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From the Editor's Desk

JIAFM
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Dear Friends,

It gives me great pleasure to present the second Issue of 2018 to the Hon'ble Members of the Academy. I wish to thank all the authors and contributors of the scientific material published in this issue. The members of the Editorial Board and the Reviewers strive hard to bring up the standard of the journal. Every person does this task in addition to his professional job and commitments. But, as we have promised you, we are not leaving any stone unturned. We hope that you enjoy and like this Academic Feast as you have enjoyed the previous ones. I, on behalf of the Editorial Team, once again thank you for giving us the opportunity to serve you and this Academy.

*We have approached the **Index Copernicus** for Indexing of the Journal. The fee for fast-tracking of the indexing process, 250 Euros, was also paid and we hope that the Journal will be Indexed in Index Copernicus, again.*

*The new feature, **Letter to the Editor**, is gaining popularity. We had 1 letter in the previous issue and now, in this issue, we have 2. We will restrict the number of Letter to the Editor to 3 per issue. The MHC for the Letter to the Editor is Only INR 500/- So please feel free to make use of this feature.*

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Jai Hind & Long Live IAFM

Dr. Dasari Harish
Editor

Editorial

The Current Status of Euthanasia in India

[1]Dasari Harish, [2]Amandeep Singh, [3]Ajay Kumar, [4]Mandar R Sane

Abstract:

Right to life is one of the basic Human Rights. It starts from the time of conception in the mother's womb till death of the individual. It means not only living with dignity, but also dying with dignity. This right has been recognised by many countries and they have taken steps to ease and preserve the dignity of a dying person. This question had come up many times in the Indian courts. In M S Dubal vs State of Maharahstra, where a police constable who met with a vehicular accident and suffered head injury leading to mental illness, tried to commit suicide by pouring kerosene over himself and setting himself on fire and hence, charged for attempt to suicide, the Bombay High Court held that "Right to Life" includes the "Right to death".[1] However, the Andhra Pradesh High Court, in Chenna Jagadeeswar & Anr. vs State of Andhra Pradesh,[2] wherein, the accused was convicted for killing his 4 children, along with his wife, and then both trying to commit suicide; said that the Right to Life does not include the right to die, under Article 21 of the Constitution of India.[3]

The Supreme Court dealt with this question in its various judgements from 1994 onwards, and finally, acknowledged that the right to life does include, in some special circumstances, the right to die, in its landmark judgement, this year.

In this editorial, we would be discussing the status of Euthanasia in our country, in the light of the said judgement - popularly known as the Aruna Shanbaug Case.

Key words: Constitution of India, Euthanasia, Passive Euthanasia, Advance Directives, Right of life

Background:

Till date, we do not have any legislation in India regarding Euthanasia. The law of the land is operating through the various judgements by the Hon'ble Supreme Court, right from Rathiram's Case, way back in 1994, to the present Aruna Shaunbag Case, in 2018. Ironically, both the judgements are similar to each other in the sense that, broadly speaking, both have decreed that the Right to dignity of life does include, in special cases, the Right to die.

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In a landmark Judgment, the Five Judge Constitution Bench of the Supreme Court of India has held that the Right to "life and liberty" as per Article 21 of our Constitution is meaningless unless it encompasses within its sphere individual dignity.[4] ñWith the passage of time, this Court has expanded the spectrum of Article 21 to include within it the right to live with dignity as component of right to life and liberty."

The Bench also held that the right to live with dignity also includes the smoothening of the process of dying in case of a terminally ill patient or a person in Persistent Vegetative State with no hope of recovery. ñA failure to legally recognize Advance Medical Directives may amount to non-facilitation of the right to smoothen the dying process and the right to live with dignity. Further, a study of the position in other jurisdictions shows that Advance Directives have gained lawful recognition in several jurisdictions by way of legislation and in certain countries through judicial

pronouncements. Though the sanctity of life has to be kept on the high pedestal, yet in cases of terminally ill persons or PVS patients where there is no hope for revival, priority shall be given to the Advance Directive and the right of self-determination. In the absence of Advance Directive, the procedure provided for the said category hereinbefore shall be applicable. When passive euthanasia as a situational palliative measure becomes applicable, the best interest of the patient shall override the State interestò The Bench has laid down the principles relating to the procedure for execution of Advance Directive and provided the guidelines to give effect to passive euthanasia in both circumstances, namely, where there are advance directives and where there are none, in exercise of the power under Article 142 of the Constitution.[5]

Introduction:

The word Euthanasia as per Oxford English Dictionary[6] is ó the painless killing of a patient suffering from an incurable and painful disease or in an irreversible comaô The word appears to have come into usage in the early 17th century and was used in the sense of ó easy deathô The term is derived from the Greek ó euthanatosô with ó euô meaning well, and ó thanatosô meaning death.[6] In ancient Greece and Rome, citizens were entitled to a good death to end the suffering of a terminal illness. To that end, the City Magistrates of Athens kept a supply of poison to help the dying ó drink the hemlockô[7] The British House of Lords Select Committee on Medical Ethics defines euthanasia as "a deliberate intervention undertaken with the express intention of ending a life, to relieve intractable suffering.[8] Euthanasia is usually characterized in to: Voluntary (with the consent of the patient whose life is being terminated), involuntary (where the consent is obtained from the guardian of the patient as he is incapable of doing so); Active (Act of Commission by the doctor), Passive (Act of Omission - withholding of treatment) and physician Assisted (where physician's prescribe the medicine and patient or the third party administers the medication to cause death).[9]

In India, the constitutional and legal validity of S. 309 IPC was challenged in the the Supreme Court through the Rathiram Case[10] wherein the Supreme Court ruled that the Section was unconstitutional. However, in 1996, the Constitution Bench of the Supreme Court reversed the 1994 ruling, stating that the right to life under Article 21 of the Constitution does not include the right to die.[11] The accused in the case were convicted by the trial court for abetment to suicide U/S 306 IPC.[12] The conviction was upheld by the High Court. The accused then approached the Supreme Court pleading that the "Right to die" be included in Article 21 of the Constitution of India and that any one abetting suicide is merely enforcing that right. The Hon'ble Supreme Court decided otherwise.

The 5 judge Supreme Court Constitution Bench on 9th March 2018 recognised that a terminally ill patient or a person in 'persistent vegetative state' has the right to seek termination of his life by executing an "Advance Directive" to refuse medical treatment. It acknowledged that the right to live with dignity, as enshrined in Article 21, also includes, in certain circumstances, the right to die.[13]

The Aruna Shanbaug Case:[4,14]

On the evening of 27th November, 1973, Aruna Ramchandra Shanbaug, a Junior Nurse at King Edward Memorial Hospital, was attacked by a ward boy, Sohanlal B Walmiki, in the hospital who wrapped a dog chain around her neck and yanked her back with it. He tried to rape her but finding that she was menstruating, he sodomized her. During the act, to immobilize her, he twisted the chain around her neck. The next day at 7.45 a.m. a cleaner of the hospital found her lying in an unconscious condition on the floor with blood all over. It was alleged that due to strangulation by the dog chain the supply of oxygen to the brain stopped and her brain got damaged.

On 24 January 2011, Pinky Virani, a journalist, claiming to be her friend, approached the Supreme Court with a plea that Aruna be allowed to end her life, as she was in that state for more than 36 years.[13] In her writ petition, Ms Pinki alleged that since the incident 36 years

have passed and on that day Aruna Shanbaug was about 60 years of age. She was featherweight, and her brittle bones could break if her hand or leg are awkwardly caught, even accidentally, under her lighter body. She had stopped menstruating and her skin was now like papier mache' stretched over a skeleton. She was prone to bed sores. Her wrists were twisted inwards. Her teeth had decayed causing her immense pain. She can only be given mashed food, on which she survives. Thus, Aruna was in a persistent vegetative state (P.V.S.) and virtually a dead person, without any state of awareness, and her brain virtually dead. She can neither see, nor hear anything nor can she express herself or communicate, in any manner whatsoever. Mashed food was put in her mouth, she was not able to chew or taste any food.[4]

She is not even aware that food has been put in her mouth. She is not able to swallow any liquid food, which shows that the food goes down on its own and not because of any effort on her part. The process of digestion goes on in this way as the mashed food passes through her system. Her excreta and the urine was discharged on the bed itself. As per the Writ Aruna, if Judged by any parameter, cannot be said to be a living person. Further it was also alleged that there was not the slightest possibility of any improvement in her condition and her body lies on the bed in the KEM Hospital, Mumbai like a dead animal, and this has been the position for the last 36 years. The prayer of the petitioner is that KEM Doctors and Staff be directed to stop feeding Aruna, and let her die peacefully.[4]

To know about the details of the condition of Aruna, a committee was set up by the Hon'ble Court as the Court found some variance between the allegations in the writ petition filed by Ms. Pinki Virani on behalf of Aruna Shanbaug and the counter affidavit of Dr. Pazare, the Head of KEM hospital where Aruna was being treated after the incident.[4]

The team of three doctors was appointed to examine Aruna Ramachandra Shanbaug thoroughly and give a report to the Court about her physical and mental condition. The committee gave their opinion thus:

- Ms. Aruna Ramachandra Shanbaug has developed non-progressive but irreversible brain damage secondary to hypoxic-ischemic brain injury consistent with the known effects of strangulation.
- She meets most of the criteria for being in a permanent vegetative state (PVS
- While she has evidence of intact auditory, visual, somatic and motor primary neural pathways, no definitive evidence for awareness of auditory, visual, somatic and motor stimuli was observed during our examinations.

The Supreme Court Judgement:[4]

After hearing the petition and perusal of the records, the Hon'ble court detailed the facts which need to be cleared before giving Judgement:

1. In a person who is in a permanent vegetative state (PVS), should withholding or withdrawal of life sustaining therapies (many authorities would include placement of an artificial feeding tube as a life sustaining intervention) be permissible or `not unlawful' ?
2. If the patient has previously expressed a wish not to have life-sustaining treatments in case of futile care or a PVS, should his / her wishes be respected when the situation arises?
3. In case a person has not previously expressed such a wish, if his family or next of kin makes a request to withhold or withdraw futile life-sustaining treatments, should their wishes be respected?
4. As Aruna Shanbaug has been abandoned by her family and is being looked after for the last 37 years by the staff of KEM Hospital. Who should take decisions on her behalf?

It then outlined the Principles which can help to guide the reply to these queries:

1. Autonomy means the right to self-determination, where the informed patient has a right to choose the manner of his treatment.
2. Beneficence is acting in what is (or judged to be) in patient's best interest. This is not to be confused with euthanasia, which involves

the doctor's deliberate and intentional act through administering a lethal injection to end the life of the patient which was in the present case under consideration.

On 7 March 2011, the Supreme Court, in a landmark judgment, issued a set of broad guidelines **legalizing passive euthanasia** in India. It however, rejected Pinky Virani's Plea. Aruna Shanbaug died on 18th may 2015.[14]

The five-judge constitution bench outlined the safeguards, saying such a directive "cannot operate in abstraction". The safeguards would remain in force till Parliament adopts a legislation on the matter, it said. "The advance directive can be executed only by an adult who is of a sound and healthy state of mind and in a position to communicate, relate and comprehend the purpose and consequences of executing the document." "It shall be in writing clearly stating as to when medical treatment may be withdrawn or no specific medical treatment shall be given which will only have the effect of delaying the process of death that may otherwise cause him/her pain, anguish and suffering and further put him/her in a state of indignity." the Bench, headed by the CJI, Justice Deepak Misra, said.

The other three judges - Justices A K Sikri, D Y Chandrachud and Ashok Bhushan - agreed with the directives and safeguards penned by the CJI.

The court said that the directives should clearly indicate

- The decision relating to the circumstances in which withholding or withdrawal of medical treatment could be resorted to.
- It should mention that the executor may revoke the instructions/authority at any time.
- It should disclose that the executor has understood the consequences of executing such a document.
- It should specify the name of a guardian or close relative who, in the event of the executor becoming incapable of taking decision at the relevant time, will be authorised to give consent to refuse or withdraw medical treatment in a manner consistent with the advance directive.
- In case where more than one advance directive is valid, the most recently signed directive would be considered as the "last expression" of the patient's wishes.
- The advanced directive should be signed by the executor in the presence of two attesting witnesses, preferably independent, and would be countersigned by a judicial magistrate who shall preserve its copy along with its digital format.
- The bench said the magistrate shall inform the immediate family members of the executor, if not present at the time of execution, and make them aware about it and hand over its copy to a competent officer of local government.

"In the event the executor becomes terminally-ill and is undergoing prolonged medical treatment with no hope of recovery and cure of the ailment, the treating physician, when made aware about the advance directive, shall ascertain the genuineness and authenticity thereof from the jurisdictional JMFC (magistrate) before acting upon the same."

