. Patil, et al[21] reported a mean duration of hospital stay of 3.9 days.The duration of hospital stay depends upon the severity of poisoning and the treatment administered. Many authors have reported similar findings in their studies.

As per mortality rate, Patil, et al,[21] in their study, observed that none of the patients died. Jesslin, et al[18] found a mortality rate of 4%. The findings are in contrast with the studies of Ramesha, et al[17] and Shoaib, et al[13] who have observed a higher mortality rate of 15.4% and 14.4%, respectively. Kumar, et al,[16] reported a mortality rate of 8.3%. Vaidya & Hulke[19] and Mittal, et al[23] also reported higher mortality rates, 20% and 18.6%, respectively. The findings of the present study are also not consistent with the study of Banerjee, et a,[10] who observed a mortality rate of 16.2%. The mortality in a case of poisoning depends upon the type of poison, dose of poison, circumstances of poisoning,

general health status of the individual and the treatment facilities available. The place of this present study is a tertiary care centre in the capital city of Orissa state. It has round the clock availability of physicians including super-specialists and state-of-the-art intensive care units.

Conclusion:

Most common poisoning is seen due to insecticide and pesticide compounds. Although there is already a legal framework for safety and controlled sale of these chemicals, there is a need for strict implementation of these measures. Most of the cases are of suicidal poisoning. All these cases must undergo psychiatric evaluation during their stay in the hospital. This will minimize the risk of next attempt of self-harm. In suicidal cases, the causative factors have not been determined as they could not be well ascertained from the history given by the patients and relatives.

The incidence of poisoning and its morbidity and mortality can be reduced by developing and implementing the following preventive and remedial strategies (suggestions of various authors in similar studies have been included):

- Health programmes should be designed and conducted for prevention of both suicidal and accidental poisoning for the benefit of the public at large.
- Strengthening of legislative measures with respect to sale of drugs and chemicals (pesticides) and strict implementation of those measures. Over-the-counter sale of the drugs should be prohibited and the drugs should be sold only on the basis of a valid prescription.
- Establishment of poison information centres which will be helpful for both the healthcare providers as well as the public.
- Improvement in techniques for early and accurate diagnosis in poisoning cases. This can be done by setting up of well-equipped toxicological laboratories for detection of poisons at all medical college & hospitals.
- Provision of prompt and adequate treatment. The health-care centres should be equipped with anti-dotes based on the common poisonings encountered in that area. A small percentage of beds should be reserved in ICU as well as wards for poisoning cases.
- Upgrading of knowledge and skills of treating physicians from time-to-time in handling such cases. This will be very helpful in reducing the morbidity as well as mortality in poisoning cases.

The pattern and magnitude of measures for control of poisoning are thus multidimensional and demanding multi-sectoral approach. Overall, the current study has managed to contribute substantial additional information regarding the prevalence of poisoning cases in a tertiary care hospital with reference to its epidemiology, morbidity and mortality. This study was done in a single tertiary care hospital. Other medical centres should also have been included to get a better and broader view. A multicentric, nation-wide study could address the study objective in an even better way.

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References:

1. Gargi J, Tejpal HR. A retrospective autopsy study of poisoning in the northern region of punjab. J Punjab Acad Fore Med Toxicol. 2008;2:17-20
2. McClure GM. Suicide in children and adolescents in england and wales 1970-1998. Br J Psychiatry. 2001;178:469-74.
3. Aaron R, Joseph A, Abraham S, Muliyil J, George K, Prasad J, et al. Suicides in young people in rural southern India. Lancet. 2004;363:1117-8.
4. New Delhi: National Crime Records Bureau Ministry of Affairs; 2009. Accidental Deaths and Suicides in India 2008. Available from: http://ncrb.nic.in/StatPublications/ADSI/ADSI2008/ADSI2008-full-report.pdf Accessed on - 01/05/17
5. World Health Organisation. International Programme on Chemical Safety. Poisoning prevention and management (2004). Available from: http://www.who. int/ipcs/poisons/en/ Accessed on -25/04/17

6. Khadka SB, Ale SB. A study of poisoning cases in emergency, kathmandu medical college teaching hospital. Kathmandu University Medical Journal. 2005;3(4):388-91.

7. Pokhrel D, Sirjana Pant, Pradhan A, Mansoor S. A comparative retrospective study of poisoning cases in central, zonal and district hospitals. Kathmandu University Journal of Science, Engineering and Technology. 2008;1(5):40-8.

8. Marahatta SB, Singh J, Shrestha R, KojuR : Poisoning cases attending emergency department in dhulikhel hospital ï kathmandu university teaching hospital. Kathmandu University Medical Journal. 2009;7(2):152-6.

9. Baral D, Rajbhandari S, Shreshtha A, Basyal B, Prasad PN : Acute poisoning cases in emergency department of tertiary level hospital, kathmandu; JGPEMN. 2011;2(3):54-8. [eISSN 2362-1168]

10. Banerjee I, Tripathi SK, Roy AS. Clinicoepidemiological profile of poisoned patients in emergency department: A two and half year's single hospital experience. Int J CritclInj Sci. 2014;4:14-7.

11. Gupta BD, Hapani JH, Shah VN. Current trend of poisoning in jamnagar: an experience of tertiary care teaching hospital; J IndAcad Fore Med, 2006;28(3):90-92

12. Howlader MAR, Sardar MH, Amin MR, Morshed MG, Islam MS, Uddin MZ, AzharMA :Clinico-epidemiological pattern of poisoning in a tertiary level hospital; J Dhaka Med Coll. 2008;17(2):111-5.

13. Shoaib MZ, Aslam M, Gupta V, Sharma V and Khan SA. Profile of poisoning cases at a north indian tertiary care hospital. Health and Population: Perspectives and Issues. 2009;32(4):176-83.

14. Maharani B, Vijayakumari N. Profile of poisoning cases in a tertiary care hospital, tamilnadu, india. J App Pharm Sci. 2013;3(1):91-94.

15. Maskey A, Parajuli M, Kohli SC, Baral S, Basnet S, Poudel N. Scenario of poisoning cases in adults admitted in manipal teaching hospital, pokhara, nepal. Nepal Journal of Medical Sciences. 2012;1(1):23-6.

16. Kumar SV, Venkateswarlu, Sasikala M, Kumar GV. A study on poisoning cases in a tertiary care hospital, J Nat SciBiol Med. 2010;1(1):35-9.

17. Ramesha KN, Rao KBH, Kumar GS. Pattern and outcome of acute poisoning cases in a tertiary care hospital in karnataka, india. Indian J Crit Care Med. 2009;13(3):152-5.

18. Jesslin J, Adepu R, ChuriS. : Assessment of prevalance and mortality incidences due to poisoning in a south indian tertiary care teaching hospital. Indian J Pharm Sci. 2010;72(5):587-91.

19. Vaidya YP, Hulke SM. Study of trends of poisoning in the cases reported to government hospital, Yavatmal. Chron Young Sci2012;3:63-7.

20. Karki RK, Risal A. Study of poisoning cases in a tertiary care hospital. Kathmandu Univ Med J 2012;10(4):70-73.

21. Patil A, Peddawad R, Verma VCS, Gandhi H. Profile of acute poisoning cases treated in a tertiary care hospital: a study in navimumbai. Asia Pac J Med Toxicol. 2014;3:36-40.

22. Ramanath KV, Naveen Kumar HD. Study the assessment of poisoning cases in a rural tertiary care teaching hospital by a clinical pharmacist. Asian J Pharm Clin Res. 2012;5(2):138-41.

23. Mittal N, Shafiq N, Bhalla A, Pandhi P, Malhotra S : A prospective observational study on different poisoning cases and their outcomes in a tertiary care hospital; SAGE Open Medicine 2013 1: DOI:10.1177/2050312113504213. Published online 2013 Sep 17. PMCID: PMC4687764 https://www.ncbi.nlm.nih.gov/pubmed/26770682. Accessed on 01/05/2017

Table - I: Percentage of Poisoning Cases

Total No. of Hospital Admissions	Total No. of Cases	Percentage
6875	110	1.6%

Table – II: Distribution of Cases as per sex

Sex	Frequency of cases	Percentage of cases
Male	50	45.46
Female	60	54.54
Total	110	100.0

Table – III: Distribution of Cases as per Age-group

Age-group (in yrs)	No. of Males	No. of Females	Total No. of poisoning cases	%age
0-10	0	0	0	0.0
11-20	7	22	29	26.4
21-30	23	27	50	45.5
31-40	7	4	11	10.0
41-50	3	7	10	9.0
51-60	7	0	7	6.4
61-70	3	0	3	2.7
>70 yrs	0	0	0	0.0
Total	50	60	110	100.0

Table – IV Distribution of Cases as per type of Poisoning

Type of Poison	Frequency of cases	%age of cases
Insecticidal	41	37.3
Corrosive	12	10.9
Plant Poison	10	9.1
Animal Poison	8	7.3
Drugs	24	21.8
Inorganic Irritants	2	1.8
Miscellaneous	9	8.2
Unknown	4	3.6
Total	110	100.0

Table –V: Distribution of Cases as per Manner of Poisoning

Manner	Frequency of cases	%age
Suicidal	92	83.7
Accidental	13	11.8
Homicidal	5	4.5
Total	110	100.0

Table VI: Cases as per Duration of Hospital Stay

Duration of Hospital Stay	Frequency of cases	Percentage of cases
0-1 day	9	8.2
1-3 days	44	40.0
3-7 days	36	32.7
7-14 days	18	16.4
>14 days	3	2.7
Total	110	100.0

Table – VII Mortality

	Frequency of cases	%age of cases
Survived	108	98.2
Expired	2	1.8
Total	110	100.0

Review Research Paper

Autopsy in Cases of Custodial Torture : Indian Perspective

[1]A. J. Patowary

Abstract

Autopsy in cases of suspected and unnatural deaths isa vital evidence in detection of the crime, and in cases of custodial death, has become the only piece of evidence as there is seldom any independent eye witness to narrate the incident. Many a time,the findings in the autopsy become the only evidence which can prove or nullify the commission of the offence. National Human Right Commission of India (NHRC), in the directions issued from time to time, has categorically stressed the need for careful and thorough autopsy examination in such cases. The main hurdle faced by the Forensic Medicine specialist in such cases is in the detection of hidden injuries in the body of the alleged victim of custodial torture without mutilation of the body. This article is intended to highlight the dissection method in custodial torture deaths with necessary precaution to be taken in such cases.

Key Words: Autopsy, Torture, Custodial Death, Human Right, Cosmetic Autopsy Incision

Key features:

- Autopsy incision, especially designed for the cases of death due to alleged torture, has been described in this article.
- Exposure of whole circumference of the body as well as all the four limbs is achieved in this autopsy incision.
- There cannot be any hidden injury in any part of the body in this incision technique.
- Examination of the penis and scrotum as well as the oral cavity in cases with rigor mortis, where mouth cannot be opened is included.
- All the incisions remain hidden, except in the anterior aspect of the shoulder joint, so cosmetic integrity of the cadaver is achieved.

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Introduction:

Torture in the custody is being practiced all over the world to extract truth or confession or the desired statement from the person in custody. In the process, different methods are used, both psychological as well as the physical torture, to extract the statement from the man in custody. Though the psychological torture leaves more trauma to the person,[1-4] it cannot be visualised, only the effect is seen on the person; the physical torture on the other hand usually leaves more evidence in the form of different type of injuries on the body which can be visualised. Many a time, physical torture,resulting in deep seated bruise or other injury, also becomes difficult to visualise during routine autopsy examination. So, care is to be taken while dissecting the body during autopsy so that no injury can remain hidden.