The hospital where such patient is admitted, would set up a medical board consisting of the head of the treating department and at least three experts from the fields of general medicine, cardiology, neurology, nephrology, psychiatry or oncology having at least 20 years of experience. The Bench said that "if the nod to withdraw medical treatment is refused by the medical board, it would be open to the executor of the advance directive or his family members or doctor or hospital staff to approach the High Court, where the Chief Justice shall constitute a division bench to decide it expeditiously after affording opportunity to the state."

An individual may withdraw or alter the advance directive at any time when he/she has the capacity to do so and by following the same procedure as provided for recording of advance directive. The withdrawal or revocation of an advance directive must be in writing.

Regarding cases where there are no advance directive, the Hon'ble court laid down the procedure which should be adopted, in addition to the safeguards to be applied in cases where there are advance directives. It said that in cases where a patient is terminally-ill and undergoing prolonged treatment for an ailment

which is incurable or where there is no hope of being cured, the doctor may inform the hospital which would set up a medical board. If the board certifies it, the hospital shall inform the Collector who would then set up another medical board comprising the Chief District Medical Officer as the chairman and three experts from the fields of general medicine, cardiology, neurology, nephrology, psychiatry or oncology, with minimum experience of 20 years. In the event of difference of opinion, the patient's nominee, his family member, treating doctor or hospital staff can move the high court for permission to withdraw life support, it said.[15]

Conclusion

A physician-patient relationship is founded more on the rights of the latter and on the freedom of self determination meaning thereby that the complete autonomy of choices vest with the patient. This is exemplified by Justice Cardozo in the 1914 decision in Schloendorff v Society of NY Hospital:[16] ñEvery human being of adult years and sound mind has a right to determine what shall be done with his own body; and a surgeon who performs an operation without his patientôs consent commits an assault.ò The patient has full moral and legal right to refuse or interrupt his physicianôs therapeutic actions. However this does not mean that he has the right to demand euthanasia. Now, the Honôble Supreme Court has paved way for execution of ópassive euthanasiaô through advance directives and has set stringent procedural guidelines for it.

According to the Court, the legal representative does not have an unconditional power to decide on the health of the incompetent patient, he has to decide neither ón the placeôof the patient nor ófororô the patient, but ówithô the patient, and, hence the óadvanced directivesôof an unconscious patient must be taken in account considering patientôs constitution with regards to his personality and his inclinations. The time has come to respect the advance directives of the patient and to respect the autonomy of the person to make decisions regarding his/her own life when he was in his compos mentis. Legalising passive euthanasia will lessen the cost of burden on the healthcare industry as well as on the family members.

The judgement has further clarified that all other forms of euthanasia, except the Passive Euthanasia stand invalid till enactment of legislation in this regard. Legislation in this regard is in consideration by Law commission. The issue, being highly sensitive, drafting the legislation may not be an easy task. If it is drafted too tightly it could impede, and perhaps invalidate the existing advance directives; and, if drafted too widely, it could lead to uncertainty. The Legislation has to be in light of the fact that Section 309 IPC has been recently decriminalised by ôThe Mental Healthcare Act, 2017ô[17]

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References:

1. Maruti Shripati Dubal vs State of Maharashtra on 25 September, 1986. 1987 (1) BomCR 499. Available from: https://indiankanoon.org/doc/490515/. Retrieved on 4th May 2018.
2. Chenna Jagadeeswar And Anr. vs State of Andhra Pradesh, 1987. Available from: https://indiankanoon.org/doc/146939/. Retrieved on 4th May 2018.
3. The Constitution of India. Available from: https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text. Retrieved on 4th May 2018.
4. Common Cause Vs Union of India & Ors. Civil Writ Petition No. 215 of 2005. 9th March 2018. Available from: https://indiankanoon.org/doc/184449972/. Retrieved on 4th May 2018.
5. Available from: http://www.livelaw.in/need-know-execution-advance-directive-living-will-passive-euthanasia-per-law-laid-sc-today/. Retrieved on 4th May 2018.
6. Available from: https://en.oxforddictionaries.com/definition/euthanasia. Retrieved on 4th May 2018.
7. Orfali R. Death with dignity. The case for legalizing physician assisted dying and euthanasia. Mill City Press Inc.

www.millcitypublishing.com. Retrieved on 4th May 2018.

8. Harris NM. The euthanasia debate. JR Army Med Corps 2001;147(3):367-70. Available from: https://www.ncbi.nlm.nih.gov/pubmed/11766225. Retrieved on: 2nd June 2018
9. Math SB, Chturvedi SK. Euthansia: right to life vs right to die. Ind J Med Res 2012;136(6):899-902. Available from: https://www.ncbi.nlm.nih.gov/pubmed/23391785. Retrieved 5th May 2018.
10. P. Rathinam vs. Union of India, 1994(3) SCC 394. Available from: https://indiankanoon.org/doc/542988/. Retrieved on: 2nd June 2018.
11. Gian Kaur vs. State of Punjab, 1996(2) SCC 648. Available from: https://indiankanoon.org/doc/217501/. Retrieved on: 2nd June 2018.
12. Available from: http://www.newindianexpress.com/nation/2018/mar/10/supreme-court-proposes-safeguards-on-living-will-for-terminal-patients-1784765.html. Retrieved on: 2nd June 2018.
13. The Indian penal Code. Act 45 of 1860. Available from: http://lawcommissionofindia.nic.in/1-50/report42.pdf. Retrieved on 5th May 2018.
14. Aruna Shanbaug Case. Available from: https://en.wikipedia.org/wiki/Aruna_Shanbaug_case. Retrieved on: 2nd June 2018.
15. Available from: http://www.newindianexpress.com/nation/2018/mar/10/supreme-court-proposes-safeguards-on-living-will-for-terminal-patients-1784765.html. Retrieved on: 2nd June 2018.
16. Mary E. Schloendorff, v. The Society of the New York Hospital. 105 N.E. 92, 93 (N. Y. 1914). Available from: https://biotech.law.lsu.edu/cases/consent/schoendorff.htm. Retrieved on: 2nd June 2018.
17. The Mental Healthcare Act. Act No. 10 of 2017. Available from: 2017http://www.prsindia.org/uploads/media/Mental%20Health/Mental%20Healthcare%20Act,%202017.pdf. Retrieved on: 2nd June 2018.

Original Research Paper

Study of Appropriate Solvent System for Separation of Pyrethroids Using Thin Layer Chromatography

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Abstract:

Pyrethroids are synthetic organic compounds synthesized from chrysanthemum flowers, that are used extensively as household and commercial insecticides. Thin layer chromatography is widely used as a method of choice in separation and identification of various compounds. Here, we used different mobile phases for separation of deltamethrin, cypermethrin and transfluthrin and found that hexane: chloroform and chloroform: acetone were ideal for separation, amongst other mobile phases.

Key Words: Pyrethroid, Thin Layer Chromatography, Mobile Phase

Introduction:

Toxicology is the science dealing with properties, action, toxicity, fatal dose, detection and estimation of, interpretation of the results of toxicology analysis and treatment of poison.[1] A poison is a substance which, when administered, inhaled or ingested, is capable of acting deleteriously on the human body.[2] Forensic toxicology deals with the medical and legal aspects of the harmful effects of chemicals on human being. The chemicals are of various types like volatile, non-volatile, organic and in organic substances which would be poisonous, in acute or chronic exposure. [3]

Recently, the establishment of toxicology labs to help in patient care, especially in poisoning cases, warranted a need to establish a specific method to detect a particular substance. In this study, we analysed different solvent systems to separate pyrethroids using thin layer chromatography method. Pyrethroids are a synthetic version of an extract from the chrysanthemum. They were chemically designed to be more toxic with longer breakdown times and are often formulated with synergists, increasing potency and compromising the human body's ability to detoxify the pesticide.[4]

Synthetic pyrethroids are derivatives of naturally occurring pyrethrins and are derived from ketoalcoholoic acids. These acids are strongly lipophelic and rapidly penetrate many insects and paralyze their nervous system.[5] They are sold as commercial pesticides, used to control pest insects in agriculture, homes, communities, hospitals, schools and as a topical head lice treatment. They are available as sprays, dusts, powders mat and coils.[6]

Material & Methodology:

The study was conducted in the Analytical Toxicology Laboratory of the department of Forensic Medicine and Toxicology, Sri Aurobindo Institute of Medical Sciences and Post Graduate Institute, Indore. Different types of pyrethroids like Deltamethrin, Cypermethrin, transfluthrin were purchased from the market. The following steps were carried out to run the pyrethroid samples by thin layer chromatography.[7]

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Working sample preparation - Working sample of pyrethroids was prepared by adding 2ml of acetone in 2ml of pyrethroids.

1. ***Preparation of solvent system*** - solvent system was prepared, based on different polarity.

- 80ml of hexane mixed in 20 ml of acetone. (80:20)
- 70 ml of hexane mixed in 30 ml of chloroform- (70:30)
- 90 ml of chloroform mixed with 10 ml of benzene- (9:10)
- 90 ml of chloroform mixed in 10 ml of acetone (9:1)
- 10 ml of acetone added in 10 ml of water (1:1)
- 30 ml of hexane mixed in 10 ml of benzene (3:1)
- 60ml of cyclohexane mixed in 40ml of toluene (60:40)

2. ***Saturation of solvent system-*** 3 ml of solvent was poured into a screw-cap jar, afterthat a piece of filter paper was placed in the jar and thenwetit thewith the solvent to saturate the atmosphere.
3. ***Preparation of TLC plate-*** The commercially available TLC plate was cut into three equal parts. Then it was marked 2cm from below. Above 10 cm was marked with pencil so that solvent will run to 10 cm. Then again 2cm was marked for handling purpose and rest plate is cut.
4. ***Sample application-*** the capillary was dipped into the working solution of pyrethroid and gently and quickly place a 1-2 millimeter spot on the plate at the position marked. Four spots were plotted out of which one of deltamethrin, second is cypermethrin, third is transfluthrin and fourth is mixture of all three. Spotting was repeated three to four times on the same TLC plate for better results. Make sure the spot is dried then only repeating spot is kept over it. The spots were allowed to air dry at room temperature.
5. ***Development of TLC plate-***After saturation of solvent system TLC plate introduced in the conventional thin layer tank with only the tip of plate dipped in the solvent. It kept inside the chamber until the solvent runs till 10 cm. after that plate was removed and air dried.
6. ***Spot Identification-*** Dried TLC plate was kept in an iodine chamber and the spots developed with the help of iodine fumes and retardation factor (Rf) was calculated for each spot.

$$\text{Rf value} = \frac{\text{Distance travelled by solvent}}{\text{Distance travelled by solute}}$$

Results & Discussion:

Pyrethroids are esters of 3-phenoxy benzyl alcohols. Liquid-liquid extraction method was used to extract pyrethroidsfrom suspected samples.

Table no 1 - Rf values of pyrethroids in different solvent system

Sr no	Pyrethroids/ Solvents	Deltamethrin Rf value	Cypermethrin Rf value	Tranfluthrin Rf value
1	Hexane : acetone (80:20)	0.35	0.36	0.5
2	Hexane : chloroform (70:30)	0.2	0.25	0.54
3	Chloroform : benzene (9:10)	0.32	0.35	0.55
4	Chloroform : acetone (90:10)	0.15	0.5	0.56
5	Acetone : water (10:10)	0.4	-	0.15
6	Hexane : benzene (30:10)	0.37	0.15	0.25
7	Cyclohexane : toluene (60:40)	0.15	0.25	0. 22

Rf value of deltametrin in different solvent system was found in between 0.15 to 0.40

Rf value of cypermetrin in different solvent system was found in between 0.15 to 0.50

Rf value of Tranfluthrin in different solvent system was found in between 0.15 to 0.56

Different methods are available for analysis of pyrethroids, such as chromatography (GC), thin layer chromatography (TLC) and high performance liquid chromatography (HPLC), of

which thin layer chromatography is very simple, cheap, rapid and less time consuming method .

In thin layer chromatography, the solvent system is selected by considering the nature of the components to be separated like polar or non-polar and also solubility, affinity and resolution, as the compound will follow the rule of ólike dissolves likeô[8] So, proper selection of appropriate solvent system for different pyrethroids can only be achieved by analyzing the Rf (Retention Factor) values of in different solvent system. Thatôs why we used both polar and non-polar solvent system in combination.The retention factor found in solvent system 1(Hexane: acetone (80:20) and 3 (Chloroform: benzene (9:10) for Deltamethrin and Cypermethrin was found to be very close which might leads to problem in identification in case of mixture. Though transflurthin shows good separation in both system. The solvent system 5 (Acetone: water (1:1) fails to develop cypermethrin and found higher Rf fordelatmetrin than transflurthin.The resolution obtain in solvent system 2 (Hexane: chloroform (70:30), six (Hexane: benzene (3:1),four (Chloroform: acetone (90:10) and seven (Cyclohexane: toluene (60:40) is quite good although the solvent system 2 & 4 separates quite well than others this might be due to non-polar nature of pyrehroids thus semi polar and non-polar solvent systems found to be suitable for their separation.[9]

Conclusion:

Thin layer chromatography is the method of choice for detection of pyrethroids and use of less non polar and polar solvents found to be the good mobile phase option.

Conflict of interest: None
Financial assistance: None

References

1. S. Parasuraman. Toxicological screening. J Pharmacol Pharmacother. 2011 ; 2(2): 74ï 79.
2. Reddy KSN, Murty OP. 33rd Ed. The essentials of forensic medicine and toxicology. The Health Science Publishers. 2014;pp498
3. Parikh CK. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology. 6th ed. New Delhi: CBS Publisher & Distributor; 2010. 5
4. Beyond Pesticides. School pesticide incidents from around the country. Available at: http://www.beyondpesticides.org/schools/publications/school_pirs.htm. Accessibility verified June 16,
5. Beilschmidt MD. Toxicology and environmental fate of synthetic pyrethroids. J Pesticide Reform 1990;10(3):32-7.
6. Pillay VV. Comprehensive medical toxicology,1st Ed. 2003;pp:175-6.
7. Kirchner JG, Thin-layer chromatographic quantitative analysis, Journal of Chromatography 1973;82(1):101-15.
8. Bele AA, Khale A. An overview on thin layer chromatography International Journal of Pharmaceutical Sciences and Research. 2011;2(2):256-67.
9. Laskowski DA. Physical and chemical properties of pyrethroids. Rev Environ Contam Toxicol 2002;174:49-170.

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Original Research Paper

A Study of Homicide Victims in JNIMS Hospital, Imphal

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Abstract:

Homicide cases are often intriguing and challenging to the investigative agencies. They often have local or regional characteristics, as well as various intricacies, which require thorough analysis and understanding for the administration of justice and to deter such incidences from recurring. In our study, 176 homicide victims brought to Jawaharlal Nehru Institute of Medical Sciences (JNIMS) Morgue, Imphal, between 2010-2014 were analysed. Most of the homicide victims were young men in the age group 21 to 40 years (106 cases); 152 cases were males. The victims were mostly militants or surrendered militants (90 cases), followed by unemployed persons (54 cases), security personnel (18 cases), businessmen(9 cases) and govt. employees(5 cases). The commonest means of committing the crime was by the use of firearm (108 cases), followed by blunt weapons (44 cases) and sharp and penetrating weapons (23 cases). Of the total 176 cases, in 72 cases, the offenders could not be identified. Among the identified offenders, 47 were shot dead by security personnel, 22 were militants and 21 were either relatives or friend. Notably, a significant number (12 cases) of homicides resulted from mob lynching, in which the victims were mostly accused of theft or anti-social acts.

Key Words: Autopsy, Homicide, Firearm, militants, mob lynching

Introduction:

No society is crime-free. Homicides are considered to be the most heinous crime afflicting mankind. Homicide is defined as killing of one human being by another human being.[1] The methods employed by criminals are many, and the patterns and circumstances of crimes may have some regional characteristics. Criminals often try to hoodwink investigative agencies to avoid penalty, and therefore naturally it becomes challenging for law enforcement agencies and the crime investigators to understand the patterns of crimes committed from time to time as well as region-specific patterns. Manipur is a state situated in the north-eastern part of the country, having diverse geographical, environmental and multicultural facets. In this small state, homicide constitutes to be a major and increasing public health problem. The present study was carried out to establish the prevalence of homicide in relation to various epidemiological, environmental and social factors. The findings will help in investigating a case of homicide which will further help in the deliverance of justice.

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Material & Methods:

A retrospective study was conducted on the cases brought for forensic autopsy in JNIMS, Imphal during the period of 5 years i.e 1st January of 2010 to 31st December 2014. A detailed history of the case, age, sex, time and place of occurrence, causes of death, type of weapon used, relationship between victim and offender, etc, were obtained from relevant sources and postmortem reports and were

recorded in a pre-designed proforma. A master chart was then prepared which included the detailed description of all cases of homicide and the chart was systematically analysed. Prior permission was taken from the Institutional Ethics Committee for this study.

Criteria for selection of cases

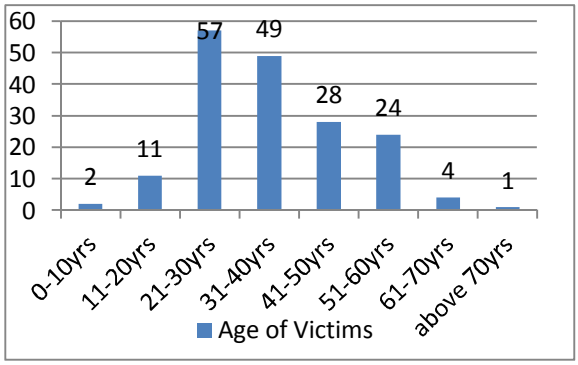
1. Fatal homicidal cases that were either hospitalized following trauma and subsequently succumbed to the injuries or were found dead with or without injuries, were included.

2. All putrefied or skeletonised bodies and those where nature of injuries was undetermined, were excluded from the study.

Results:

During the study period of 5 years, a total of 824 postmortem examinations were conducted in JNIMS, Imphal, of which, 176 were of fatal homicide. The male: female ratio was 6.3:1 and the commonest age group was 21-30 years (32.4%), followed by 31-40 years (27.8%). Of the 176 cases, 1 was above 70 years, while 2 were in the age group 0-10 years. (**Chart-1**). Homicide was nearly twice as common in urban as compared to rural areas. Incidence of homicide was more or less uniformly distributed throughout the year and there was no strong diurnal predilection.

Chart-I : Age of the Victims



51.1% of the victims were either militants or surrendered militants, followed by unemployed persons (30.7%) or security personnel (10.2%) (**Chart - II**). Again, offenders in 41% of the cases were not identified. Among the identified ones, security personnel were responsible for 26.7% of the homicide cases, followed by militants in 12.5% cases. In 12 cases (6.8%), the offenders were in form of a mob, as mentioned in **Table-1**. It was observed that firearm injury was the most common cause of homicidal deaths, 108 cases (61.4%), followed by blunt weapon injury in 38 cases (21.6%), as shown in **Chart-III**.

Chart-II : Occupation of the Victims

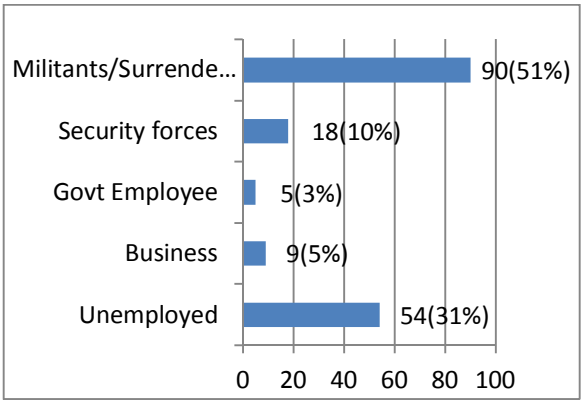


Chart-III: Type of injury

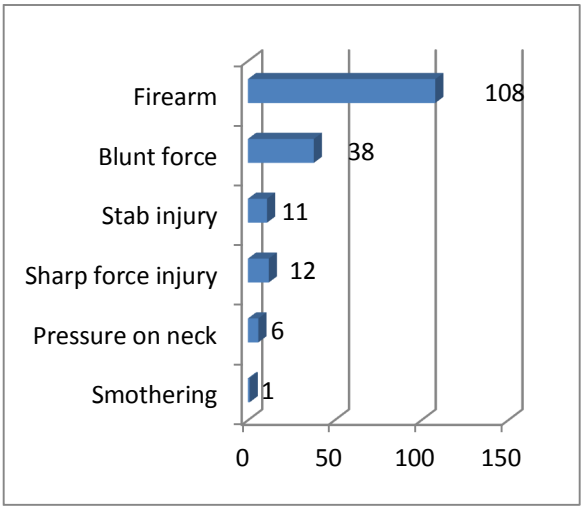


Table -I: Type of Offenders

Types of Offender	Number of cases	%
Security personnel	47	26.70
Militants	22	12.50
Relatives/ Acquaintances	11	6.25
Friends	10	5.69
Stranger	2	1.14
Mob	12	6.82
Unknown	72	40.90
Total	176	100%

Discussion:

In the present study, out of total 824 medico-legal autopsies conducted by the

department, 176 were of homicidal deaths, 21.4%. Males outnumbered the female victims in the ratio of 6.3:1 and the commonest age group was 21-30 years. These findings are consistent with that of other studies.[2-4] This could be because of aggressive nature of the young adult male. Incidence of homicide was twice in urban as compared to rural areas. In Manipur, 61.5% of the total population resides in the urban areas. Population concentration seems to have more to do with the quantum of homicides. Similar finding was also reported in the study carried out in different parts of India and abroad, including a study conducted in the city of Itabuna, Brazil.[2-5]

In the present study, homicides were found to be evenly distributed during all parts of the day, which may also be interpreted as 'no particular part of the day seems to be safe for the victims' and there was not much seasonal variation as far as homicide incidents are concerned. In a study conducted by Gupta, et al, the number of homicides was slightly more at night than in daytime and there was no seasonal predilection.[4]

Maximum deaths were attributed to firearm use, accounting for 61.4% of the cases and most of the victims were either militants or surrendered militants. Manipur is a trouble-torn state where militancy problems continue to be a major factor. Militants procure arms and ammunitions from across the porous international border. Skirmishes between security personnel and militants are common. Even intra and inter-fights among militant groups are well-known. This finding is not in agreement with other authors, where blunt weapon was the commonest,[6-9] sharp weapon was commonest in a study in Mangalore[2] and Delhi.[4] In other places of India where strict firearm legislations curtailed rampant availability, firearm deaths are almost negligible and the means of homicide are usually the tools used in daily living.

In this study, Security personnel were the most common identified offenders (26.7%), followed by underground militants (12.5%). Majority of the offenders were unidentified. Unresolved militancy seems to be one of the biggest problems in Manipur leading to crimes including murder.

One of the best deterrents of crime is an effective investigative set up. An in-depth understanding of patterns of various crimes is a must. Homicidal deaths have their own character and this also may further have a local/ regional characteristics. In Manipur, firearm deaths constitute the major chunk of homicidal deaths. Militancy and counter-militancy operation seems to be taking a huge toll on the law and order situation. A sincere government policy to resolve the militancy is the need of the hour. Imparting high moral values especially in young male population and discouraging culture of violence in every forum will go long way in controlling crime in the society. The judicial system also needs to infuse confidence in the peopleôs minds.

Conflict of interest: None

Financial Assistance: None

References:

1. Reddy KSN, Murty OP. The essentials of forensic medicine and toxicology. 33rd Ed. New Delhi: Jaypee Brothers Publishers (P) Ltd; 2014: p290
2. Vij A, Menon A, Menezes RG, Kanchan T, Rastogi P. A retrospective review of homicides in Mangalore, South India. J Forensic Leg Med. 2010;17(6):312-5.
3. Mohanty S, Mohanty MK, Panigrahi MK, Das SK. Fatal head injury in homicidal victims. Med Sci Law. 2005;45(3):244-8.
4. Gupta A, Rani M, Mittal AK, Dikshit PC. A study of homicidal deaths in Delhi. Med Sci Law. 2004;44(2):127-32.
5. Costa FA, Trindade RF, Santos CB. Deaths from homicides: a historical series. Rev Lat Am Enfermagem. 2014;22(6):1017-25.
6. Hargrave DR, Warner DP. A study of child homicide over two decades. Med. Sci. and Law. 1992: 32(3):247-50.
7. Fischer J, Kleemann WJ, Troger HD. Types of trauma in cases of homicide. For. Sci. and Law. 1994;68(3):161-7.
8. Dikshit PC, Kumar A. Study of homicidal death in central Delhi. J Indian Acad. Forensic Med.1995;4(1):4-46.
9. Sinha US, Kapoor AK, Pandey SK. Pattern of homicidal deaths in SRN Hospitalôs Mortuary at Allahabad. J Indian Acad. Forensic Med.2003;20(2):33-6

Original Research Paper

Pattern of Sudden Natural Deaths among Autopsies Conducted at Mysore Medical College

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Abstract:

Background: Sudden deaths are important from a medicolegal point as they may raise suspicion of foul play. Sudden death is a death which is not known to have been caused by any trauma, poisoning or violent asphyxia, and where death occurs all of a sudden or within 24 hours of the onset of the terminal symptoms. **Aims**: To find the socio-demographic profile (age, sex and religion) of the deceased of sudden death and to find out the pattern of cause of sudden natural death. **Materials and Methodology:** This cross-sectional retrospective study was conducted in the department of Forensic Medicine, Mysore Medical College, Mysore, from January 2010 to December 2015. During this period there were 204 cases of sudden natural death. **Results**: During the period of study, autopsy was conducted on 204 sudden natural deaths, of which, 177 were male. Majority of the cases were from the 25 - 50 year age group, minimum from the age group of up to 10 years. Of the 204 cases, 128 were due to diseases of cardiovascular system, 46 due to diseases of respiratory, 16 due to diseases of central nervous, 9 due to diseases of gastrointestinal, 4 due to diseases of genitourinary systems, respectively, while 1 died due to disease of some other system involvement. Coronary artery disease was the single largest cause of death, accounting for 119 deaths (41%). The other causes of death in the descending order of frequency were: Lobar Pneumonia (29 cases) and Sub-arachnoid haemorrhage (13 cases). Majority of these deaths cases occurred while the person was outside the hospital setting (64%), followed by patients who were admitted to the hospital (36%). Among the study population, 49% were Hindu by religion. **Conclusion**: We found that a significant number of sudden deaths occurred in adults, particularly in the population above 30years, posing a health concern in our society. Cardiac causes contributed the maximum number, with atherosclerosis being the main culprit in causing CAD

Key Words: Sudden Natural Death, Cardio-Vascular System, Respiratory System, Coronary Artery Disease, Autopsy

Introduction:

Natura death means the death occurring due to some natural disease or pathological condition, old age, debility or devitalisation; here the death is not intended or attempted and also does not occur accidently. But very often, natural deaths form the basis of medico-legal investigations, if they have occurred suddenly in apparently healthy persons and under suspicious circumstances. Suspicion usually arises when an individual is found dead in a public place, without anyone having witnessed the death. Usually, after a complete and detailed postmortem examination and laboratory investigations, actual natural cause of death is established.

It is quite possible for a person to be apparently healthy, but at the same time,

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suffering from a serious disease of which he may not even be aware. Sudden deaths are important from a medicolegal point as they may raise suspicion of foul play.[1] World Health Organisation defines sudden death as "Death which occurs within 24 hours from the onset of symptoms".[2] It can also be defined as deaths which are sudden, unexpected, clinically unexplained, or otherwise obscure even though there need to be no unnatural element in their causation.[2] But there is lot of difference of opinion regarding this definition among forensic experts and clinicians. Therefore, in the present study, we have followed the easily acceptable definition given by Apurba Nandy: "Sudden death is a death which is not known to have been caused by any trauma, poisoning or violent asphyxia, and where death occurs all of a sudden or within 24 hours of the onset of the terminal symptoms".[3]

It is worth mentioning that emphasis is given to the unexpected character, rather than suddenness of death. In many occasions, the individual may not die immediately but fight for few hours after the onset of terminal symptoms. Sometimes sudden deaths occur in older individuasl and generally under circumstances which arouse no suspicion. But such deaths in younger individuals are likely to induce suspicion. An autopsy is recommended in persons covered by an Insurance policy in such a situation. The purpose of medicolegal autopsy in such deaths is to determine whether poisoning or violence has been in any way responsible for the death. Absence of external evidence of injuries does not preclude death from physical violence.

The incidence of Sudden death is approximately 10 percent of all deaths. Where diseases of Cardiovascular system account for about 45-50%, Respiratory system 15-23%, Nervous system 10-18%, Alimentary system 6-8%, Genito-urinary system 3-5% and 5-10% are of miscellaneous causes.[4] This statistics varies from place to place, hence an attempt was made to study the pattern of sudden natural deaths occurring in and around the historical city of Mysore.

Aims and Objectives:

1. To find the socio-demographic profile (age, sex and religion) of the deceased of sudden death.
2. To find out the pattern of cause of sudden natural death.

Materials and Methodology:

This cross-sectional retrospective study was conducted in the department of Forensic Medicine, Mysore Medical College, Mysore, from January 2010 to December 2015. During this period there were 204 cases of sudden natural death. Details of the cases were collected from police requisition, post-mortem report, histopathological examination report and in case of hospitalized patients, medical records were studied and the provisional diagnosis and time of onset of terminal symptoms written in them were noted. This was entered in a proforma and then it was entered in to Microsoft Office Excel Worksheet and analysed.

Inclusion criteria:

(a) All sudden natural deaths.

Exclusion criteria:

(a) Deaths due to road traffic accidents, homicides, suicides, and blast injuries.
(b) Decomposed bodies.

Results:

In this study, of the 204 cases of sudden natural death, 177 (87%) were male, the male: female ratio being 9:1. t was observed that 13 cases were of age group less than 25years, 132 cases were of 25 - 50 year age group, and 59 cases were of age group above 65years. Majority of the cases belonged to 25 - 50 year age group. Least cases were of the age group of up to 10 years. (**Table 1**).

Table 1: Distribution of cases according to age and gender.

Age in years	Males	Females	Total
Less than 25 years	10	3	13
25 to 50 years	121	11	132
Above 50 years	46	13	59
Total	177	27	204

Again, of the 204 cases, 128 cases (63%) were due to diseases of cardiovascular

system, 46 cases (22%) due to respiratory system, 16 cases (8%) due to central nervous system, 9 cases (4.4%) due to gastrointestinal system, 4 cases (2%) due to genitourinary system and 1 case (0.5%) was due to disease of some other system. (**Table 2**)

Table 2: Distribution of cases according to the system involved.

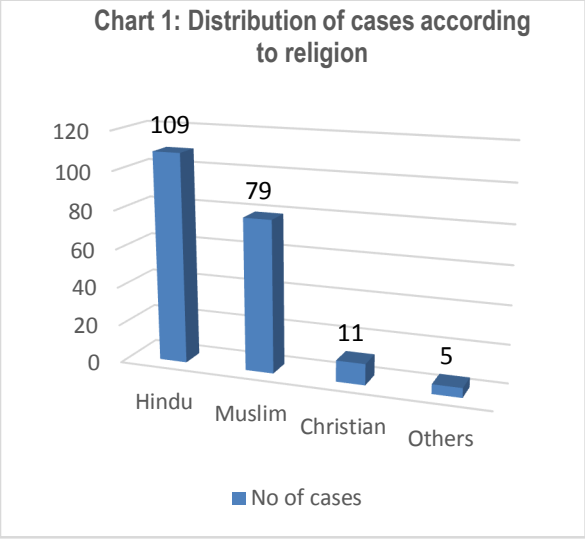
System involved	Males	Females	Total
Cardio vascular system (CVS)	114	14	128
Respiratory system (RS)	41	5	46
Central nervous system (CNS)	13	3	16
Gastro intestinal system (GIS)	07	2	09
Genito-urinary system (GUS)	1	3	04
Others	01	00	01
Total	177	27	204

Majority of sudden deaths cases occurred while the person was outside the hospital setting (64%) followed by patients which were admitted to the hospital (36%). (**Table 3**)

Table 3: Distribution according to place of death.

Place of death	Number of cases
Home	77
Hospital	73
Public places	37
Police custody (Lock up)	1
Jail	2
Others	14
Total	204

Among the study population 49% were Hindu by religion and 37% were Muslims and 5% were Christians. (**Chart 1**)



It was observed that Coronary artery disease was the single largest cause of death accounting for 119 deaths (41%). The other causes of death recorded in present study in descending order of frequency were: Lobar Pneumonia (29 cases); Sub-arachnoid haemorrhage (13 cases); Tuberculosis and perforation of gastrointestinal system (8 cases each); Bronchopneumonia (6 cases); Myocardial Infarcation (4 cases); Myocardial Bridging and Lung abscess (3 cases each); Ruptured aortic aortic aneurysm, Postpartum haemorrrhage and Cerebral haemorrhage (2 cases each); Brain abscess, rupture of liver abscess, rupture of ectopic pregnancy, tumours of kidney (1 case each). (**Table 4**)

Table 4: Pattern of cardiovascular deaths.

Sl No	System and disease		No of cases
1	CVS	Myocardial Infarction	04
		Coronary artery disease	119
		Myocardial bridging	03
		Ruptured aortic aneurysm	02
2	RS	Lobar puemonia	29
		Bronchopneumonia	06
		Lung abscess	03
		Tuberculsis	08
3	CNS	Sub arachnoid haemorrhage	13
		Cerebral haemorrhage	02
		Brain abscess	01
4	GIS	Perforation	08
		Rupture of liver abscess	01
5	GUS	Postpartum haemorrhage	02
		Rupture of ectopic pregnancy	01
		Tumour of kidney	01
6	Others		01

Discussion:

In the present study, the male to female ratio was 9:1. This is consistent with the observations of Zanjad and Nanadkar,[5] but differs with that of Escoffery and Shirley.[6] This might be due to difference in geographic distribution of disease pattern, lifestyle and dietary habits. Majority of our cases were of the age-group between 25-50 years and minimum cases in age group less than 25 years. This is consistent with the observations of Zanjad and Nanadkar,[5] and Gupta, et al,[7] but differs from

those of Escoffery and Shirley.[6] Diseases of cardiovascular system accounted for 63% of all sudden deaths, followed by respiratory system, CNS, alimentary system, etc. The findings are more or less consistent with those of Nandy,[3] Reddy[4] and Zanjad and Nanadkar.[5]

The system wise causes of sudden death were as follows:

1) Cardio vascular system (CVS): Myocardial infarction, coronary artery disease, myocardial bridging, ruptured aortic aneurysm
2) Respiratory system: Lobar pneumonia, bronchopumonia, lung abscess, tuberculosis
3) Central nervous system: subarachnoid haemorrhage, cerebral haemorrhage, brain abscess
4) Gastrointestinal system: perforation, rupture of liver abscess
5) Genitourinary system: postpartum haemorrhage, rupture of ectopic pregnancy, tumour of kidney

The most frequently reported causes of death in descending order of frequency were: Coronary artery disease (119 cases), Lobar Pneumonia (29 cases), Sub-arachnoid haemorrhage (13 cases), Tuberculosis and perforation of gastrointestinal system (8 cases each). These findings are not consistent with the findings of M. Ramu.[8] The relatively low prevalence of deaths due to coronary artery disease in study of M. Ramu might reflect a selection bias, as all the cases in his study were those that were admitted and died in hospital.[8] Coronary artery disease, as the most frequent cause of death, was also observed by Zanjad and Nanadkar,[5] Gupta, et al,[7] Jorgen,[9] Sarkioja, et al[10] and Anthony, et al.[11]

The fact that about 83.1% of all cases occurred outside the hospital setting suggests that these victims were either not aware of their prevailing medical conditions or refused to seek appropriate medical intervention. It, therefore, becomes imperative to evolve strategies that will help educate the entire population about the significance of the signs and symptoms of various medical conditions and need to seek medical advice early. Efforts should also be geared toward making health care facilities readily accessible.

Majority (49%) of the were Hindus, followed by Muslim and Christians. This type of similar finding are observed by Mukhopadhyay, et al.[12]

Conclusion:

We observed that a significant number of sudden deaths occurred in young adults, particularly in the population above 30years, posing a health concern in our society. Cardiac causes contributed the maximum number and atherosclerosis being the main culprit in causing CAD. It is a challenge to the healthcare providers and increased awareness is needed among the population at risk. Regular checkups after the age of 30 may be made mandatory so that sudden deaths can be averted and life can be improved.

Conflict of Interest : None
Financial Assistance: None

References

1. Parikh CK. Parikh's textbook of medical jurisprudence, forensic medicine and toxicology. 5th Ed. New Delhi: CBS Publishers and Distributors; 2005: 254.
2. WHO International classification of diseases and related health problems 10th revision (ICD 10) version for 2010. Available from: who.int/classifications/icd10/browse/2010/en#R96. Accessed on 2015 Nov 8.
3. Nandy A. Principles of forensic medicine including toxicology, 3rd Ed, New Central Book Agency (P) Ltd: Kolkata, 2010: 226- 229.
4. Reddy KSN. The essentials of forensic medicine and toxicology. 29th Ed, K Suguna Devi: Hyderabad. 2009: p 136.
5. Zanjad NP, Nanadkar SD. Study of sudden unexpected deaths in medico-legal autopsies. J Ind Acad For Med. 2006;28(1):27-30.
6. Escoffeery CT, Shirley SE. Causes of sudden death in Jamaica: a medicolegal (coroner's) autopsy study from the university hospital of the west indies. F S I 2002;129:116-21.
7. Gupta S, Panchal R, Sondarva D. An approach to sudden natural deaths in medicolegal autopsies at Karamsad, Gujarat. J Ind Acad For Med. 2011;33(1):30-2.