As per the Indian legal system, there is no provision for torture in the custody and any kind of death in custody is treated as culpable homicide; however, as can be deduced from the provision under CrPC Sec 46, the right of private defence can be used in such cases, where a police officer can use force extending to causing death of the person, as may be necessary to arrest a person accused of an offence punishable with death or imprisonment for life. In

all such cases, there are strict guidelines from the NHRC as regards the investigation, autopsy, as well as reporting such cases.[5-8]

The NHRC, in it's letter dated Aug. 10, 1995, from the then Chairperson, Justice Ranganath Misra to the Chief Ministers of all the states,categorically said that, ñThe Commission is of a prima-facie view that the local doctor succumbs to police pressure which leads to distortion of the facts. The Commission would like that all post-mortem examinations done in respect of deaths in police custody and in jails should be video-filmed and cassettes be sent to the Commission along with the post-mortem report".[6,7]

Justice M.N. Venkatachaliah, Chairperson, in his letter to all the Chief Ministers (No. NHRC/ID/PM/96/57), dated March 27, 1997, categorically said that in number of instances, the Commission has noticed that the post-mortem reports appeared to be doctored due to the influence/ pressure to protect the interest of the police/ jail officials. He also said that there is hardly any outside independent evidence in cases of custodial violence, the fate of the cases depends entirely on the observations recorded and the opinion given by the doctor in the post-mortem report. If the post-mortem examination is not thoroughly done or manipulated to suit vested interests, then the offender cannot be brought to book and this would result in travesty of justice and serious violation of human rights in custody would go on with impunity.[6,7]

A meticulously performed autopsy not only helps the law enforcing agencies to find out the truth, but many a times, helps the innocent to prove his or her innocence. Similarly, a carelessly performed autopsy not only hides the evidence, but may lead to travesty of justice. So, we have to take utmost care to find out all the possible injuries or evidence while performing an autopsy in cases of alleged custodial torture, so that there is no scope for any unnoticed / unexplored injury in the body of the alleged victims.

Disadvantages of Presently Practiced Incisions:

Most of the time, the autopsy surgeons in India use basic three types of incision, namely-

- **"I" shaped incision:**exposure to the neck structure particularly in both sides of the neck is not adequate.
- **"Y"-shaped incision:** visualization of the neck structure is difficult.
- **Modified Y-shaped incision:** visualization of the neck structures in the front of the neck and to some extent, also the sides of the neck is achieved.

In none of the above incisions, exposure of the posterior aspect of neck, thorax or abdomen is achieved; so hidden injuries may remain undetected in those areas. Apart from these, there is another incision practiced in some center i.e. **cosmetic autopsy incision**[9-12]**(**which was***developed in the year 2006by this author***) and the advantages are -

- Whole circumference of the neck, thorax and abdomen is exposed so, better detection of injuries.
- Abdomen is closed in two layers so, no seepage from abdominal cavity.
- All the incision marks remain hidden except the mark of curved incision in the front of the shoulderjoint so, better acceptance for the relative of the deceased.

But, though in this incision, the whole circumference up to the trunk is exposed, it also failed to addresses the issue of hidden injury in the limbs which are the most vulnerable part in torture cases.So, to detect any injury in the suspected areas of the body, many a times, the autopsy surgeons have to make some incisions on the suspected areas for confirming the presence or absence of any injury, thus mutilating the body with multiple incision marks, which imparts a negative impact on already marooned relatives of the deceased.

So, we have to adopt the autopsy incision which will help in exposing all parts of the body with minimum visible external marks on the body, so that we can explore all the hidden injuries and at the same time satisfy the relatives of the deceased with minimum external marks; extended cosmetic autopsy incision fulfils these all the criteria where whole of the body is exposed with minimum external marks on the body.

Extension of Cosmetic Autopsy Incision:

The incision is designed to expose the whole of the body so as to find out all the possible injuries in all parts of the body, and at the same time, most of the incisions remain hidden when viewed from the front except one incision mark in the front of the shoulder joint. The steps of the incision are follows:[9-12]

1. **Positioning the body:**Body is placed in prone position with a wooden block under the shoulder, so that the neck remains in flexed position (**Fig-1**).
2. **Incision on the back:**
   a) Scalp incision is made from one mastoid process to the mastoid process of the other side in coronal plane through the vertex. (**Fig-2**)
   b) The incision is extended bilaterally through the posterior border of the sternocleidomastoid and then through the posterior border of the trapezius to the posterior aspect of acromion process. (**Fig-2**)
   c) A curved incision is made bilaterally from the tip of acromion up to the mid axillary line in the axilla through the medial border of the posterior aspect of the shoulder joint which is then extended up to the iliac crest through the mid axillary line bilaterally.(**Fig-2**)
3. **Reflection of the posterior flap:**The posterior flap of the scalp is reflected back up to the occiput and anteriorly up to the supra-orbital ridges. The posterior flap is then reflected back making superficial strokes by the scalpel on the subcutaneous tissues, continued through the neck, then the back of the chest and back of the abdomen up to the superior border of sacrum. Thus, the whole flap of the skin is reflected back up to the superior border of the sacrum exposing the whole of the back of the head, neck, chest and abdomen (**Fig-3**).
4. **Exposure of the lower limbs:** From the iliac crest, the incision is extended round the buttocks up to the midpoint in gluteal folds, then through the middle of the each of the thighs in posterior aspect extending through the popliteal fossa up to the posterior border of the heel. Incision is then extended by both lateral and medial borders of the sole of foot up to the metatarso-phalangeal joints (**Fig-4**).

The skin flaps are reflected both medially and laterally to expose the whole circumference of the lower limbs up to the heel (**Fig-5**). The flaps in the sole of foot are reflected distally up to the metatarso-phalangeal joints to expose the sole (**Fig-6**).

Exposure of the anterior aspect

5. **Positioning the body:** After completion of the examination of the posterior aspect, the flap of the skin is replaced back and the body is turned back to the supine position with a wooden block under the shoulder to keep the neck in extended position.
6. **Incision in the front:**
   a) A curved incision is made from the acromion process through the medial border of the shoulder joint to the mid axillary line bilaterally, as was made in the posterioraspect (**Fig-7**).
   b) Another incision is made from the mid axillary line on the iliac crest bilaterally over the inguinal ligament, to meet at the symphysis pubis (**Fig-8**).
   c) The skin with the superficial tissue flap is reflected up, up to the root of the neck and then to the inferior margin of the mandible bilaterally taking care not to injure the rectus sheath and the neck structures. (**Fig-9**)

This way, the whole of front of the neck chest and abdomen is exposed.

7. **Opening the abdominal cavity:** To open the abdominal cavity, a para-medial incision is made on the rectus near the symphysis pubis, which is extended upward by keeping the index and the middle fingers as guard up to the xiphoid process using a scissors or enterotome(**Fig-10**) which is then extended bellow the costal margin bilaterally up to the anterior axillary line to open the peritoneal cavity. (**Fig-11**).

Opening the thorax: The sternum is removed by cutting at the costochondral junction and then separating the sterno-clavicular joint to open the thorax.

Now after separating the diaphragm, the whole of the thorax and abdomen can be examined.

8. **Exposure of the oral cavity:** The skin flapis then reflectedupwardup just below the angles of the mouth; an incision is made on the muscles of the lower lip on the alveolar margin from midline, extending laterally up to the temporomandibular joints bilaterally to expose and open the whole of the oral cavity. Examination of the teeth can also be done in this way and can be noted (**Fig-12**).

After examination, on repositioning the flap back, the facial appearance reverts back to the original without any sign of disfiguration (**Fig-13**).

9. **Exposure of the upper limbs: I**ncision iscontinuedfrom the axilla through the posterior medial border in the arm and forearm up to the medial aspect of the wrist joint, then through the medial border of the palm up to the 5thmetacarpo-phalangeal joint from where incision is continued through the base of the fingers towards lateral aspectand then through the lateral border of palm up to the lateral border of thinnar eminence (**Fig-14**). Skin flaps are reflected to both sides of the incision up to the wrist; the skin of the palm is reflected proximally to expose the whole of the palm. (Fig-15)
10. **Exposing the Penis and scrotum:** A rhomboid shaped incision is used with one angle of it in the symphysis pubis, two on the thighs by the lateral aspect of the scrotum and lower angle at the anterior margin of the anus. The skin is reflected from all directions towards the centre to expose the scrotum and penis to examine any injury to the penis and scrotum. (**Fig-16**)

The anal canal and the rectum, which is one of the vulnerable area for custodial torture, can be examined while reflecting the gluteal flaps medially and then removing the rectum between two ligatures from inside.

The vaginal canal in female can also be examined in the same way like that in case of examination of the penis and scrotum using the same rhomboid shaped incision.

The cranial cavity is to be opened as usual using autopsy saw and examined for any findings.

Closing of the incisions:[9-12]

The sternum is replaced to its position. The abdomen is closed by stitching the rectus and the costal margin (**Fig- 17**). Now the flap of the skin is replaced. The incision over the inguinal ligament is stitched first then the bilateral mid axillary incisions up to the axilla. Stitches are continued on the arm and the forearm, the palmer flap is replaced back and stitched together. Then the stitches are continued in the front on the curved incision in the medial border of the shoulder. The body is then turned back to stitch the curved incision on the medial margin of the shoulder joint in the back and then on the incisions on both sides of the posterior aspect of the neck up to the mastoid process and then continued to close the scalp incision. Incisions on the lower limb is then stitched, the sole is replaced back and stitched properly. (**Fig-18**).

Advantages of this incision

Stitches are not noticed in the neck region which remain visible in others; so better acceptability for the relatives of the deceased (**Fig-18**).

But the most important advantage of this incision is that, all the injuries in the body including those in the back of the neck, thorax and abdomen as well as the limbs, can be visualized, which is not achieved in any of the other incisions (**Fig-19,20**).

Conclusion:

Cases of custodial deaths are always with allegations and counter allegations with wide publicity in the media. Similarly, the persons indulging in torture in the custody are not going to inflict injuries in the exposed areas of the body, rather will choose the areas which usually are not noticed in external examination. So, the role of autopsy surgeon become very much important, as many a time the autopsy findings alone become the evidence for or against the allegation; there is hardly presence of any witness in such cases when it is occurring in the custody of the police or defense personals. Hence, each and every such autopsy

should be meticulous, complete with detailed findings which only will help in finding the fact.

This incision technique holds good to serve the purposeas there is no scope for any hidden injury in any part of the body; the whole surface of the body is exposed and so can be examined and documented by photograph and video recording, which is mandatory in such cases.[13-15] As there is exposure of whole of the body surface, which cannot be achieved by any other incisions mentioned at the beginning this article, the autopsy surgeon can very well address the presence or absence of any hidden injury in any part of the body supported by documentation by photograph and video recording during autopsy.

To conclude, this is the ideal method of incision for the autopsy in cases of death due to custodial torture.

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I pay my sincere homage to all the departed souls whose cadavers were dissected in the incision technique, may their soul rest in eternal peace.

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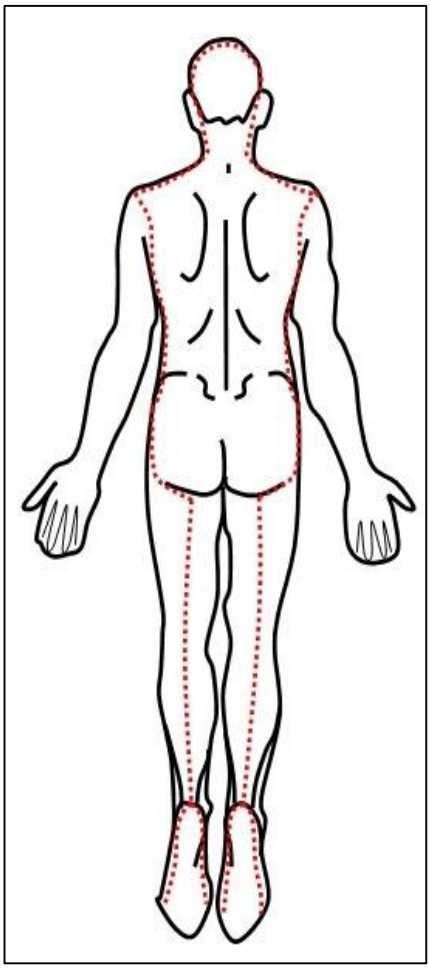
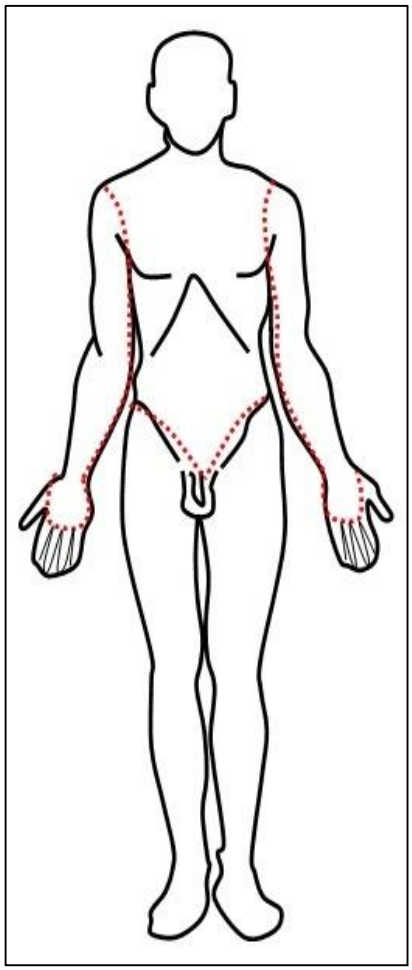
References:

1. Break them down ï systemic use of psychological torture by us forces. Cambridge: Physicians for Human Rights; 2005.p.1-17.
2. Karmakar RN. Forensic Medicine and Toxicology. Kolkata: 4th Ed. Academic Publishers; 2006.p.628.
3. Sydney A. A Moral Military. Philadelphia: Temple University Press; 2009; p.1-6,153-158.
4. Eisenman SF. Abu Gharib Effect. London: Reaktion Books Ltd; 2007.p.8-9.
5. National Human Right Commission of India. NHRC guidelines regarding arrest. [online]. [cited 2016 Jul 01]; Available from URL:http://nhrc.nic.in/
6. National Human Right Commission, India- List of Important Instructions / Guidelines Issued by the Commission. [online]. [cited 2016 Jul 01]; Available from URL:http://nhrc.nic.in/
7. National Human Right Commission, India. Custodial deaths. [online]. [cited 2016 Jul 01]; Available from URL: http://nhrc.nic.in/cdcases.htm
8. Bansal YS, Murali G, Singh D. Custodial Deaths ï An overview of the prevailing healthcare scenario. J IndAcad Fore Med. 2007;32(4):315-7.
9. Mahanta P (Ed). Modern Text Book of Forensic Medicine & Toxicology. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd; 2014.p.205-10.
10. Pillai VV. Text Book of Forensic Medicine & Toxicology. 17th Ed. Hyderabad: Paras Medical Publication; 2015.p.168,69.
11. Patowary AJ. The fourth incision - a cosmetic autopsy incision technique. Am J For Med Pathol. 2010;31(1):37-41.
12. Patowary AJ. The fourth incision - a few modifications in autopsy incisions. J IndAcad Fore Med. 2010;32(3):234-8.
13. National Human Right Commission of India. Guidelines for video-filming and photography of post-mortem examination in case of death in police action. [online]. [cited 2016 Jul 01]; Available from http://nhrc.nic.in/Documents/Guidelines_for_video_photography_of_PME_death_in_police_action.pdf
14. Patnaik AK. Model protocol for autopsies in custodial deaths. Issues In Medical Ethics. 1999; 7(2):48-49.
15. National Human Right Commission of India. Letter to all home secretaries regarding the revised instructions to be followed while sending post-mortem reports in cases of custodial deaths. [online]. [cited 2016 Jul 01]; Available from:http://nhrc.nic.in/Documents/PostMortemReportInstructions.pdf

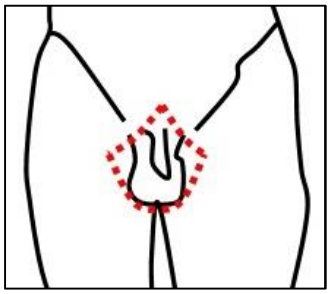
PHOTOGRAPHS OF THE INCISION:



Prone position



Supine position



Perineal region

INCISIONS PLAN

Fig. 1 Positioning the body in prone position

Fig. 2 Scalp incision and extension up to the iliac crest

Fig. 3 Reflection of posterior flap

Fig. 4 Extension of incision up to the heel

Fig. 5 Reflection of medial and lateral flaps in lower limb

Fig. 6 Reflection of sole of foot

Fig. 7 Anterior incision on shoulder joint

Fig. 8 Anterior incision on inguinal

Fig. 9 Reflection of anterior flap

Fig. 10 Para medial incision on rectus

Fig. 11 Exposure of peritoneal contents by sub-costal dissection

Fig. 12 Exposure of teeth and oral cavity

Fig. 13 View after replacement of the flap

Fig. 14 Incision on upper limb up to palm

Fig. 15 Exposure of the upper limb tissue

Fig. 16 Exposure of the penis and scrotum

Fig. 17 Closure of the abdominal muscles

Fig. 18 View after completion

Fig. 17 Deep bruise not detected externally

Fig. 18 Bruises on the back not detected externally

Review Research Paper

Bioethics of Euthanasia Present Global Scenario

[1]Zachariah Thomas

Abstract

Euthanasia, as it is now known, is essentially the doctrine that when, owing to disease, senility or the like, a person's life has permanently ceased to be either agreeable or useful, the sufferer should be painlessly killed either by himself or by another. The intentional termination of patient's life in such a situation by an act or omission of medical care is called euthanasia or mercy killing. This is the most active area of research in contemporary bio ethics. The present article is aimed at a global overview regarding legalization of euthanasia.

Key Words: Euthanasia, Physician Assisted Suicide (PAS), Living Will, Article 21

Introduction:

Euthanasia has always been in limelight as a subject matter of debate in the field of medicine and law. The general presumption is that every human being is desirous to live and enjoy the fruit of his life till he lives. There are situations where human beings wish to end their lives by unnatural means. This happens mostly in cases where one is suffering from painful chronic and incurable disease.

History says that Suetonius, a Roman historian, is the first writer who used the term Euthanasia.[1] The term euthanasia has been derived from the Greek word Euthanotos meaning, good death[1]. The word was used in the 17th century by Francis Bacon to refer to an easy and painless death, since it was the physician's duty and responsibility to alleviate the physical suffering of the patient[2].

As far back as 300-400 BC, both Socrates and Plato accorded moral sanction to assisted killing and suggested that it was punishable in certain circumstances.[2]

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Definitions:

Euthanasia - The infliction of a painless death on an individual suffering from severe, intractable pain or discomfort arising out of a terminal illness or condition.[3]

Physician Assisted Suicide (PAS):- The physician prescribing a drug or other action to facilitate a patient taking his/ her, own life, with the committed action taken by the patient.

Terminal illness: Illness or injury or degeneration of physical or mental condition causing extreme pain and which according to medical opinion will inevitably cause death or has ensured persistent and irreversible vegetative condition.[2]

Palliative care: The provision of reasonable medical and nursing procedures for the relief of physical pain, discomfort or emotional and psychological suffering as well as providing food and water.

Classification:

Euthanasia has been classified into[3]

1. **Voluntary euthanasia**: The dying individual consents to the act.
2. **Non voluntary euthanasia**. The person cannot make his wishes known. This include cases where the person is, in coma, too young, senile, mentally deficient, severely brain damaged.
3. **Compulsory (involuntary) euthanasia:** Decision by society to terminate life of an individual

4. **Active euthanasia**: Inflicting painless death by an act of commission for e.g. injection of lethal dose of barbiturate.
5. **Passive euthanasia** (negative euthanasia) Inflicting painless death by an act of omission, i.e. when the patient dies because of the medical professional either do not do something necessary to keep the patient alive, or when they stop doing something that is keeping the patient alive for example, switch off life-support machines, disconnect a feeding tube, do not carry out a life extending operation, do not give life extending drug.
6. **Paediatric Euthanasia; Euthanasia** administered to seriously sick or deformed infant.
7. **Geriatric euthanasia**: Euthanasia administered to seriously sick, aged individual
8. **Battle field euthanasia**: Euthanasia administered to severely wounded or handicapped individual.

World Medical Association Resolution on Euthanasia:[4]

(Adopted by the 39th World Medical Assembly Madrid, Spain, October 1987; Adopted by the WMA General Assembly Washington 2002)

The World Medical Association Declaration on Assisted Killing or P.A.S, Euthanasia, adopted by the 39th World Medical Assembly, Madrid Spain, October 1987 states[4] ñEuthanasia, that in the act of deliberately ending the life of a patient even at the patientôs own request or at the request of the close relatives is unethical. This does not prevent the physician from respecting the desire of a patient to allow the natural process of death to follow its course in the terminal phase of sicknessò

The WMA statement on Physician Assisted Suicide, adopted by the 44th WMA, Marbella Spain, September 1992 likewise states[4]

ñPhysician Assisted Suicide like Euthanasia is unethical and must be condemned by the medical profession where the assistance of the physician is intentionally and deliberately directed at enabling an individual to end his or her own life, the physician acts unethically. However the right to decline medical treatment is a basic right of the patient and the physician does not act unethically even if respecting such a wish results in the death of the patientò

The World Medical Association has noted that the practice of active euthanasia with physician assistance has been adopted in to law in some countries. It reaffirms its strong belief that euthanasia is in conflict with basic ethical principles of medical practice and WMA encourages all National Medical Associations and physician to refrain from participating in euthanasia, even if national law allows it or decriminalizes it under certain conditions[4].

Arguments for Euthanasia:

According to euthanasia expert Ezekiel Emanuel,[5] proponents of euthanasia invariably present four main arguments:

1. People have a right to self-determination and thus should be allowed to choose their own fate.
2. Assisting a subject to die might be a better choice than requiring that he/she may continue to suffer.
3. The distinction between passive euthanasia which is often permitted, and active euthanasia, which is not substantive (or that the underlying principles- the doctrine of double effect) is unreasonable or unsound.
4. Permitting euthanasia will not necessarily lead to unacceptable consequences, *pro* euthanasia activists often point to countries like the Netherlands and Belgium, and states like Oregon, where euthanasia has been legalized and is mostly unproblematic.

Arguments against Euthanasia:

Ezekiel Emanuel, argues that there are four major arguments presented by opponents of euthanasia.[5]

1. Not all deaths are painful.
2. Alternatives such as cessation of active treatment, combined with the use of effective pain relief available.
3. The distinction between active and passive euthanasia in morally significant.
4. Legalizing euthanasia will place society on a slippery slope which will lead to unacceptable consequences.

Living Will or Advance Directive:

In several Western countries, adult individuals, over a specified age, can execute a **'living will or advance directive',** which entitles him/ her to refuse treatment any time in future in the event of a catastrophic accident or natural disease. The usual phraseology in a living will is as follows "If I suffer an incurable, irreversible illness, disease or condition and my attending physician determine that my condition is terminal, I direct that life sustaining measures that would serve only to prolong my dying be withheld or discontinued[6].

Do Not Resuscitate Order (DNR)[6].

This 'do not resuscitate' order on a patient files means that a doctor is required, not to resuscitate if the heart stops functioning. DNR can be regarded as a form of passive euthanasia. They are not controversial unless they are abused, since they are intended to prevent patients unnecessary suffering.

The opponents of euthanasia (particularly active euthanasia) state that there are moral religious and ethical objections, which cannot be ignored. They argue that no one has the right to take away the life of an individual, not even the individual himself. The concept of sanctity of life is inviolable and doctors having taken an oath (The Hippocratic Oath) to preserve life at all costs, cannot justify allowing a patient to die either through active or passive means[6].