8. Ramu M. A 3-year review of 946 coroner's autopsies performed at kingston hospital, jamaica. West Indian Medical Journal. 1976;25(4):235-40.

9. Jorgen V. The organization of investigation of natural unexpected death in denmark. Forensic Sciences. 1976; 8: p 9-11. Available from:

10. https://www.sciencedirect.com/science/article/pii/0300943276900406. Accessed on: Nov. 8, 2015

11. Sarkioja T, Hirvoenen J. Causes of sudden unexpected deaths in young and middle-aged persons. F S I. 1984;24:247-61. Available from: https://www.ncbi.nlm.nih.gov/pubmed/6724459. Accessed on: Nov. 8, 2015

12. Anthony TC, Paul KA, Krikler DM, Michael DJ. Community study of the causes of ñnaturalò sudden death. B M J 1988;297:1453-6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1835183

13. Mukhopadhyay S, Dutta SS et al. A retrospective study of sudden death cases in medical college and hospital, kolkata. IOSR Jour Dental and Med Sci. 2015;14(1): 9-18

Original Research Paper

Injury Constellations in Light Motor Vehicular Accidental Deaths: An Autopsy Experience

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Abstract:

Accidents represent a major epidemic of non-communicable diseases in the present century. They are part of the price we pay for technological progress.[1] Of all the systems that people have to deal with on a daily basis, road transport is the most complex and the most dangerous.[2] 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 9th leading cause of DALYs lost to the 3rd leading cause in the world and will be 2nd leading cause in developing countries.3

In this study it was seen that young males were the most common victims of light motor vehicular road traffic accidents. Most of them died of head injury sustained during a head on collision, more commonly with a heavy motor vehicle, during night hours. Owing to the lack of first aid facilities along the roads, deaths were frequent during first hour of the accident. Majority of the victims did not wear seat belts and sustained injuries over extremities. More than a quarter of the male victims had consumed alcohol.

Key Words: Accidental deaths, DALYs, Vehicular Injuries

Introduction:

Accidents represent a major epidemic of non-communicable diseases in the present century. They are part of the price we pay for technological progress.[1] Of all the systems that people have to deal with on a daily basis, road transport is the most complex and the most dangerous.[2] 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 9th leading cause of DALYs lost to the 3rd leading cause in the world and will be 2nd leading cause in developing countries.[3]

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Each year, road traffic injuries take the lives of 1.2 million people around the world and seriously injure millions more. The death rate is highest and still growing in low and middle-income countries, where pedestrians, motorcyclists, cyclists and passengers are especially vulnerable.[4]

India is passing through the triple epidemic of communicable and infectious diseases, non-communicable diseases and injuries, due to epidemiological and demographic transition.[5] According to a report of the Ministry of Home Affairs, Government of India, one accident occurs every two minutes in India, with the accident rate corresponding to 45 per 100 000 population.[6] However, there is underreporting of traffic injuries by the health sector in India. India has 1% of vehicles in the world; but it accounts for about 6% of the total unintentional injuries.[6] Car Registrations in India averaged 104835.45 cars per month from 1991 until 2016, reaching an all-time high of 304900.00 cars in March of 2012.[7] With enormous number of light motor vehicles being added to Indian roads daily the incidences of their accidents is on the rise.[8] The present study

was undertaken to analyse constellation of injuries sustained by deceased victims of light motor vehicular road traffic accidents in this region.

Material and Methodology:

Sample:

This is a prospective study with a study sample consisting of 95 (78 males and 17 females) cases of fatal light motor vehicular (LMV) road traffic accidents (RTA) brought for medicolegal autopsy at a major teaching hospital in Central India over a period of three years from July 2011 to July 2014. Cases satisfying the following definition of RTA and RTC were selected: RTA - A collision involving at least one vehicle in motion on a public road that results in at least one person being injured or killed. RTC - A collision or incident that may or may not lead to injury, occurring on a public road and involving at least one moving vehicle. The selection of cases was consecutive. The reason behind smaller sample size (n=95) over a period of three years is the fact that cases of road traffic accident which didnôt involve light motor vehicles (cars, four wheelers etc.) were excluded from the study. Institutional ethical committee clearance was obtained.

Data Collection:

Along with the basic demographics which were recorded by talking to the accompanying relatives, police inquest papers, and hospital records. History as regards the circumstances of the accidents and other relevant data about injuries to the victims, the site of impact was obtained from police inquest papers. Meticulous post-mortem examination was conducted with special reference to characteristics and distribution of external and internal injuries. All cases were analysed with respect to age, time of accident, offending vehicles or objects, survival period of victims, mechanism of accident, pattern and distribution of injuries, fatal injuries, cause of death and history of alcohol consumption. All the details were noted in a prescribed proforma.

Statistical Analysis:

The data collected was checked, entered, and analysed using the statistical software MedCalc 16.8.4. Group differences were examined using categorical and ordinal scaled data sets and compared by the Chi-squared test. P value less than 0.05 was considered as statistically significant.

Observation and Results:

The victims

During the span of study, a total of 95 cases of LMV RTA were brought for medicolegal autopsy at the mortuary of Indira Gandhi Government Medical College, Nagpur. Of these, 78 (82.1%) were males. The victims' ages were categorized by means of 10 year intervals. The peak age group for the victims was 21 ï 30 years (**Table 1**).

Time of incident

Most of the accidents occurred during night hours ï 48 males (61.6%) and 14 females (82.3%) (p = 0.1042) (**Table 1**).

The offending vehicle

Heavy motor vehicle (HMV) including trucks and buses were the most common offending vehicle that led to accidents. As many as 25 males (32%) and 8 females (47.2%) were killed in accidents with HMV as the offending vehicle (p = 0.4623) (**Table 1**).

Survival period

Majority of the victims ï 28 males (35.8%) and 8 females (47.2%) (p = 0.8813) succumbed to the injuries either on the spot or on the way to hospital (**Table 1**).

Manner of collision

Head on collision was by far the most frequent manner of collision while hit from behind was the least common. 47 males (60.2%) and 12 females (70.2%) died in accidents involving head on collisions (p = 0.2339) (**Table 1**).

Seat belt

As far as wearing seat belts was considered, it was noted that 40 males (51.2%) and 12 females (70.5%) (p = 0.1622) had not worn seat belts. However the status of seatbelt was not known in 22 cases (**Table 1**).

Cause of Death

Head injury was the most common cause of death for both the sexes. As many as 21 males (26.9%) and 8 females (47.2%) (p = 0.0339) died of head injury, while sepsis was the least common cause of death (**Table 1**).

Site of injury

Extremities were the most commonly involved anatomical sites both in males (31.9%) and females (25.8%) (p = 0.7181) followed by head neck and face region. It is not surprising that the total number of cases is outnumbered by the number of sites of injuries as 83 victims suffered injuries at multiple sites (**Table 1**).

Alcohol

History of alcohol consumption and smell of alcohol was found positive in 26 (27.4%) cases. All of them were males (**Table 1**).

Table 1: Injury constellations with respect to time of accident, offending vehicle, survival period, manner of collision, status of seat belt, cause of death, site of injury and alcohol consumption

Parameter	Males		Females		P value
	n	%	n	%	
Time of accident					
18:00 - 06:00	48	61.5	14	82.3	0.1042
06:00 - 18:00	30	38.4	03	17.6	
Offending vehicle					
HMV	25	32	08	47.2	0.4623
LMV	11	14.1	04	23.5	
Three wheelers	2	2.5	00	00	
Dash to stationary object	21	26.9	03	17.6	
Unknown	19	24.3	02	11.7	
Survival period					
Death on spot/on the way to hospital	28	35.8	08	47.2	0.8813
Less than 1 hour	11	14.1	02	11.7	
1-24 hours	12	15.3	02	11.7	
24-48 hours	14	17.9	03	17.6	
48-72 hours	08	10.2	02	11.7	
More than 72 hours	05	6.4	00	00	
Manner of collision					
Head on	47	60.2	12	70.5	0.2339
Dash from behind	03	3.8	02	11.7	
Side impact	18	23	03	17.6	
Unknown	10	12.8	00	00	
Status of seat belt					
Worn	17	21.7	04	23.5	0.1622
Not worn	40	51.2	12	70.5	
Not known	21	26.9	01	5.8	
Cause of death					
Head Injury	21	26.9	08	47.2	0.0339
Blunt trauma to Chest	16	20.5	01	5.8	
Blunt trauma abdomen	14	17.9	01	5.8	
Hemorrhagic Shock	03	3.8	04	23.5	
Spine injury	05	6.4	00	00	
Injury to vital organs	18	23	03	17.6	
Septicemia	01	1.2	00	00	
Site of injury#					
Head, neck, face	57	26	14	22.5	0.7181
Chest	43	19.6	12	19.3	
Abdomen	24	10.9	09	14.5	
Back	13	5.9	06	9.6	
Pelvis	12	5.4	05	8	
Extremities	70	31.9	16	25.8	
Alcohol					
Objective evidence of alcohol consumption	26	33.3	00	00	

 # Site of injury outnumbered total number of victims as 83 victims were injured at multiple anatomical sites

1.1 Cause of death vs. Manner of collision: It was observed most of the victims in LMV RTAs had died of head injury sustained in head on collisions (**Table 2**).

Table 2: Cause of death in relation to the manner of collision

Manner /COD	Head on	Behind	Side	Unknown	Total
Head Injury	14	03	07	05	29
Blunt trauma to Chest	12	00	03	02	17
Blunt trauma abdomen	12	00	02	01	15
Hemorrhagic Shock	05	00	00	02	07
Spine injury	05	00	00	00	05
Injury to vital organs	10	02	09	00	21
septicemia	01	00	00	00	01
Total	**59**	**05**	**21**	**10**	**95**

Discussion:

Motorization has enhanced the lives of many individuals and societies, but the benefits have come with a price. Although the number of lives lost in road accidents in high-income countries indicate a downward trend in recent decades, for most of the world's population, the burden of road-traffic injuryð in terms of societal and economic costsð is rising substantially.[9] Injury and deaths due to RTA are a major public health problem in developing countries where more than 85% of all deaths and 90% of DALYs were lost due to RTA.[10]

In accordance to other studies,[11-14] majority of the victims were young males aged between 21- 30 years and most of them had met with a RTA during night hours. This being the most productive age group, gives an indication about the socio-economic implications of RTAs on the family and society, more so in a developing country like India. Similar to previous studies HMV like truck, buses, trailers etc. were the most common offending vehicle[11,15] with 'head on' being the most common manner of collision. Impact with heavy vehicles usually has a fatal outcome due to their greater mass and velocity. The lack of discipline and traffic sense due to low education level amongst such drivers is responsible for their rash driving. Also at times, they have to drive for long hours which makes them fatigued and more prone for accidents. As many as 49 (51.6%) victims died either on the spot or within first hour of the accident and majority of the victims were not using seat belts. Both the observations were concurrent with the existing literature.[16,17] The first hour after the trauma is called the ñgolden hour.ò If proper first aid is given, road accident victims have a greater chance of survival and a reduction in the severity of their injuries. Higher number of deaths during these golden hours in this study itself indicates the poor state of medical care/first aid along the roads of this region

The high incidence of deaths due to head injuries is striking.[18,19] Proportionately more females (47.2%) died of head injury than males (26.9%). However, as far as the site of injuries over the body was concerned, the extremities topped the list followed by head-neck- face region. Presence of maximum surface injuries over the extremities can be due to the fact that limbs have a larger surface area and are often the first point of contact either with the offending vehicle or the surface/road. Objective smell of alcohol with positive history of consumption was seen in 33.3% of the male victims. In India, driving under influence/ after consumption is almost customary in commercial vehicle drivers. Private car owners and youngsters are also major players in the game. Small bars along the Indian highways are of prime concern to control drunken driving. Driving under influence/ after consumption was responsible for 70% of road fatalities in Mumbai and Delhi[16, 20].

Conclusion:

Young males were the most common victims of light motor vehicular road traffic accidents. Most of them died of head injury sustained during a head on collision, more commonly with a heavy motor vehicle, during night hours. Owing to the lack of first aid facilities along the roads, deaths were frequent during first hour of the accident. Majority of the victims did not wear seat belts and sustained injuries over extremities. More than a quarter of the male victims had consumed alcohol.

Strict implementations of rules and regulations, stringent actions against the violators and up-gradation of trauma centres can help to alleviate severity of problems arising out of road traffic accidents. But strict implementation of traffic rules and stringent punishments alone will not solve the persisting crisis. Change in the mind set of riders and drivers and road users realizing their responsibilities will bring about a change.