Ethical Dilemma Involved in Euthanasia:

Medical practitioner's dilemma:[7]

The medical practitioner's dilemma on euthanasia and assisted killing revolves around the Hippocratic Oath which they take at the time of entry into their profession. A part of the Oath states that "I will give no deadly medicine to any one if asked, nor suggest any such counsel; and in like manner I will not give a woman a pessary to produce abortion".[7] Thus practicing euthanasia would contravene the Hippocratic Oath.

However the supporters of euthanasia argue that the original Hippocratic Oath has lost its significance in modern society which has seen drastic socio-economic, political and moral changes. If the doctor tries to prolong the inevitable death, and there by the patient is not allowed to die with dignity, then he is not said to have acted in the best interest of the patients[8]. Thus while an attempt to prolong life violate the promise to relieve pain, relief of pain by killing violate the promise to prolong and protect life.

Dilemma among Family:

Euthanasia also presents dilemma to the family members of the patient. In 1924, Thomas Mann[9], has aptly said "a man dying is more the survivor's affair than his own". On the one hand, family members of the patient would find difficulty in seeing the suffering of the patient. On the other hand, they also find difficulty in giving consent to terminate the life of the patient. It is hard for them to digest the fact that they are in a way responsible for the death of their dear one. Thus it is always difficult for family members to arrive at a decision on euthanasia.

At the State level, the value conflict can be illustrated by examining rights theory and utilitarianism[9]. Advocates of Rights theory[9] contend that the State has a limited right to intrude on the affairs of individual. Only on the ground of compelling State interest, does it have the right to limit individual's right to privacy and self-determination. State interest can exist if there is a significant threat to society, or when the interest of a third party is at stake. There is no compelling State interest when an individual decides to die or to undergo euthanasia. Therefore state intervention in such cases is unwarranted[9].

Thomas Jefferson[10] provides the other dimension of Rights theory. According to him, "care of human life and happiness, and not their destruction is the first and only legitimate object of good governance." Therefore, in the pursuit of this objective State can intervene in the individual affairs.

The following utilitarian consideration should be taken by the State[10]

1. Risk of physician abuse
2. Sanctity of medical profession
3. Effect of assisted killing and euthanasia to the value accorded to life in society.
4. Cost of keeping terminally ill patient alive.

Global Scenario Regarding Euthanasia:

Netherlands:

Some countries have virtually legalized active euthanasia, if performed by a physician under strict guidelines (physician assisted suicide) for eg. The Netherlands (Holland) Belgium and Luxembourg.[11]

The Netherlands practices physician assisted suicide (PAS) openly ever since Royal Dutch Medical Association officially endorsed it in 1984[12] and the parliament approved the practice, provided it was done within a frame work of specified guidelines. PAS is legal under specific circumstances and for children over the age of 12 years withparental consent. It also allows doctors to euthanize dementia patients, if they believe the person is experiencing unbearable suffering although few cases are done practically.

Groningen protocol[13]

Created in September 2004 by Eduard Verhagen, the medical director of the Department of Pediatrics at the University Medical Center Groningen, (UMCG) the Netherlands, it contains directives with criteria under which physician can perform active ending of life on infants who are seriously ill or suffer from significant birth defects without fear of legal prosecution. The final decision about ôactive ending of life of infantô is not in the hands of the physician, but with parents; physicians and social workers agreeing to it. The criteria are, amongst others: ôunbearable suffering and unexpected quality of life.ô Only parents can initiate the procedure.

Belgium and other countries[14]:

In Belgium, PAS is legal for people over the age of 18 years[14]. About 80% of the cases involve terminally ill cancer patients and paraplegic or quadriplegic accident victims. In order to qualify for euthanasia, a patient must suffer from an incurable (not necessarily terminal) condition and experience unbearable physical or psychological pain. In the past, several cases of Belgians who were not terminally ill, were euthanized including 43 years old deaf twins who were going blind, and a patient with childhood abuse and a failed sex change operation. Government is further considering extending it to seriously ill children and adults with early dementia. Presently, people now can make a written declaration that they wish to be euthanized if their health deteriorates, but the request is only valid for 5 years and they must be in irreversible coma. The new proposal would abolish the time limit and the requirement the patient be in a coma where by someone who is diagnosed with Alzheimerôs can be put to death years later in the future.

Global Status of Euthanasia:

Elsewhere in Europe, euthanasia is only legal in Luxembourg, Physician assisted suicide is also allowed in Switzerland. In Mexico, law allows the terminally ill to refuse further treatment and medication to extent life. France, Canada are also contemplating to legalize PAS for those suffering from an incurable terminal illness[13-14].

Japan:

The concept of assisted killing and euthanasia has been not so precisely recognized in Japan[15]. Until now, there have been a few adjudication cases where a patient with incurable disease was led to his early death by his family member or his doctor, without having a chance to express his will and only with putative intent and these cases were judged as guilty, since they were not euthanasia in its true meaning. Although, there is no legislation for euthanasia in Japan, 4 allowable conditions of active euthanasia were presented in 1995 and they were now considered as one of the guiding principles in Japan:

1. The patient suffering from unendurable physical pain, as a definitive symptom. At present this pain is restricted for physical pain, not mental pain.
2. The patient truly cannot avail his death-and is now lying on his death-bed.
3. There is no other way to remove or relieve the patientôs physical pain.
4. The patient himself has permitted the reduction of his own life. In this case, a putative intent such as the witness of his family member in not enough.

China:

In the Republic of China, the problem of euthanasia, especially active euthanasia, is in dispute[15]. The major opinion in China is that

euthanasia should be strictly controlled by legislation. On the other hand, minor opinion insists that euthanasia is illegal and against vocational ethics of physician. Prof. Jia, a Faculty of Forensic Medicine, China Medical University narrated a case of mercy killing. A husband handed over a cup of pesticide to his wife. She had been long asking him to let her die because of incurable disease. The husband could not find sedatives and thus gave her pesticides leading to her early death. After the death of the wife, her ñlast will and testamentò to her children was found, which mentioned that ñplease do not hate your father. I myself asked him to let me die with ease, because this is the only way for me to be released from painò However, contrary to her last will, the husband was given a three year prison sentence for abetment of suicide. Prof. Jia personally considers that the allowable way of euthanasia is to exclude pain if a person suffers from the pain unendurably and for the present, he is opposed to the legislation of euthanasia, because of the necessity for further discussion and the careful insight into accompanying, unexpected bad results.

Sri Lanka:

In Sri Lanka, the law does not permit a physician to terminate a life at the request of the patient, even if such patient is in grave pain and suffering from an incurable disease[15]. A physician can only give drugs to relieve pain and cannot give on overdose to terminate life. Itôs true that Asian people have their own cultural background, but the problem of euthanasia is now discussed as in European countries, and the movement for the legislation of euthanasia has appeared as well.

The Death With Dignity Act, 1994[16]:

The Death With Dignity Act, 1994 of the State of Oregon, US and the Northern territory of Australia which was however overturned by Australian senate in 1997. The state of Oregon accepts assisted suicide request for residents aged 18 or over with terminal illness. Initiative 1000(I -1000) of 2008 established the US state of Washingtonôs Death with Dignity Act which legalizes PAS with certain restrictions. Passage of this initiative made Washington the second US state to permit terminally ill patients to determine the time of their death.

Famous Euthanasia Cases across the World:

Karen Ann Quinlan Case:[17]

Karen, a 21 year-old girl, fell in to coma after imbibing an over dose of alcohol and drugs on 15th April, 1975. She passed in to persistent vegetative state, from which recovery was extremely remote. Her parents, both deviant Roman Catholics, were initially hopeful of a miracle, but as the months passed by, they realized that this was only wishful thinking and that their daughter was never going to come back to meaningful existence. They requested that life support systems prolonging the futile ordeal be switched off. The doctors attending the case refused, and the issue was taken to court. In 1976, the New Jersey Supreme Court delivered a verdict in favour of Karen's parents. However, while the supports system were subsequently switched off, artificial feeding was not stopped and Karen continued to ólive ô for nearly 10 more years before her heart finally stopped in 1985. The case, however, served to focus attention as a topic that had for decades been considered taboo.

Terri Schiavo Case: (1990-2005)[18]

Terri Schiavo collapsed in her home in Florida due to sudden cardiac arrest, on 25th February 1990. She suffered massive brain damage due to lack of oxygen and after two and half months in coma, her diagnosis was changed to óvegetative stateô For the next few years, doctors attempted speech and physical therapy and other experimental therapy, hoping to return her to a state of awareness. In 1998, Schiavoôs husband, Micheal, petitioned the court of Florida to remove her feeding tube. He was opposed by Terryôs parents, Robert and Many Schindler, who argued that she was conscious. The court determined that she would not wish to continue life prolonging measures and on 24th April 2001, her feeding tube was removed for the first time, only to be reinserted several days later.

On February 2005, county judge ordered the removal of Terri Schiavoôs feeding tube. Several appeals and federal government intervention followed, which included U.S

President George. W. Bush returning to Washington DC to sign legislation designed to keep her alive. After appeal, though the Federal Court system upheld the original decision to remove the feeding tube, staff at the hospital where Terri was being cared for, disconnected the feeding tube on 18th March 2005 and she died on 31st March 2005.The Schiavo case resulted in a big, boost to the activism of prolife movement and disability right group. This case differed from Quinlan case by involving settle law rather than breaking new legal ground on the right-to die

Aruna Shanbaug case:[19]

Aruna Shanbaug (alternatively spelled Shanbhag), was a former nurse from Haldipur, Uttar Kannada, Karnataka, in India. In 1973, while working as a junior nurse at King Edward Memorial Hospital, Parel, Mumbai, she was sexually assaulted by a ward boy, Sohanlal Bhartha Walmiki, and has been in a vegetative state since the assault. On 24th January 2011, after she had been in this status for 37 years, the Supreme Court of India responded to the plea for euthanasia filed by Aruna's friend - journalist Pinki Virani, by setting up a medical panel to examine her. The court turned down the mercy killing petition on 7thMarch 2011. However in its landmark judgment, it allowed passive euthanasia in India.

On December 17th 2010, the Hon'ble Supreme Court, while admitting the plea to end the life, made by activist-journalist Pinki Virani, sought a report on Shanbaug's medical condition from the hospital in Mumbai and the government of Maharashtra. On 24th January 2011, the Supreme Court of India set up a medical panel to examine her. The three-member medical committee, checked upon Aruna and concluded that she met "most of the criteria of being in a permanent vegetative state". However, it turned down the mercy killing petition on 7th March 2011. The court, in its landmark judgement, however allowed passive euthanasia in India. Shanbaug died from pneumonia on 18 May 2015 after being in a persistent vegetative state for nearly 42 years.

Pinki Virani's lawyer, Shubhangi Tulli, ruled out filing an appeal stating "the two-judge ruling was final till the SC decided to constitute a larger bench to re-examine the issue". Pinki Virani herself stated, "Because of this woman who has never received justice, no other person in a similar position will have to suffer for more than three and half-decades[19].

Current Legal Status in India:

Justice Markandey Katju, in the recent Aruna Shanbaug case opined that:

ñEuthanasia is one of the most perplexing issues which the courts and legislature all over the world are facing today. This court in this case, is facing the same issue and we feel like a ship in an uncharted sea, seeking some guidance by the light thrown by the legislations and judicial pronouncement of foreign countries, as well as the submission of learned counsel be with us[19]ò Judicial opinion acknowledges that Euthanasia is a ógray areaôin Indian criminal law.

Article 21 of the Indian Constitution:[19]

Article 21 of the Indian Constitution states ôNo person shall be deprived of his life or personal liberty except according to the procedure established by lawô has been the central point of discussion in the debate over euthanasia in India." The moot question for consideration has been ñwhether right to life under Article 21 also include right to die?ò

Right to life does not mean mere animal existence, but it includes a dignified or qualitative life. Article 21 of the Constitution envisages, Right to preserve one's life and personal liberty. However I.P.C section 306 and 309[21] which punish abetment to suicide and attempt to commit suicide respectively were found to be the two important provisions in the way of having a legal right to die.

Medical Council of India regulations on euthanasia[20]

The Medical Council of India, notification dated 11th March 2002 states[21]:

In exercise of the powers conferred under S. 20A, read with S 33(m) of the IMC Act 1956 (102 of 1956) the Medical council of India, with previous approval of the central government here by makes the following regulation relating to Professional Conduct, Etiquette and Ethics for registered medical practitioners. Under this regulation, Chapter 6.7 deal with Euthanasia.

Practicing euthanasia shall constitute unethical conduct.

Recommendations and Conclusion:

Euthanasia must be considered as a separate and distinct entity and must never be confused with suicide. Terms such as physician assisted suicide, which can mislead, must be substituted with more acceptable terminology for e.g: physician-assisted euthanasia. In the debate revolving around euthanasia, religion and moral tenets must not be allowed to take center stage. The issue must be debated purely on ethical, psychological and scientific lines.

In physician assisted killing and euthanasia, todayôs emphasis is on patientôs rights as being superior to physicianôs right or societyôs beliefs. The person should have the right to die with dignity and to die without suffering, just as people have the right to live with dignity. The quality of life in an issue that must be incorporated in all cases where the life of a person is prolonged indefinitely by artificial means.

To force a patient to be kept alive in a vegetative state when medical opinion is certain that there is no chance of recovery, is cruel both on the patient and his/her family and friends. The law must therefore clearly allow, for euthanasia-both active and passive-in such situations. There must however be very strict safe guards to ensure that the provision is not misused by people, who may benefit from the death of the patient.

The Judiciary, legislating bodies, medical fraternity and community at large should understand the current concepts and rectify certain well entrenched misconceptions in this regard. This is especially true for a country such as India which is composed of diverse religions communities, tradition, customs and belief. It is high time that India legalizes physician assisted suicide and be a part of the handful of nations that allows euthanasia ongrounds of compassion and maintaining the dignity of the individual.

Conflict of interest: None

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References:

1. Lalith Kishore. ôMercy killingô Pros and cons. available at http://www.merinews.com/catfully sp. Accessed on: 10th May 2016. Passive euthanasia - A relook. available from: http://164.100.47.132/ paper laid files/Law and Justice /report 241.pdf. Accessed on: 10th May 2016
2. Pillay VV. Euthanasia. In Text Book of Forensic Medicine and Toxicology. 17th Ed. Hyderabad , Paras Medical Publisher 2016.p.48
3. K.Kannan. Ed. Modi's A Text Book of Medical Jurisprudence and Toxicology. Lexis Nexis. 25th Edn. 2016, Appendix 3; 343-44.
4. Emanuel EJ, Battin MP. What are the potential cost saving from legalizing physician assisted suicide? New Eng J Med. 1998;339: 167-72.
5. Pillay VV. Euthanasia; legal, social, and humanitarian aspects. Recent Advances in Forensic Medicine and Toxicology. G. Biswas. Ed. Health Sciences Publisher. Jaypee New Delhi 3:46-7,55.
6. Emphasis added http: // nktiuro.tripod.com/hippocras.html Accessed on: 10th May 2016
7. Sangeetha Mugunthan. A constitutional perspective of euthanasia and ó right to dieô Karnataka Law Journal, Part 3, Feb 2006 p.10.
8. Flamm A & Forster H. Legal limits when does autonomy in health care prevail? Michael Freeman, Andrew Lewis. Eds. Law and Medicine vol3 Oxford university press. 2000 p.142.
9. Spitti Sarkar. Right to Die ï To be or not to be? available at http://www.legalserviceIndia .com/article/die.html. Accessed on: 10th May 2016
10. Smartt U. Euthanasia and the law, Crime law Justice weekly. 2009: 173:100
11. Legaity of Euthanasia. available from: http//legality of euthanasia. Accessed on: 10th May 2016
12. Verhagen Sauer PJJ. The Groningen protocol - euthanasia in severely ill newborn. N Eng J. Med. 2005;352:959-62
13. Cheng M. Belgium moves to make euthanasia legal for children, dementia patient. Available from http// life.national post.com/2013,10/31Belgium moves to make euthanasia legal for children-dementia patient. Accessed on: 10th May 2016
14. Ohshima T. Present situation of euthanasia in Japan/Asia. J Fore Med Toxicol. 1999;16:15-6.
15. Kinney HC, Korein J, Panigrahy A, Dikkes P, Goode R. Neuropathological findings in the brain

of Kaern Ann Quinlain-the role of thalamus in persistant vegetative State. New Eng J Med. 1994;330:1469-75.

16. Cranford R. Facts, lies and videotapes. The permanent vegetative state and the sad case of Terri schiavo. J Law Med Ethics. 2005;p.363-71
17. Aruna Shanbaug VS Union of India and Ors. Decided on 7thMar 2011. http://ibnlive.in.com/new full text Supreme Court judgment-on-Aruna euthanasia. petition/145201-5 3html > accessed on 9.5.16.
18. Bakshi PM. The constitution of India Universal Law Publishing Co Pvt Ltd 12th Ed 2014 Fundamental rights PartIII, Article 21.
19. Indian Penal Code available from http://mha.nic.in/pdfs IPC 1860 pdf
20. KrishanVij. Text Book of Forensic medicine and toxicology Elsevier 2011; 5th Ed. pp 356.
21. MCI-211(2)/ 2001/New Delhi dated 11thMarch, 2002

Case Report

Disguising the Gender Identity and Committing Crime In Delhi: A Case Report

[1]Abhishek Yadav, [2]Mahesh Kumar, [3]Mansi Kumar, [4]Adarsh Kumar, [5]Sudhir K Gupta

Abstract

"Eunuchs" "Hijras" as they are called in India, are the persons who are neither male nor female. Many times, some males disguise their gender identity by posing as the third Gender and extort money from people on red lights and rob the general public. We report a case where a person posing as a eunuch was apprehended by police in a case of assault, but, after medical examination, turned out to be a male cross-dressing as a female. Honourable Supreme Court of India had recognized "Eunuchs" "Hijras" as "third gender" and had directed the Government to take steps for their welfare and extend all kinds of reservation in admission in educational institutions and for public appointments. So, it will be very important to differentiate the real gender ambiguity from the fake ones. The authors, considering the same, intend to increase awareness among medical professionals to adopt the proper procedure for determining the sex in an individual.

Key Words: Intersex, Eunuchs, Third Gender, Barr Body, Karyotyping.

Introduction:

"Eunuchs" "Hijras," are the persons who are neither male nor female and are present in the all the societies and countries.[1] In India, due to ambiguity of their gender, they can be seen asking people for money in public places like buses, traffic intersections, trains, marriages, functions etc. Many a times, some males disguise their gender identity by cross dressing and make-up like females and pose as the Third Gender individual. They extort money from people on red lights and rob the general public. When they are caught under criminal charges, the genuineness of their gender ambiguity poses a problem as the police face the question whether to detain them with males or with females. We report a case where a person posing as a eunuch was apprehended by police in a case of assault but after medical examination turned out to be a male cross-dressing as a female.

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Case History and Findings:

A patient was brought in police custody to Casualty, JPNA Trauma Centre, AIIMS, New Delhi, on charges of being involved in a case of assault. On General Physical Examination, the person was found to have three abrasions - two over the cheek, along with swelling; and one over right little finger. One laceration was present over head. GCS was 15 and all the vitals were within normal limits. The patient was discharged from casualty and brought to the Department of Forensic Medicine & Toxicology, AIIMS, for medical re-examination and sex determination.

On examination, the patient was wearing female kurta and blue jeans, weighing

54kg, height 159cm, chest circumference 82cm, and abdominal circumference 80cm. Breast development was Tanner stage zero with no gynecomastia **(Image-1)**. Scalp hairs were 45cm long, brown black, having made ñJudahòwith two plastic hair clips. Three tattoos were found on different sites. One tattoo mark of size 12x8cm, ñButterflyò shaped, was present over left lower abdomen, the second was 11x22cm in size, ñFlowerò shaped, present over lower back midline and the third, ñFairyò shaped, was present over right scapula. General physical examination along with systemic examination, was normal. No fresh external injury was present over the body. All the injuries were consistent with the first MLC made in JPNA Trauma Centre.

On local examination of external genitalia, Pubic hairs were of normal pattern and distribution (rhomboid), black, curly ranging 2.5 to 3cm **(Image-2).** Secondary male sexual characteristics were well developed. Penis was of normal adult size, circumcised and smegma was absent. The length of flaccid penis was 8cm and circumference was 7.5cm. Scrotal sac was having normal rugosities and both the testes were present at the bottom of scrotal sac. A tissue defect of size 0.3x0.3cm was present over the penile skin near the root, which on questioning, was informed that it was present since birth, with no discharge or urination. Blood sample for Karyotyping analysis had been preserved in Genetic Laboratory; AIIMS which when processed by ôG-Banding Method,ô came out to be of ôMALE KARYOTYPEô **(Image-3)**.

After medical re-examination and Karyotyping, it was opined that the alleged person was a male, both, phenotypically as well as genotypically.

Discussion:

Disorder of Sex development or Intersex is an intermingling in one individual of characters of both sexes in varying degrees including physical form, reproductive organs, hormonal profile and sexual behaviour, which results from some defect in the embryonic development.[2-6] Concealed sex is hiding oneôs sex by wearing dress of the opposite sex, done often by criminals to avoid being caught by the police.[2-6]

The determination of sex in living individuals can be based on presumptive evidence which is outward appearance of an individual and cannot be relied upon in concealed sex. Probable evidences are based upon secondary sexual characters.[6] But in cases of intersex like Female Pseudohermaphroditism, also known as 46 XX DSD, the external examination will not lead to a proper scientific conclusion.[2-6] Then, the individual should be examined for the presence of testis and ovary, ôDavidson bodyô (polymorph nuclei demonstrating an additional lobe rarely found in males), 'Barr body' or sex chromatin found in females and chromosomal analysis. The diagnosis of the patient in the present case was confirmed after Karyotyping report and he was found to be a male, both genotypically and phenotypically.

Besides Criminal offences, the question of sex determination can arise in the cases of heirship, marriage, divorce, legitimacy etc.[4] In 2014, the Honourable Supreme Court of India, recognized Hijras and Eunuchs, as ñthird genderò.[7] The Centre and the State Governments were directed to take steps for their welfare like HIV Sero-surveillance Centres, medical care in the hospitals and provide them separate public toilets etc. The court also ordered the State to take steps to treat them as socially and educationally backward class and extend all kinds of reservation in admission in educational institutions and for public appointments. If the order of the Honourable court is implemented then it will be very important to differentiate the real third gender from fake individuals. The authorities will ultimately resort to Medical Help for the determining the gender ambiguity of the persons claiming to be from the third gender. The authors, considering the same, intend to increase awareness among Medical professional to adopt the proper procedure for determining the sex in an individual, which should be confirmed by Karyotyping and other suitable methods, so as to prevent any misdiagnosis and administration of natural justice.