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References:

1. Park K. Epidemiology of chronic non-communicable disease and conditions. in: park's textbook of preventive and social medicine. 20th Ed. M/s Banarsidas Bhanot Publishers, Jabalpur, India. 2009. p. 353.
2. Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E et al. World report on road traffic injury prevention. World Health Organization, Geneva. 2004. Retrieved from: http://apps.who.int/iris/bitstream/handle/10665/42871/9241562609.pdf;jsessionid=0F962F0D90226C32AE7A258F343F61AB?sequence=1. Accessed on 01/06/2017.
3. Murray CJL, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: global burden of disease study. Lancet 1997;349(9064):1498-504
4. World Health Day 2004: road safety is no accident. Retrieved from http://www.who.int/mediacentre/news/releases/2004/pr24/en/ Accessed on 28-12-2016.
5. Krug E (Ed). Injury: A leading cause of the global burden of disease. Geneva: World health organisation:1999. Retrieved from: http://www.who.int/violence_injury_prevention/publications/otherinjury/injury/en/. Accessed on 01/06/2017
6. Verma PK, Tewari KN. Epidemiology of road traffic injuries in Delhi: result of a survey. Regional Health Forum WHO South-East Asia Region 2004;8(1):1-10. Retrieved from: http://apps.searo.who.int/PDS_DOCS/B0031.pdf. Accessed on 01/06/2017.
7. India car sales. Trading economics. Retrieved from http://www.tradingeconomics.com/india/car-registrations Accessed on 22/12/2016
8. Sharma SM. Road traffic accidents in India. Intl J Advanced Integrated Medical Sci 2016;1(2):57-64.
9. Ameratunga S, Hijar M, Norton R. Road-traffic injuries: confronting disparities to address a global-health problem. Lancet 2006;367:1533ï 40.
10. Nantulya VM, Reich MR. The neglected epidemic: Road traffic injuries in developing countries. BMJ 2002;324:1139ï 41.
11. Singh CH, Dhattarwal SK. Pattern and distribution of injuries in fatal road traffic accidents in Rohtak (Haryana). J Indian Acad Forensic Med. 2004;26(1):20-23.
12. Menon A, Nagesh KR. Pattern of fatal head injuries due to vehicular accidents in Manipal. J Indian Acad Forensic Med. 2005;27(1):19-22.
13. Patel DJ, Agnihotram G. Study of road traffic accidental deaths (rta) in and around bastar region of chhattisgarh. J Indian Acad Forensic Med 2010;32(2):110-2.
14. Kumar A, Lalwani S, Agrawal D, Rautji R, Dogra TD. Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. Ind J Neurotrauma, 2008;5(2):63-7.
15. Chandra J, Dogra TD, Dixit PC. Pattern of cranio-intracranial injuries in fatal vehicular accidents in Delhi, 1966-76. Med Sci Law. 1979;19(3):186-94.
16. Luchter S, Smith A, and Wang J. Fatal Injuries in light vehicle crashes - time to death and cause of death. Annu Proc Assoc Adv Automot Med. 1998;42:277.
17. Crinion JD, Foldvary L A, Lane JC. The effect on casualties of a compulsory seat belt wearing law in South Australia. Accident Analysis & Prevention1975;7:81-9.
18. Gupta S, Deb PK, Moitra R, Chhetri D. Demographic study of fatal cranio-cerebral road traffic injuries in north bengal region. J Indian Acad Forensic Med 2007;29(1):25-7.
19. Khajuria B, Sharma R, Verma A. A profile of the autopsies of road traffic accident victims in Jammu. J Clinical Diagnostic Research 2008;2:639-642.
20. Indian driving schools. road safety; drunken driving. 2011. Retrieved from: http://www.indiandrivingschools.com/drunken-driving.html. Accessed on: 01/06/2017..

Original Research Paper

Identifying the Unidentified: Is it Still a Difficult Problem?

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Abstract:

Every day, a large number of missing reports are lodged in various police stations of the country and, on the other hand, a number of dead bodies are recovered with no identification marks/ proof found on them. Lack of proper facilities for preserving the body enhances decomposition at a faster rate, while State statutes mandating the disposal of the dead within 72 hours of death,[1,2] fuels further the need for quick and hasty identification in the short time available to the authorities. In these circumstances, it is of immense importance to evolve a systematic procedure to trace the missing persons and to identify the unknown bodies. 'Un-identification' of these dead bodies on a larger scale could be the next major medical hazard across our metropolitan cities.

Key Words: Unclaimed, Un-Identified Bodies, System to Identify

Introduction:

Identity is important in practically all aspects of life. Though the duty of establishing identity of a person is primarily a police responsibility, it does warrant greater contribution by Forensic Experts in various legal proceedings.

Types of identification of a person are - complete & partial. Complete identification refers to the absolute fixation of individuality of a person, while partial identification refers to that kind of identification, where only few characters of identity are found out and the identity profile of concerned person remains incomplete.[3]

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Legal identity or Temporary identity is one kind of assigning a number or character (such as A, B, etc.) to each unidentified body/ remains by those who are in custody of the unclaimed bodies.[1] Police, as a routine before burying these unclaimed remains, would follow this type of identification. A plastic bottle containing mud and the assigned character written in a piece of paper with ball pen is practiced by some Police officials in southern districts of Tamilnadu.[2]

World Scenario:

Federal Bureau of Investigation (FBI) in USA has implemented an unidentified personôs file system into its National Crime Information Centre (NCIC) to establish a central repository for information concerning missing and unidentified persons. This enables law enforcement officers across the USA to share and cross-reference information from missing personôs files against information of unclaimed bodies.[3]

Forensic Pathology Service (FPS) in South Africa; Crime Scene Index (DNA profiles collected from crime scenes) & Convicted Offender Index (DNA profiles of convicted offenders);[4] Reference Index (samples from persons suspected or charged of offence) & Elimination Index (DNA profiles of people

collecting & analyzing forensic samples) are also tried in various countries.[6,7]

Indian Scenario:

"Zonal Integrated Police Network" containing data of missing persons and unclaimed bodies from Police forces of Chandigarh, Delhi, Haryana, Himachal Pradesh, Punjab, Rajasthan, Uttaranchal & Uttar Pradesh is offering an initiative that caters service to the above states in India.[8] Random efforts include unclaimed body registry maintained by Maharashtra police, 'unidentifieddeadbodies.com' based in Gujarat, 'unknownbodies.org' based in Hyderabad, too offer service towards cremation of unclaimed bodies.[9] Both these websites offer available anthropometry and photograph of those dead individuals.

Since our country lacks a nationwide database of missing persons and unclaimed bodies, correlating both the lists for better identification of unclaimed bodies remains a cumbersome entity. But unlike many other countries, we have a nationwide unique identification system[5] which takes into account fingerprints of all fingers in addition to retinal scans. This identification system is not linked to the unclaimed registry due to many legal hurdles and objections; and national wide statistics of missing persons and their track record is not available due to our diversity and many other reasons. If this link work is undertaken, identifying the unclaimed would not be a difficult task anymore.

Background:

According to National Crime Records Bureau (NCRB) data, there were 34,592 unidentified dead bodies recorded in India.[11] Maharashtra ranked highest in the number of unclaimed bodies (6,185), followed by Tamil Nadu (3,739), Karnataka (3,533) and Uttar Pradesh (3,409). The statistics revealed that states like Mizoram, Nagaland, Sikkim, Andaman and Nicobar Island, Dadra and Nagar Haveli and Lakshadweep had no cases of unclaimed bodies found.[11]

Chennai is the fourth largest city in India with a population of more than 70,00,00 as per 2011 statistics.[12] It has the third largest "expatriate" population (people living away from their native) accounting to 1,00,000 by 2016.[13] Government General Hospital, Chennai, which is attached to Madras Medical College, is the largest referral center for the state of Tamilnadu. We report the retrospective analysis on "unclaimed dead bodies" in Government General Hospital, Chennai over a two-year period.

Method Used in the Study:

This was a retrospective study on unclaimed dead bodies, brought to Rajiv Gandhi Government General Hospital, Chennai, from January 2015 - December 2016. The data were collected from the autopsy records of the department and inquest papers of the Investigating officer. The age of the deceased was ascertained from the available data from the investigating officer and/or from the age estimation based on the anatomical features at autopsy on the dead body. Study was started after due approval from the Institutional Ethics Committee.

Results:

The total number of autopsies conducted in 2015 (2618) & 2016 (2770) had 1095 unclaimed bodies over the study period, with 965 males and 130 females. Majority of the males were in 40 to 60-year age group and the females in > 60-year age group. (**Table 1**)

Table 1: Baseline characteristics

Age (years)	Male	Female	Total
0-20	18	2	20
20-40	145	6	151
40-60	208	20	228
>60	101	30	131
Total	**965**	**130**	**1095**
Age data available	472	58	530

Table 2 shows the cause/ probable cause of death of the 1095 cases. The most common medico-legal cases were either road or train traffic accidents, while the most common medical cause was myocardial infarction.

Table 2: Probable cause of death

Type of cases	
RTA	355
TTA	198
Drowning	10
Electrocution	1
Fall	29
Hanging	5
Poisoning	3
Assault	19
Injuries	4
Head Injury	40
Others	3
Medical causes	
Pulmonary/ Miliary TB	47/ 67
MI	170
Aspiration pneumonia	36
Non-traumatic SAH	22
Stroke	18
Other medical causes	50
Pending	9
Pneumonia	9

Five hundred and thirty three (48.7%) bodies were identified after the police investigation, whereas in the remaining 562 (51.3%) cases, identity could not be established. Among the bodies that could be identified, 339 (63.6%) cases could be identified within 24 hours. (**Table 3**).

Table 3: Identification of unclaimed bodies (Time elapse)

Identified within	Number
24h	339
2-3 days	84
4-7 days	41
7-14 days	37
14-30 days	23
> 1 month	9

DNA testing was done in 10 cases, of which one could be matched. Skull superimposition was done in one case, which could not secure a positive match. Finger prints were recorded in 825 out of 1095 cases, of which only 191 were identified, 342 were identified through dress materials & its markings, personal belongings, tattoos, key chains etc. (**Table 4)**

Table 4: Identification done (Technique type)

Technique employed	Number (n=1095)	Positive match (Identified)
DNA fingerprinting	10	1
Skull superimposition	01	Nil
Fingerprint	825	191
Personal belongings	1095	342

Our study showed that 20.3% of the total autopsies conducted every year were on unclaimed dead bodies, majority of whom were males in 40 to 60-year age group, similar to the previous study from Lucknow.[14]

Thanks to advances in technology, many local whatsapp groups are available, which connect all the police stations in the region. Information on all the medico-legal cases of the region are shared in the group, which help in connecting the cases and establishing identity. ZIPNet (Zonal Integrated Police Network) introduced in the year 2004, is an official website to share Crime and Criminal Information in real-time.[8] It contains a module on ówunidentified dead bodiesô in which the photograph and available information of the unclaimed bodies are published, in an attempt to improve the rate of identification of unclaimed bodies in the recent time.

Conclusion & Recommendations:

William E. Gladstone, Prime Minister of England said:[15]

ñShow me the manner in which a nation or community cares for its dead and I will measure, with mathematical exactness, the tender mercies of its people, their respect for the law of the land and their loyalties to high ideals.ò

1. Complete fingerprint and palm print of all unclaimed bodies can be recorded in post mortem examination document and kept in department (as many are left unrecorded by Police),
2. Linking of fingerprint data for the purpose of proper identification of unclaimed bodies and hence its proper funeral rites (though Aadhar agency, Unique identification Authority of India moved the Supreme Court against using the Aadhar details for criminal tracing),

3. Skull superimposition can be made mandatory for all unclaimed bodies,
4. National level DNA data base could d be created with a wider flexibility so as to keep a check on this alarming increase in the number of un-identified bodies (expensive nature of the test prevents in practical enforcement).