Conflict of interest: None
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References:

1. Sharma P. historical background and legal status of third gender in indian society. International Journal of Research in Economic & Social Sciences. 2012; 2(12):64-71.
2. Rao NG. Textbook of forensic medicine and toxicology. 2nd Ed. New Delhi: Jaypee Brothers; 2010. Chapter-11; Forensic Identity: p 83-90.
3. Aggarwal A. Textbook of forensic medicine and toxicology. New Delhi: Avichal Publishing Company; 2014. Chapter-3; Identification: p 63-66.
4. Reddy KSN, Murty OP. The essentials of forensic medicine and toxicology. 33rd Ed. New Delhi: Jaypee Brothers; 2014. Chapter 4; Identification: p 297-331.
5. Mahanta P. Modern textbook of forensic medicine & toxicology. New Delhi: Jaypee Brothesr: 2014. Chapter 5; Identification: p 73-79.
6. Pillay VV. Textbook of forensic medicine and toxicology. 17th Ed. Hyderabad: Paras Medical Publisher; 2016. Chapter 4; Idntification: p 62-66.
7. Writ Petition (Civil) 604 of 2013. Honourable Supreme Court of India. 2014 Apr 15 [Internet]. Cited 2016 Dec 28. Available From: http://supremecourtofindia.nic.in/outtoday/wc40012.pdf

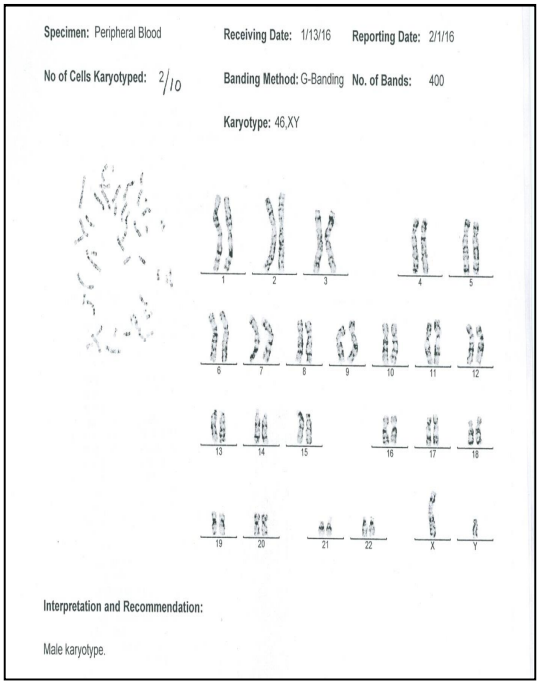
Image-1

Local examination showing Male Genitalia

Image-2

Examination of Secondary Sexual Characters

Image-3: Karyotype report of Patient



Case Report

Postmortem Diagnosis of Fat Embolism Syndrome – A Rare Case Report

[1]Nitin S. Ninal

Abstract

Fat embolism means occlusion of blood vessels by fat globules, which is invariably seen in almost all cases of long bone fractures, whereas, fat embolism syndrome (FES) is nothing but the clinical manifestations resulted due to fat embolism affecting different organ systems. Much literature is not published regarding the FES in Indian context. Post-mortem diagnosis of FES is primarily based on microscopic findings and usually is a diagnosis of exclusion. A case of 21yrs young male involved in a road traffic accident and who sustained a long bone fracture and died within 12hrs of insult, after developing acute respiratory distress, is being presented. Diagnosis was made on the basis of clinical records, autopsy and microscopic findings. As Postmortem diagnosis of FES is rarely done in our current set up of forensic practice, this case is being reported.

Key Words: Postmortem examination, Fat embolism, Fat Embolism Syndrome, Long bone fracture.

Introduction:

In 1873, Bergman was first to establish the clinical diagnosis of FES.[1] Fat embolism develop in nearly all cases with long bone fractures or during orthopedic procedures but are usually asymptomatic.[2] It can also be observed in cases of non-traumatic conditions like pancreatitis, diabetes mellitus etc.[1] FES characteristically shows the triad of dyspnoea, altered sensorium and petechiae over skin.[3] According to the theory proposed by Gauss in 1924, trauma to long bones releases fat droplets by disrupting fat cell in the fractured bone or adipose tissue. These fat droplets enter the torn veins near the long bone. This occurs when the intramedullary pressure is higher than venous pressure. Fat droplets are then transported to pulmonary vasculature where it causes mechanical obstruction and are trapped as emboli in lung capillaries. Further small droplets of 7 - 10 $^{1/4}$m size may pass through the lung and reaches systemic circulation causing embolisation to brain, skin, kidneys or retina.[1] However, in routine clinical set up, FES is rarely diagnosed at the required point of time and that is why meticulous postmortem examination is required for to reveal the FES.

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Case Report

A dead body of 21 yr young male was brought to the mortuary of the institute, with history of road traffic accident at around 11.30pm. After going through the inquest papers and medical records, it was noticed that without getting primary treatment at nearby hospital, over the night the patient was shifted to a (250kms) private hospital where he had received further treatment and was planned for the operative intervention of open reduction with internal fixation. Till then patient was stable. Suddenly he developed acute respiratory distress and altered sensorium. He was resuscitated for the same but could not be revived and succumbed the injuries in the morning at about 9.30am.

On external examination, it was the body of an average built and moderately nourished young adult; rigor mortis was well

marked over the head, neck, face and upper limbs and was partly present in lower limbs. Reddish purple colored post-mortem lividity was present over the back of the body on dependent parts, except over pressure areas and it was not fixed. Cyanosis was appreciated in finger nails. Deceased was having multiple fresh graze abrasions of sizes ranging from 2x1cm to 7x3cm over left thigh, left knee, left leg and left great toe. Also he was having hematoma measuring about 10x8cm over antero-lateral aspect of left thigh at its middle third, without any externally visible deformity. On palpation; closed, displaced fracture of left femoral shaft was noted. No other injury was present. On internal examination, there was no injury to the visceral organs. The only significant finding was cerebro-pulmonary edema with petechial hemorrhages over lung surface. Initially, opinion was reserved as to the provisional cause of death and organ pieces were preserved in 10% formalin for histopathological examination.

On histopathological examination of both lungs, (**Image -1**), there was extensive alveolar edema, multiple fat emboli in pulmonary blood vessels occluding most of the luminal part, lipophage and neutrophilic infiltration in interstitium with hemorrhagic pulmonary infarction. Extensive cerebral edema was noted in brain. Final cause of death was given as ñDeath due to fat embolism syndrome following fracture of left femurò

Discussion:

Mere fat embolus and FES are two completely different entities and it requires expertise to diagnose FES. Much literature is not published in Indian context regarding the postmortem diagnosis of FES. However, post-mortem diagnosis of FES is primarily based on microscopic findings and it is a diagnosis of exclusion. As such, exact incidence of FES is not known, but many a times, fat embolism and milder forms of FES may go clinically undetected, and in obvious clinical situation, the diagnosis is overlooked. This is highlighted in the study of Georgopoulos, et al, by the fact that incidence of clinically detected fat embolism was only <1% where as the incidence rose to up to 20% with the help of post mortem examinations.[4] In an Indian study, a level I trauma center in India, after retrospective analysis of case records of 1,692 patients, reported an incidence of FES as 0.7%.[5] FES is more frequent in closed, rather than, open fractures. Patients with a single long bone fracture have a 1 to 3 percent chance of developing the syndrome and it increases in correlation with the number of fractures. Johnson, et al, has noted FES in up to 33 percent of patients with bilateral femoral fractures.[6] Similarly, in the present case, the deceased was having closed fracture of femoral shaft, suggestive of more chances of developing the FES.

The time required to develop FES is between 12 -72 hrs after the initial injury. Rarely, cases occur as early as 12 hrs or as much as 2 weeks later.[7] It was found to be about 12 hrs in this case, which indicates early development of FES. Early immobilization reduces the incidence of FES and the risk is further reduced by operative correction rather than conservative management.[1] Similar case was presented by Cuculic D, et al, stating that fatty droplets mostly observed in lung and brain capillaries remain the diagnostic standard.[8] The postmortem diagnosis of FES, traditionally based on the histological demonstration of fat globules seems not to be enough, nowadays. A quantitative analysis of size and localization of the fat emboli has been discussed as reliable method of grading the pulmonary fat embolism in order to determine its relative functional contribution in death pathogenesis.[8]

In conclusion, though fat embolism is invariably present in most of the cases of long bone fracture, one should have a high index of suspicion to diagnose the FES clinically. Simultaneously early immobilisation and immediate intervention also plays an important role in development of FES, absence of which could have been one of the possible factors to develop FES in this case.

Acknowledgement:

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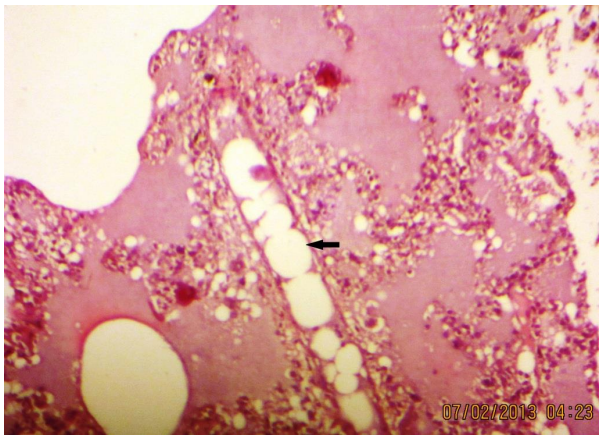
References:

1. Jain S, Mittal M, Kansal A, Singh Y, Kolar PR, Saigal R. Fat embolism syndrome. J Assoc Physicians India 2008;56:245-49.
2. N. Shaikh, A. Parchani, V. Bhat, M. A. Kattren. Fat embolism syndrome: Clinical and imaging considerations: Case reports and review of literature. Indian J Crit Care Med 2008;12(1):32-36
3. J. George, R. George, R. Dixit, R. C. Gupta, N. Gupta. Fat embolism syndrome. Lung India 2013;30(1):47-53.
4. Georgopoulos D, Bouros D. Fat embolism syndrome - clinical examination is still the preferable diagnostic method. Chest. 2003;123:982-3.
5. Gupta B, Dsouza N, Sawhney C, Farooque K, Kumar A, Agrawal P, et al. Analysing fat embolism syndrome in trauma patients at AIIMS apex trauma centre, New Delhi India. J Emerg Trauma Shock. 2011;4:337-41.
6. Johnson, MJ, Lucas, GL. Fat embolism syndrome. Orthopedics. 1996;19:41.
7. Carr J, Hansen S. Fulminant fat embolism. Orthopedics 1990;13:258-61.
8. Cuculiĺ D, Stemberga V, Coklo M, Sosa I, Stifter S, Bosnar A. Trauma related fat embolism syndrome in forensic practice. Coll Antropol. 2010.;34(2):723-6.

(Image – 1) Arrow showing fat emboli completely occluding the pulmonary vessel



Case Report

Anaphylactic death due to multiple bee stings – A Case report

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Abstract

Among the unnatural deaths, those occurring due to insect bites are uncommon and fatality due to bee sting is even rare. Though bee stings may be routinely encountered, specifically among rural population residing in close proximity to dense forests, they are rarely seen in urban areas. But, Chandigarh, even though an urban area, but having one of the highest 'green cover' in the country, is not a stranger to bee sting cases. In most of the cases, the sting causes local reaction; occasionally, a life threatening anaphylaxis may occur leading to death. In general, multiple bee stings are rare, may be caused by a particular group of so called 'Africanized' honeybees, as they usually attack in a swarm. Deaths due to massive envenomation have also been reported in literature among the affected individuals. Fatality in such cases is attributed to systemic anaphylactic shock, suffocation, worsening of pre-existing disease or Disseminated Intravascular Coagulation (DIC) following multisystem involvement. Here, we report a case of death due to anaphylactic shock following multiple bee sting injuries caused by a swarm of bees. The associated postmortem features of anaphylaxis, various methods and their significance of establishing the diagnosis are also discussed.

Key Words: Multiple bee stings, Anaphylaxis, Autopsy, Histo-pathology Examination

Introduction:

Bee and wasp stings are a well-known form of envenomation in the tropical countries like India. They are included under class Insectawhich mainly comprises of three orders - namely - Hymenoptera, Lepidopetra and Coleopteran. Order Hymenoptera, which includes two membranous winged flies, is further divided *Vespoidea* (Wasps, Yellow hornets), Formicidea(Fire ants) and Apoidea (honey bees). Hymenoptera stings are commonly caused by honey bee (Apismellifera), hornets (Vespa &Dolichovespula species), paper wasp, European wasp and yellow jackets.[1]

Honey bees are usually found in colonies in form of large nest under caves, hollow cavity and branches of trees and in wall cavities. They have bright yellow body, black markings on the abdomen and are usually 10 to 15mm in length with barbed sting.They can bite only once as the sting gets embedded in the skin, whereas the wasps and hornets can sting multiple times.Bees mostly attack when disturbed or provoked.[1,2] In general, presence of detached sting in the skin is a sign of honey bee sting, because the stings of wasps and hornets do not usually detach.[3]

Usually, bees are associated with highly painful stings, leading to intense local reaction, some extending to cause systemic allergic reactions. The severity and duration of a reaction following stinging can vary from person to person. In addition, sometimes one's own reaction to a bee sting may differ between occurrences.[2] Unusually, they may result in systemic anaphylaxis leading to death, however this often remains un reported due to under

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recognition of associated features or non availability of proper history. Very rarely, they could be associated with fulminant presentation characterized by rhabdomyolysis, haemolysis, multi-organ failure and disseminated intravascular coagulation, which may be fatal.[4,5] The mortality rate due to bee sting was estimated to be approximately 1-5 % in different countries.[6]

Recently, it was found that most of multiple bee sting injuries are caused by African subspecies *Apismelliferascutellata*, the so called ñKiller beeò, which attacks in larger numbers with less provocation and with great persistence. A number of about 500 stings have been considered necessary to cause death by direct toxicity, but as few as 30-50 stings have been proved to be fatal in children. Honey bee venom, known as apitoxin, is a bitter colourless liquid; the active portion of the venom is a complex mixture of proteins including mellitin, which alters capillary permeability and causes local inflammation, lowers blood pressure and acts as an anticoagulant as a whole. Other components include vasoactive amine (dopamine, histamine), Phospholipase A, Acid Phosphatase, minimine (cause local pain), apamine, neurotoxin, toxic Peptide 401 (mast cell degranulating peptides) except serotonin, which is present in wasp venom.About 4% of the human population is hypersensitive to Hymenoptera venom.[1]

We report a rare caseof death due to anaphylaxis, following multiplestings by a swarm of bees.

Case report:

A 48 years old unemployed man, who used to stay on the platforms near aGurudwarain Chandigarh, was stung by a swarm of honey bees. As per history provided by the I.O, the deceased was taking rest on the pavement that evening, when two passers-by threw stones over ahoney bee nest on a nearby tree and ran away. Following this,the bees were disturbed, and the whole swarm rushed and attacked the man. He shouted out for help, ran towards the public convenience nearby and eventually sat below the running tap water to get rid of them. After about 15- 20 minutes, he fell down unconscious. The man was taken by abystanderto the Emergency of our institute, where he was declared 'brought in dead'. **(fig. 1)**Since the deceased was a vagabond and could not be identified, post mortem was conducted 72 hours later; also, previous history of bee and wasp bite could not be ascertained.

On post-mortem examination, few dead honey bees were found over him and inside the layers of his clothing**. (fig. 2)** Early decomposition changes over face, upper one third of chest and upper arms were present. External examination of the body showed more than 70 stings all over, mainly involving the exposed parts of the body; predominately on the scalp, face, neck, upper limbs and trunk. Swelling and multiple bullae with purpuric lesions of upper arms were noticed. **(fig 3 & 4**).

On further internal examination, larynx was found to be congested and oedematous. Grossly, heart was unremarkable and the other organs such as lungs, liver, kidneys were congested in appearance. These were sent for histopathological examination, which revealed acute tubular necrosis of kidneys, while rest of organs were found to be unremarkable.Chemical and toxicological analysis of routine viscera showed negative result for any poison /venom/ intoxicating substance.

After perusal of all the findings obtained during crime scene investigation, autopsy, histopathological examination and chemical analysis; cause of death was opined to be due to anaphylaxis as a result of multiple bee sting envenomation.

Discussion:

Anaphylaxis following insect bites and stings leads to vascular or respiratory reactions, severity of this reaction dependents upon individualõs response and nature of incidence.[2]Among these, bee sting usually has 35-60% chance of causing anaphylactic shock in priorly sensitized cases.[3]

Generally, stings of mouth, face and neck cause oedema of larynx, pharynx and leads to respiratory distress by obstruction. Often the anaphylactic reaction may occur immediately or within 20 minutes, and manifest as respiratory distress, faintness, and unconsciousness, leading to death in about 2 to 15 minutes.[1,3,7] On postmortem examination of anaphylactic deaths, external signs are rare and

usually unremarkable; very rarely,it presents with skin rashes, petechial haemorrhages or distinctive marks of insect bite; also internal organs would be congested.[8] All these findings are consistent with our case; however, due to delay in conducting the post mortem examination, oedema in upper respiratory could not be appreciated.

Also,there could be exacerbation of underlying disease or wide range of delayed effects are likely to be manifested upon the patient who has been stung - like serum sickness, polyradiculomyelitis, seizures, acute renal failure, haemolysis, thrombotic thrombocytopenic purpura(TTP), DIC, cardiac arrhythmia or myocardial infarction (MI) in previously normal person ï Kounissyndrome.[2,5,9,10,14]However, none of them could be demonstrated in our case due to very short survival time.

As per the case described by Rastogi, et al, a 71year old male labourer was stung by a swarm of bees accidentally while returning home, following which he developed local reaction like intense pain and redness immediately, and after 24 hours, he developed systemic complications like rise of temperature, chills and swelling of limbs and was unable to move from bed. He was admitted to the hospital with hyperpyrexia, hypotension, unconscious and died during the course of treatment shortly.Autopsy revealed anaphylactic shock with vascular changes.He observes that Type 1 hypersensitivity reaction, mediated by IgE at site of bite, and type III hypersensitivity reaction, mediated by immune complex deposition, systemically leading to vascular changes like DIC and finally to death.[6]

Another case, described by Gorge P, et al - a 22 year old male woodcutter from Himachal Pradesh was stung by numerous wasps, around 100 in number,predominately over face, neck and upper limbs, for which he took symptomatic treatment in nearby local hospital. 36 hours later, he developed complication and got admitted in higher centre in restless, irritable manner with icterus and hepatomegaly.Complete biochemical study was conducted and he was diagnosed as DIC and rhabdomyolysis following wasp envenomation; during the course of treatment on 9th day, the patient expired.[4]

Acute renal failure, being one of the rare complications following bee sting, may directly be related to insect bite, leading to acute interstitial nephritis or rhabdomyolysis induced tubular injury.[4,11,12] In our case, histopathological examination of kidneys showed acute tubular necrosis, which appears to be a co-incidental finding rather than a direct cause, as the deceased collapsed within a short interval of 20 minutes; this pre-existing kidney disorder could have attributed to the fatality.

Potential importance of post-mortem investigations like serum radio-allergo-absorbent testing(RAST) for IgE and tryptase levelsstill remains controversialin diagnosing deaths related to bee venom.[3] In cases of massive envenomation, RAST levels increase, a level of more than 2 indicates significant sensitivity, warranting anaphylaxis as the cause of death; tryptase levels on the other hand are 100 % specific to anaphylaxis in case of suspected bee stings. This enzyme is a mast cell specific protease regularly released on degranulation, and is raised in anaphylaxis, normal value of tryptase being 13.5 mcg/l. However, main disadvantage of these tests are that serum samples have to be collected within 3 hours following death and should be stored in a temperature below 21°c, which most of the time is not possible in cases of unexpected deaths.[3] Here, even in our case, delay in conducting postmortem examination,along with presence of decomposition changes negated the chances of sending samples for same.

In Sweden, a retrospective study of 10 years regarding human fatalities caused by wasp and bee stings showed 19 fatalities due to wasps and 1 due to bees; that gave an annual incidence of 0.2 per million inhabitants. Among the fatalities, most of the deceased were 50 and above, associated with underlying cardiovascular disease, history of previous severe reactions after insect stings were uncommon.[13]Another retrospective study in Australia showed a fatality rate of 0.02% per million population per year.[14]

In 2001 an observational study on bee sting related deaths in South Australia was conducted and the following information was

released: -a) bee sting related deaths are rare and unnoticed, b) bee sting related deaths are classified into three types - i) bee sting órelated deathsô in which the stings are involved in the mechanism of death, but not the exact cause of death, ii) systemic reaction or anaphylactic deaths, which include deaths due to IgE mediated reactions, iii) mass envenomation due to multiple stings, a rare one.[3]

Multiple bee sting injury leading to mass envenomation is almost always fatal, irrespective of the status of previous sensitization.It is an acute medical emergency warranting active intervention inorder to prevent death.[15,16]Hence, any patient sustaining multiple bee stings is to be kept in observation for at least 6 hours as there is a potential risk to develop anaphylaxis and multi-system involvement, particularly respiratory and renal failure.[15]Laboratory evaluation for haemolysis, thrombocytopenia, liver and renal abnormalities, CK levels and rhabdomyolysis should be carried out. Parenteral adrenaline is the treatment of choice for counteracting anaphylaxis along with presence of airway support, antihistamines, steroids, bronchodilators, IV fluids and ionotropic agents.[16]

Preventive measures like frequent cleaning of garbage, surrounding areas and decaying cans attracts less bees, sealing off wall cavities, removing with help of bee keepers, killing bees with 1-3% foam or detergents; following exposure, remove the stings immediately and shift the patient to hospital for observation. In addition, individuals allergic to such stings should carry auto injectors of adrenalin for self-administration.[17]

Conclusion:

Even though honey bee sting is a common case in emergency department, multiple bee sting injury envenomation is an acute medical emergency and is usually fatal, and, hence needs immediate managements. Mass envenomation by multiple bee stings are one of the most important cause of sudden deaths and negative autopsies.Mass envenomation by bee stings is a rare case and ours is one among those cases.

We wish to bring it to the notice and awareness among medical professionals for early mitigations, proper treatment, to avoid complications and fatality.

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References:

1. Pillay VV. Venomous bites and stings. Comprehensive Medical Toxicology.2nd Ed. Hyderabad. Paras Publishing; 2008:997-1001.
2. Anolay Nezih, Nihat Arslan M, Kumral Bahadır, Büyük Yalçın. Death caused by honey bee stings: case report. Medicine Science 2014;3(2):1305-14.
3. Riches KJ, Gillis D, James RA. An autopsy approach to bee sting-related deaths. Pathology 2002;34,257-62.
4. George P, Pawar B, Calton N, Mathew P. Wasp sting: an unusual fatal outcome. Saudi J Kidney Dis Transplant. 2008;19(6):969-72.
5. Rachaiah NM, Jayappagowda LA, Siddabyrappa HB, Bharath VK. Unusual case of acute renal failure following multiple wasp stings. N Am J Med Sci.2012;4(2):104-6.
6. Shetty SK, Ullal HG, Kassam ZN, Chidhananda PS, Boloor A, Rastogi P, et al. Death due to massive bee injury- a case report. J Punjab Acad Forensic Med Toxicol. 2012;12(1):33.
7. Reddy KSN, Murty OP. The essentials of forensic medicine and toxicology.33rd Ed. New Delhi. Jaypee brothers medical publishers (P) Ltd. 2014.p.566.
8. Edston E, Hage-Hamsten MV, Postmortem diagnosis of anaphylaxis. In. Forensic Pathology Reviews, Vol.3,Totowa, NJP Humana Press Inc; 2005.p.270-72.
9. Puttegowda B, Chikkabasavaiah N, Basavappa R. Acute myocardial infarction followinghoneybeesting. BMJ Case Rep. 2014. doi:10.1136/bcr-2014-203832. Available from: https://www.ncbi.nlm.nih.gov/pubmed/24729117
10. Schafer T, Vieluf D, Eisenmenger W, Ring. Sudden death after one wasp sting. Allergy and Clinical Immunology News. 1990;2(4):117-8.
11. Atmaram VP, Mathew A, Kurian G, Unni VN. Acute renal failure following multiple wasp stings. Indian J Nephrol.2005;15:30-2.
12. Odinaka KK, Achigbu K, Ike I, Iregbu F. Bee sting envenomation resulting in gross hematuria in an eight year old nigerian male with sickle cell

anemia: Case report. Niger Med J. 2015;56(1):69-70.