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References:

1. W. P. No. 10701 0f 2001 and W. P. M. P. No. 15495 of 2001, High Court of Judicature at Madras, dt: 09.01.2001.
2. Govt. Letter No. 31185 / Z 1 / 2001-1 dt: 26.06.2001; Govt. Letter No. 35286/ Z1/ 2001, dt: 10.07.2001 (issued by Govt. of Tamilnadu in continuation of W. P. in ref No.1).
3. NG Rao, Textbook of Forensic Medicine and Toxicology, 2nd Edition, Jaypee Publishers, 2010: p65.
4. Personal communication, Inspector of Police, AWPS, Tirunelveli, Tamilnadu.
5. FBI, National Criminal Information System. Available at https://www.fbi.gov/services/cjis/ncic. Accessed on: 27.06.18.
6. The Criminal Law (Forensic Procedures) Amendment, DNA Act 2014, amending the South African Police Service Act, 1995. Available at: http://dnaproject.co.za/legislation/homepage/legislation/a-new-dna-act. Accessed on: 27.06.18
7. Milot E, Marie MJ, Germain LH, Crispino F. The National DNA Data Bank of Canada: a Quebecer perspective, Front Genet. 2013;4:249. Available from http://journal.frontiersin.org/article/10.3389/fgene.2013.00249. Accessed on: 27.06.18.
8. Zonal Integrated Police Network, Unidentified dead bodies index 2007 to present, Available from: http://zipnet.in/index.php?page=un_identified_dead_bodies, Accessed on: 27.06.18.
9. G.O.Ms.No.95., dated: 15 March 2011, Issued by Govt. of Andhra Pradesh, available at http://unknownbodies.org, maintained by Sri Satya Harishchandra Foundation, Hyderabad. Accessed on 27.06.2018.
10. The Aadhaar (targeted delivery of financial and other subsidies, benefits and services) Act, 2016. Act No 18 of 2016. Available from: https://www.uidai.gov.in/images/the_aadhaar_act_2016.pdf. Accessed on: 27.06.18.
11. National Crime Records Bureau, Un-identified Dead Bodies Report, 2017. Available from: http://ncrb.gov.in/Flyers/ncrbFlyerSept2017.pdf. Accessed on 27.06.2018.
12. Registrar General of Indian Census, Indian Census 2011, Metropolitan (UA) ï Chennai. Available from: http://www.censusindia.gov.in/2011census/hlo/pca/pca_data.html. Accessed on: 27.06.2018
13. Growing expat community favour cluster accommodation. The Economic Times. 15 Jan 2009. Available from: https://economictimes.indiatimes.com/jobs/expats-face-similar-hardships-in-india-and-china/articleshow/59326052.cms. Retrieved. 27 July 18.
14. Kumar S, Verma AK, Ali W, Singh US. Homeless and unclaimed persons' deaths in north India (Jan 2008-Nov 2012): a retrospective study. Med Sci Law. 2015 Jan;55(1):11-5.
15. Sloane DC. Is the cemetery dead ? University of Chicago Press, 2018. p163
16. Jayaprakash PT, Singh B, Yusop RAM, Asmuni HS. Skull Photo superimposition: A remedy to the problem of unidentified dead in malaysia. Malaysian J Forensic Sci 2010;1(1):34-41.

Original Research Paper

Reliability of Sternal Length and Sternal Index in Sex Determination

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Abstract:

Identification is the recognition of an individual by means of various physical features and biological parameters, which are unique to each individual. Our study on sternum was done as an attempt to obtain certain parameters by which sex determination of individual is possible with a reasonable accuracy. The material for the present study consists of 60 (33 Male, 27 Female) sterna obtained from the cadavers brought for medico-legal postmortem examination at a Government Medical College Hospital, Tamilnadu. The mean combined length of male sternum was 151.70 mm, with a standard deviation of 29.5 and the mean length of female sternum was 119.74 mm, with a standard deviation of 19.5. The mean difference between the length of male and female sternum was 31.96 mm. The mean sternal index for males was 48.27 mm, with a standard deviation of 4.65 and for females, it was 53.52 mm, with a standard deviation of 4.96.

Combined length of sternum and manubrium is a reliable criterion for the determination of the sex of a sternum. Due to wide variation in the results of different studies, the sternal index is not a reliable criterion for sex determination

Key Words: Identification, Sex Determination, Length of Manubrium, Length of Sternum, Sternal Index, Hyrtlôs Law

Introduction:

Identification is the recognition of an individual by means of various physical features and biological parameters, which are unique to each individual. Since the bones resist putrefaction and destruction by animals, they can be used for identification and can lead to a reliable determination of age, sex, race and stature of the individual.[1] Sex determination from unknown skeletal remains is one of the major tasks for forensic experts. In case of mass-disasters such as terrorist attacks, airplane crashes, earthquakes, etc, when badly decomposed, mutilated or damaged human remains consisting of only a few bones or their fragments are recovered from the site, it becomes crucial to establish the identity of the individual, especially, the sex. Though a number of bones such as pelvis, skull, femur etc., are helpful for sex determination, these bones are not always found at such scenes. In such situations, forensic pathologists have to depend on less sexuallydimorphic elements of human skeleton such as sternum. Studies like this, can provide useful clues and information to

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scientifically prepare experts to face such situations in the future wherein bones like pelvis and skull may not be part of the skeletal remains recovered for examination.[2] When the entire skeleton or skull or pelvis is available, sex determination can be done with reasonable degree of accuracy. When only a single bone is presented for examination, it is difficult to determine the sex of the individual accurately. Our study on sternum was done as an attempt to obtain certain parameters by which sex determination of individual is possible with a reasonable accuracy.

Materials and Methodology:

The material for the present study consisted of 60 (33 Male, 27 Female) sterna obtained from the cadavers brought for medico-legal postmortem examination at Department of Forensic Medicine, Chengalpattu Medical College, Chengalpattu, Tamilnadu from January 2017 to March 2017. Prior approval of the Institutional Ethics Committee was taken for the study.

The sex of the individuals was noted. The sterna were removed from the cadavers by sectioning the costal cartilages just beside the costochondral junction. Cases belonging to the age-group 20-60 years were only considered. Deformed, diseased and fractured sterna were not included in the study. The sterna were buried in the soil for 12 weeks for natural maceration of soft tissues. The dried and decayed soft tissues were gently removed. Subsequently, the following measurements were taken from the sterna: Length of the manubrium (M), Length of mesosternum (S), Combined length of manubrium and mesosternum= M + S. Data feeding was done in Excel sheets and SPSS version 16 was used for Statistical analysis. **Fig: 1, 2.**

Results & Discussion:

***Combined length of Manubrium and sternum (M+S)**:*

The mean combined length of male sternum was 151.70 mm, with a standard deviation of 29.5; the mean combined length of female sternum was 119.74 mm with a standard deviation of 19.5. The mean difference between the length of male and female sternum is 31.96 mm, which is statistically significant, as given in **Table-1**

Fig-1: Male sternum

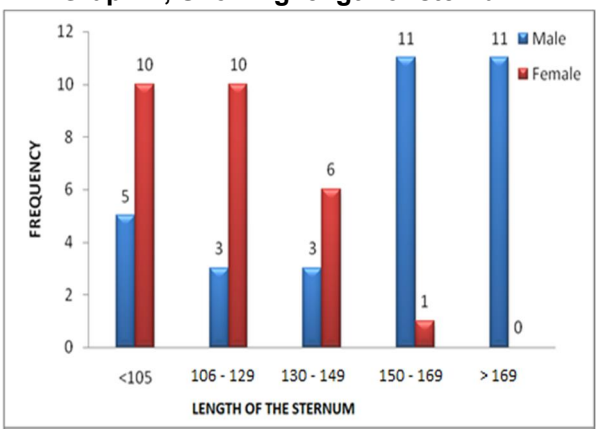
Fig-2: Female sternum

Ashley[3] concluded that a combined length of 149 mm was the dividing line between the two sexes i.e., if the combined length of the manubrium and sternum is less than 149, it belongs to the female sex, and if the length is > 149 mm, it belongs to the male sex. In our study, of the 33 male sterna, 22 were more than 149 mm in length. Of the 27 female sterna, 26 were less than 149 mm, as shown in **Graph-1**. Thus, by applying Ashleyøs 149 rule, we can correctly identify 66.67% of male sternal and 96.3% of female sterna. Kaneria, et al[4] observed that by applying Ashleyøs rule, 51.85% of male and 95.65% of females can be sexed correctly. Vina Vaswani[5] applied this rule and found that only 30% of male sterna but all the female sternal could be sexed correctly. Chandrakanth, et al[6] attempted applicability of this rule and observed that only 25.3% of males but 91.8% of female sterna could be sexed correctly.

Table-1: Combined length of manubrium and sternum (M+S)

Sex	Number of cases	Range	Mean	SD	Level of sign. (P)
Male	33	103 - 184	151.70 mm	29.5	**0.0001**
Female	27	99 - 159	119.74 mm	19.51	**0.0001**

Graph-1; Showing length of sternum



The combined length of Manubrium and sternum was studied by various authors in India, in the past few years, as shown in **Table-2**. The sternal lengths obtained in our study are comparable to those by others.[4,7-10] The slight variations in the findings may be due to regional differences. Thus, combined length of manubrium and sternum is a reliable criterion for sex determination.

Sternal index (Manubrio-Corpus index = M/S x 100):

The mean sternal index for males was 48.27 mm, with a standard deviation of 4.65 and for females, it was 53.52 mm with a standard deviation of 4.96. The average difference between male and female sternal indices was 5.65. This is also statistically significant. **Table-3**. Similar observations have been made by others,[4,11-14] as shown in **Table-4**.

Table-2: Combined length of Manubrium and sternum in various studies

Author	Sex	Number of cases	Mean length of M+S (mm)	SD
Singh J.[7] (North India)	Male	252	145.69	11.41
	Female	91	124.87	10.12
Puttabanthi S[8] (Andhra Pradesh)	Male	57	139.55	21.09
	Female	22	110.64	8.13
Adhvaryu A[9] (Gujarat)	Male	45	141.06	10.64
	Female	55	122.31	9.38
Kaneriya D[4] (Surat)	Male	27	149	21
	Female	23	126	12
Changani MV[10] (Gujarat)	Male	57	138.10	11.63
	Female	26	116.11	11.08
Present study (Tamil nadu)	Male	33	151.70	29.5
	Female	27	119.74	19.51

Table-3: Sternal index

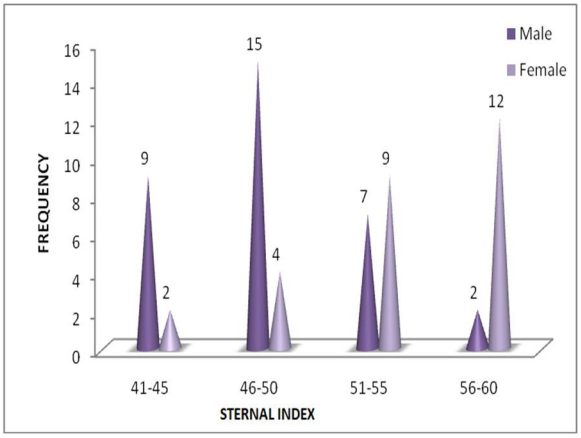
Sex	Number of cases	Range	Mean	SD	Level of significance (p)
Male	33	41 – 52	48.27 mm	4.65	**0.0001**
Female	27	46 - 60	53.52 mm	4.96	**0.0001**

Table-4: Percentage of cases obeying Hyrtl's law (Sternal index < 50 in males; > 50 in females)

Author	Number of cases	Sex	% of cases obeying Hyrtl's law
Narayan and Verma[11] (1958)	126	Male	34.12
	27	Female	81.48
Jit (1980)[12]	312	Male	31.08
	88	Female	88.64
Dahiphale (2000)[13]	96	Male	52.20
	47	Female	100
Devinder Kumar[14] (2006)	56	Male	89.28
	44	Female	75.00
Kaneria (2013)[4]	27	Male	70.37
	23	Female	100
Present study (2017)	33	Male	72.73
	27	Female	77.78

24 male sterna out of 33 had a sternal index of less than 50 and 21 female sterna out of 27 had a sternal index of more than 50. **Graph-2**

Graph-2 : Showing Sternal Index



It was also observed that the sternal index of 15 sterna (25% cases) (9 males and 6 females) were in the overlapping zone. **Fig-2**. Therefore, Hyrtlõs law may not be accurate for sex determination when applied on a single specimen though the results are statistically significant.

Conclusion:

The results of the present study and its relevance with other similar studies show that the combined length of sternum and manubrium is a reliable criterion for the determination of the sex of a sternum.

From our study we can conclude that Ashleyõs 149 rule can correctly identify the sex of more than 96% of female sterna. Other studies on sternum also support this fact

Due to a wide variation in the results of different studies, the sternal index is not a reliable criterion for sex determination.

However, further studies are required over larger population to ascertain the reliability of sexing criteria using sternum.