13. Johansson B, Erriksson A, Örnehult L. Human fatalities caused by wasp and bee stings in Sweden. Int J Legal Med. 1991;104(2):99-103
14. McGain F, Harrison J, Winkel KD. Wasp sting mortality in Australia. Med J Aust 2000;173(4):198-200.
15. Deshpande PR, Farooq Ahsan KK, Bairy M, Prabhu RA. Acute renal failure and/or rhabdomyolysis due to multiple bee stings: a retrospective study. North American J Med Sci/. 2013;5(3):235-9.
16. Dutta TK, Mukta V. Indian guidelines and protocols: Bee sting. Medicine update 2013(toxicology section 12), published by the association of physicians of India:417-20, available from http://www.apiindia.org/content_mu_2013.html, accessed on 6.10.2016.
17. Mc Gain F, Harrison J, Winkel KD. Wasp sting mortality in Australia. Med J Aust 2000;173(4):198-200..

Fig: 1

Fig: 2

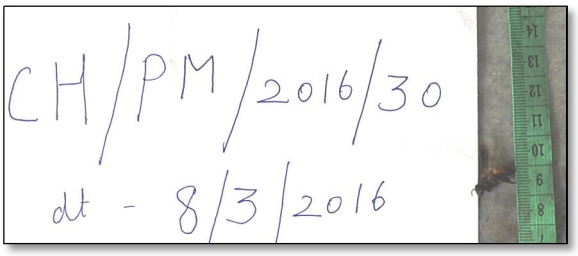

Fig: 3

Fig: 4

Case Report

High Voltage Electric Burn Injury to Penis - A Case Report

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Abstract

History of electricity is not more than 300 years old as also the mortality related to it. With time, the inventions dependent on electricity made humans depend on it. Ever increasing dependency on industry and domestic needs on electricity is also exposing man to the injury by electric current and equipments running on it. The other source of such injury is lightning, which is very much life threatening due to the very high voltage content. An injury due to high voltage is often very morbid in nature due to instantaneous high energy production upon the contact with the surface of the body.

Here we present a case of burn injury due to high voltage transmission wire coming in direct contact with abdominal wall a child leading to burning of the abdomen, scrotum and penis.

Key Words: Electrocution, Burn, Abdomen, Penis

Introduction:

The invention of electricity proved to be a great boon to the human civilization. With time and the inventions based on electricity, almost whole of the mankind became dependent on it. Domestic use of electricity started with the invention on electric bulb, fans and other home appliances. With this, started the injuries and death from electric current. The first recorded death caused by electric current from an artificial source was reported in 1879, when a carpenter in Lyons, France, accidently came in contact with a 250-volt AC generator.[1]

National crime records bureau data showed 10218 deaths from electrocution and that constitute 2.6% of all the accidental deaths, of which 0.7% were by lightening, which forms about 2833 cases.[2] Self electrocution in India accounts for 0.7 % of the total suicides, that is 952 out of 134799 suicide deaths in the year 2013.[2]

Electrical injury is produced by the conversion of electric energy into heat while passing through tissue.

Electrocution, though not very common, is often fatal. It can cause serious injuries and even permanent disabilities in survivors. Clinical manifestation can range from no apparent injury to serious systemic damage.[3]

For wider understanding, electrical injuries are divided into high voltage (> 1000 V) and low-voltage (< 1000 V). Domestic supply is often of low voltage, whereas high voltage supply is usually to the industries. High voltage transmission of electricity is also used for the supply from substation to substation. From the substation it is converted to low voltage (250 volts) for the domestic supply. Most of the high voltage supply is through non insulated wires, which attract injury and accidents. Most of the time, poor maintenance of these wires and non favourable weather conditions lead to injury from broken wires.

High-voltage electrical trauma, which is more common in construction workers, involves a spectrum of lesions ranging from devastating soft tissue and neuromuscular injuries to potentially fatal outcomes such as respiratory arrest due to respiratory centre paralysis or respiratory muscle tetany.[14] In general, the main path physiologic characteristics are varying degrees of

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cutaneous thermal damage combined with extensive destruction of the deeper tissue layers, soft tissue coagulation rhabdomyolysis, and peripheral nerve injuries.[4,5]

With low voltage circuit, neurovascular channels carry the least resistance while muscle, skin and bone have increasingly greater resistance to the flow of current. AC current passing through the large vessels take the heart into the axis of the flow leading to ventricular fibrillation and heart block.[6]

Case Report

A young boy of about 14 yrs was flying kites on his roof and was moving backwards, not realizing that the high tension wire (11000 V) passing by the side of the roof rails. The wire touched the boy at the level of the abdomen and he sustained burn injury to right lower abdomen and genitalia.

This incident happened in the morning about 40 km west from the city Aligarh in a village, district Aligarh, U P. Within short time, patient was brought to the emergency unit of the JNMCH, Aligarh, where he was managed primarily and then attended by emergency surgical team and Forensic Medicine unit.

On examination, from head to toe, it was found that the whole face got 1st degree burns, with 1st degree burns in both the axilla. Injury to the right half of the abdomen, involving right iliac fossa, with a defect in the abdominal wall of about 10 cm by 10 cm leading to the protrusion of the abdominal content, was present (Fig.1). This further extended up to lower external genitalia specially penis.

On detailed examination of the penis and scrotum, it revealed that scrotum sustained 1st degree burns and penis showed a severe burn injury in the shaft, leaving about 1 cm terminal part and glans. It involved whole of the skin, corpus cavernosum, corpus spongiosum and urethra, due to which urinary catheter could not be placed. Burn injury to right great toe showed a punched out lesion, which seems to be very characteristic of the exit wound (Fig.2).

The forensic medicine team did the evaluation of amount and degree of burn injury and then the patient was taken up by paediatric surgery unit for further management.

Discussion:

High voltage electric injury is increasing day by day in our country due to ever increasing population and expanding electrification of rural areas. (Target 109524 villages in the year 2014- 2015 annual report.)[7] Poor quality and maintenance of the high tension wires may lead to their frequent falling on barren or farm lands posing constant threat to farmers and animals.[8] In domestic areas, unauthorized construction of houses around the high voltage transmission wires is a constant and morbid threat to human life.[8] Houses with unauthorized balconies and open roofs invite accidents like fall from height and electric injury.[9]

Low voltage injuries are often lethal as they cause ventricular fibrillation or respiratory arrest, and penetrate skin easily, as against high current flow, which. There may be no external mark of injury in low voltage supply or very minimally burn mark[15]. The energy production in high voltage is proportional to the square of the voltage supplied but it has low skin penetrating power as the amount of current is often very low. The energy produced is often so high (1000 ^{0}C or even more) that it causes severe local burn injury. The most common sites of injury are points of contact and of exit of current. The most common sites of contact with the source include the hands and the skull.[10]

The most common areas of ground are the heels. A patient may have multiple entry and exit points, depending upon the point at which body was in contact with the exit source. Burns in severe electrical accidents often appear as painless, depressed, yellow-gray, punctate areas with central necrosis, or the areas may be magnified.[11] High-voltage current often flows internally and can create massive muscle damage.[11]

The exact path and physiology of electrical injury is not well understood because of the large number of variables that cannot be measured or controlled when an electrical current passes through tissue. With high-voltage injuries, most of the injury appears to be thermal and most histological studies reveal

coagulation necrosis consistent with thermal injury.[12]

In this case, most injuries were surface injuries and this explains how high voltage of short duration cause severe superficial burn. Skin provides high resistance, which often does not allow low current to penetrate. This may explain the total loss of abdominal and injury to the penis. This injury to the penis and scrotum may lead to development of impotency and infertility. This attracts charges grievous hurt in the Indian Penal code system and liabilities may be fixed.[13]

Conclusion

- Electrical burns are the second most common cause of burns.[2]
- Despite the most recent developments in the treatment of high-tension electrical injuries, this type of injury which involves the urogenital system, continues to present high morbidity rates.
- At the time of presentation, documentation of injuries is important, not only for the immediate resuscitation of the victim, but also medico legally.
- Nearly all cases of electrical injuries eventually involve litigation for negligence, product liability, or worker compensation.
- Injury to the urogenital system, specially which affects the potency of male, falls in the first clause of grievous hurt (320 IPC) in India.[13]

Prevention

1. The law needs to be more aggressive in the citizen safety, especially for the power supply and electrical appliances.
2. Power supply companies should be more accountable to, poor infrastructure and maintenance, especially in terms of human life and disabilities related to the workers and the civilians.
3. No such law is in place directly addressing the issue properly redressed and compensation provision should be established.
4. High-voltage electrical burns to the penis are not common. Thus the aim in such injuries should be of penile reconstruction are to enable urination and sexual function and to reconstruct anaesthetically acceptable penis

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References:

1. Jex-Blake AJ: The Gulstonian lectures on death from electricity in the late nineteenth century, Med Instrum. 1975; 9:267.
2. Accidental deaths and suicides in India 2013, National crime records bureau, Ministry of home affairs government of India, http://ncrb.gov.in. Accessed on 28th July 2016
3. Chilbert M, Maiman D, Sances A Jr, Myklebust J, Prieto TE, Swiontek T, et al. Measure of tissue resistivity in experimental electrical burns. J Trauma, 25: 209ï 215, 1985
4. Puschel K, Brinkman, B, Lieske K. Ultra structural alteration of skeletal muscles after electrical shock, Am J Forensic Med Pathol. 1985; 6:246.
5. Smith J, Rank BK. A case of severe electric burns with an unusual sequence of complications. Br. J. Surg.1946;33:365-68 [jalt10i3p248.pdf]
6. Hunt JL, McManus WF, Haney WP, Pruitt BA. Vascular lesions in acute electrical injuries. J Trauma. 1974;14:461ï 73.
7. 46th Annual Report 2014-15 Rural Electrification Corporation Ltd. www.recindia.nic.in. Accessed on 28th July 2016
8. Punjab-Haryana High Court, Raman vs State Of Haryana And Others on 2 July, 2013, CWP No.14046 of 2012. https://indiankanoon.org/doc/91696789/. Accessed on 28th July 2016
9. Madras High Court, Arulmeri vs The Superintendent Engineer on 9 October, 2012, W.P (MD) No.1994 of 2008. https://indiankanoon.org/doc/48755560/ Accessed on 28th July 2016
10. Barrash J, Kealey GP, Janus TJ. Neurobehavioral sequelae of high voltage electrical injuries: Comparison with traumatic brain injury. *Applied Neuropsychology.* 1996;3:75-81.
11. Teodoreanu R, Popescu SA, Lascar I. Electrical injuries. Biological values measurements as a prediction factor of local

evolution in electrocutions lesions. J Med Life. 2014;7 (2):226-36.

12. Nataraj RV, Pandora M, Page S, Jagade M, Kar R, Parelkar K. Virtue of Patience in Surgery. Int J Otolaryngo & Head & Neck Surg. 2014;3:239-47.
13. Section 320 IPC (Indian Penal Code 1860) Accessed from http:// www.Vakilno1.com/bareacts/Indian penal code. Accessed on 28th July 2016
14. Jaffe RH: Electropathology: a review of the pathologic changes produced by electric currents, Arch Pathol 5:839, 1928
15. Wright R K and Davis J H. The investigation of electrical deaths; A report of 220 fatalities J. F.Sci .25 514-21

Fig.1 showing abdominal content protruded

Fig.2 showing burn injury to penis and scotum

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One of the Foreign Speakers at the CME being felicitated

Delegates at the Poster Presentation

Prof Kalpesh, President, Felicitating the Organsing Chairperson, Prof Harish Pathak

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