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References:

1. Camps FE. Ed. Gradwohlõs legal medicine. 3rd Ed. Bristol. John Wright & sons Ltd; 1976. p. 110.
2. Singh J, Pathak RK, Singh D. Morphometric sex determination from various sternal widths of Northwest Indian sternums collected from autopsy cadavers: A comparison of sexing methods. Egyptian J Forensic Sciences 2012;2:18-28.
3. Ashley GT. The human sternum - the influence of sex and age on its measurements. J Forensic Med. 1956; 3:27-43 [Cross reference: Mohit Gupta, Anil Kumar, SK Khanna. Determination of Sex from Sternal Bone In Central Delhi Population. J Indian Acad Forensic Med 2014;36(3):235-7.]
4. Kaneriya D, Suthar K, Patel V, Umarvanshi B. Mehta C and Tailor C et al Morphometric study of sternum for determination of sex. Cibtech Journal of Bio-Protocols 2013;2(2):6-13. Available at http://www.cibtech.org/cjbp.htm. Retrieved on 7/10/2017.
5. Vaswani VR. Determination of age and sex from sternum from autopsied bodies obtained from district hospital. (Unpublished doctoral dissertation). Karnataka University 1995. (A dissertation work by Vaswani VR in Jawaharlal Nehru Medical College, Belgavi, Karnatka. Dr. Mestri SC was the Professor and Head of Forensic Medicine)
6. Chandrakanth HV, Mestri SC, Pramod Kumar GN. Determination of age and sex by human sternum. an anthropometric study. LAP Lambert Academic Publishing, GmbH & Co. KG. 2012 (A monogram published on the dissertation work of Dr.Chandrakanth HV)
7. Singh J, Pathak RK, Singh D. Morphometric sex determination from various sternal widths of Northwest Indian sternums collected from autopsy cadavers: a comparison of sexing methods. Egypt J Forensic Sci. 2012;2(1):18-28. Available at: https://www.sciencedirect.com/science/article/pii/S2090536X12000032. Accessed on 7/10/2017.
8. Puttabanthi S, Velichety SD, Padi TR, Boddeti RK, Ratna Priyanka. Sexing of unknown adult human sterna by metrical analysis. Int J Biol Med Res 2012;3(2):1516-9. Available at:https://www.researchgate.net/publication/2217

16593_Sexing_of_unknown_adult_human_sterna_by_metrical_analysis. Accessed on 7/10/2017

9. Adhvaryu A, Adhvaryu M, Rathod S, Chauhan P, Joshi H. A study of sexual dimorphism in human sterna. Int J Med Res Health Sci 2013;2(3):577-81.
10. Changani MV, Javia MD, Varma KA. Determination of sex from various measurements of human sternum & manubrium in Gujarat population. J Res Med Den Sci 2014;2(1):59-65
11. Narayan D, Varma HC. Sternal index for male and female in U.P. J Anat Society India 1958;7:71-2. [Cross reference: Pawan Mittal, Vijay P. Khanagwal, P.K. Paliwal. Reliability of Sternal Index in Sexual Dimorphism In the Haryanvi Population of India. J Indian Acad Forensic Med 2014;36(2):135-7.]
12. Jit I, Jhingan V, Kulkarni M. Sexing the human sternum. Amer J Physical Anthropol 1980;53(2):217-24.
13. Dahiphale VP, Baheete BH, Kamkhedkar SG. Sexing the human Sternum in marathwada region. J Anat Society India 2002;51(2):162-7.
14. Atal DK Murari A, Naik SK. Role of Sternal Index in Determination of Gender. J Forensic Med Pathol 2008;1(3&4):71-4

Original Research Paper

Violence Against Women at Bhayangkara Hospital Pekanbaru, Indonesia: A 5 Years Retrospective Study

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Abstract:

The study of violence against women was carried out at the Emergency Departments of Bhayangkara Hospital Pekanbaru over a period of 5 years with the aim to study type of violence, and pattern of injury. A total of 2421 cases fulfilled the criteria. The most affected victim's age group was 25-34 Yrs (40.7%); two-third of victims were housewives, the average incidence per year of 484.2. Physical assault was dominant (95.2%) and most occurred at outdoor domestic (70.8%). Bruise and abrasions were the more frequently found injuries, with head as the most common site. The age distribution, profession, scene of violence, presence of wound, number of wound, site of wound, number of body region and blunt injury had no significance. No abnormal finding was found in 79.5% victims on the genital and in 96.6% victims on the perianal area. There was a recognizable pattern regarding the multiplicity of the injuries, the types of injury and the preferred sites of injury.

Key Words: Violence Against Women, Physical Assault, Sexual Assault, Pattern of Injury

Introduction*:*

Violence against women (VAW) is a significant public health problem, as well as a fundamental violation of women's human rights. World Health Organization reported that more than 1 in 3 women (35.6%) around the world have experienced physical and/or sexual partner violence, or sexual violence by a non-partner.[1] A national survey in the United States reported that approximately 1.3 million women were physically assaulted by an intimate partner annually.[2]

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According to police-reported data, about 173,600 women aged 15 years and older were victims of violent crime in 2011. This translates into a rate of 1,207 female victims for every 100,000 women in the population in Canada.[3] Snapshot Data 2016 from United Nations Population fund that in Asia and the Pacific Region, the percentage of women who reported physical or sexual violence, or both, by an intimate partner in their lifetime varied between 15% in Laos and 68% in Papua New Guinea.[4] A survey in Ukraine showed that the incidence of violence against women and girls has increased from 2007 to 2014. The percentage of women who suffered physical violence increased from 17% in 2007 to 19 % in 2014, sexual violence increased from 5% to 8% and both physical/sexual violence increased from 18% to 22%.[5]

Violence against women is a widespread and serious violation of human rights that has severe physical, psychological, emotional and social consequences. Some health consequences include physical injury; receive hospital emergency care; mental health problems such as depression, anxiety and post-traumatic stress disorder, suicide; disabilities; and a higher risk of

non-communicable diseases, including hypertensive disorders and cardiovascular disease.[1,4]

In Indonesia, a Survey on Violence against Women and Children (2006), showed that the total number of woman victims in 2006 was 2.3 million or 3.07 percent. Victims in rural areas were higher than their urban counterparts (1.3 million versus 1.0 million).[6] Meanwhile, data from Annual Report National Commission on Anti-Violence Against Women, Republic of Indonesia (2017) showed an increase in the number of VAW since 2010, which continues from year to year. The number of cases of VAW in 2016 amounted to 259,150 and 75% were of domestic violence and 22% in the community.[7]

Regarding studies on VAW, few studies have reported on the prevalence of VAW in Indonesia. Hayati, et al reported that the overall prevalence of lifetime exposure to sexual and physical violence was 22% and 11% was among women in rural areas.[8] There is no data regarding the prevalence of VAW in hospital setting, especially in urban areas.

Pekanbaru is the capital city of the Riau Province, one of the 34 provinces in Indonesia. This city is the third largest (inland) urban area on the Sumatra Island with a population of approximately 1.05 million people.

Violence is a criminal act against the body and human life. The role of forensic examination is very important to address justice system needs through forensic evidence collection. The forensic expert will obtain a history of violence, perform physical examination, document exam findings, collect evidence, interpret and analyze the findings.[9] In Indonesian legal system, the forensic doctor will examine living victims on request by the police official. The medicolegal report is given by the forensic doctor after all the protocol and medicolegal examination has been performed. We use the term *Visum et Repertum* for the medicolegal report which can be used as evidence in court (*Pro Justicia*).[10]

The principal aim of this study was to identify the type of violence and pattern of injuries on the VAW victims in the Emergency Departments of Bhayangkara Hospital Pekanbaru (BHP). This hospital is a teaching hospital of the Faculty of Medicine, Universitas Riau and the hospital center for forensic medical services in Pekanbaru. All VAW cases reported to the police will be referred to the Bhayangkara Hospital Pekanbaru. By understanding the various dimensions of this global problem through data collection and analysis, the decision makers are better able to develop and evaluate measures designed to prevent and eliminate violence against women.

Material and Methodology

A retrospective descriptive study was conducted at the BHP. All medico-legal injury reports of living victims from January 1st 2010 to December 31st 2014 were studied for type of violence, and pattern of injury. The medico-legal report (*Visum et Repertum*) of the woman victims with inclusion criteria age 18 years and older who had been brought for examination to the Emergency Department, was reviewed. The completeness of the data was obtained by compiling and recording the necessary data that was contained in the medico-legal report (*Visum et Repertum*) of VAW cases. Official approval was obtained from Director of BHP. The research protocol was approved by the Institutional Research Committee of the Faculty of Medicine, University of Riau.

Data was analyzed using SPSS (SPSS Inc., Chicago, IL, USA) program version 21.0. Chi square test and appropriate statistical tests were used to study significant association or comparison between two qualitative variables. P-value less than 0.05 was considered statistically significant.

Results

A total of 2421 cases were identified for inclusion in this study. Overall, the total number of medicolegal cases coming to the BHP over the study period was 6876. The average VAW percentage of all cases of living victims was 35.2 % and varied from 33 % to 38 % per year. The number of woman victims increased across the years, peaking in the year 2013. Average incidence of VAW victims per year was 484.2. (**Figure 1**).

Figure 1. The Incidence and Distribution of the medicolegal cases coming to the BHP during the study period

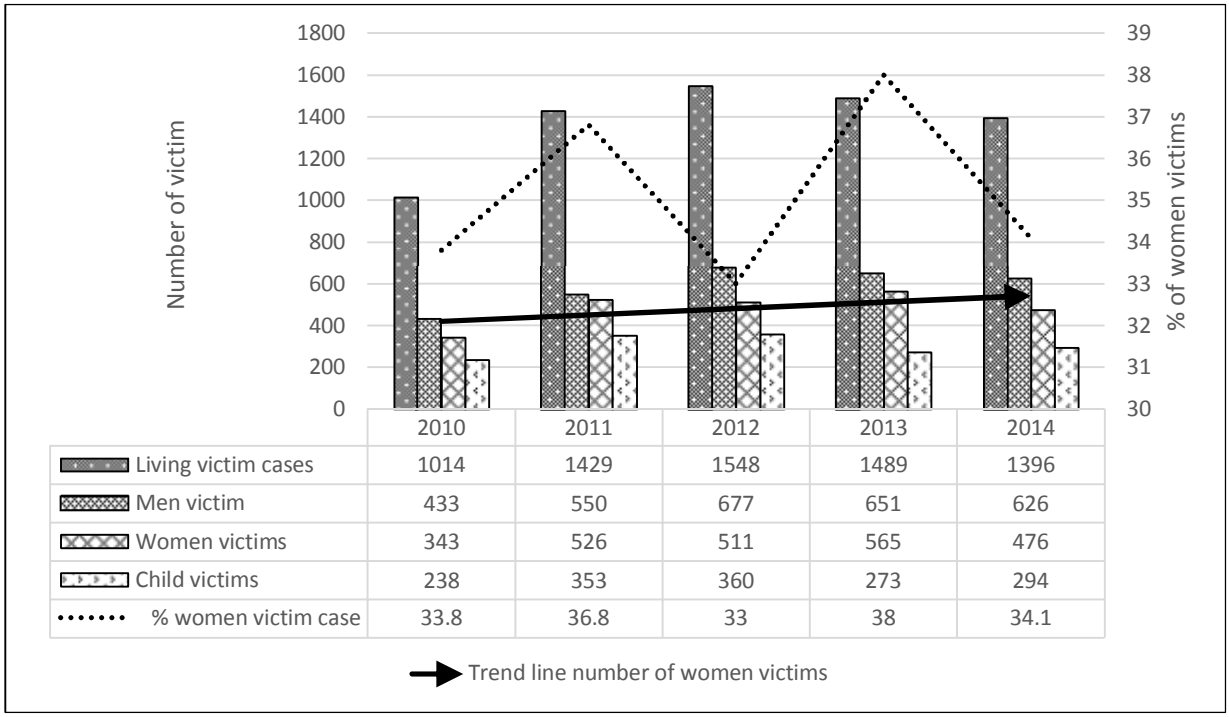

Table 1: Distribution of Victims as per incidence, age, profession and scene of violence by type of violence

Variable	Type of violence		Total N (%)[a]	p-value
	Physical assault n (%)[a]	Sexual assault n (%)[a]		
Number, % of total	2304 (95.2)	117 (4.8)	2421 (100)	0.000*
2010	307 (13.3)	36 (30.8)	343 (14.2)	
2011	502 (21.8)	24 (20.5)	526 (21.7)	
2012	492 (21.4)	19 (16.2)	511 (21.1)	
2013	538 (23.4)	27 (23.1)	565 (23.3)	
2014	465 (20.2)	11 (9.4)	476 (19.7)	
Age, median, year	30 (18+ - 80)	21 (18+ -70)	30 (18+ - 80)	0.000**
18+ – 24	604 (29.9)	83 (70.9)	684 (28.4)	
25 – 34	961 (41.7)	25 (21.4)	986 (40.7)	
35 – 44	51 (22.4)	7 (6.0)	524 (21.6)	
45 – 54	177 (7.7)	1 (0.9)	178 (9.4)	
55 – 64	27 (1.2)	0 (0.0)	27 (1.1)	
65 – 74	15 (0.7)	1 (0.9)	16 (0.7)	
75 – 84	3 (0.1)	0 (0.0)	3 (0.1)	
> 84	0 (0.0)	0 (0.0)	0 (0.0)	
Profession				
Housewife	1528 (66.3)	32 (27.4)	1560 (64.4)	0.000*
Regular limited, income work	229 (9.9)	14 (12.0)	243 (10.0)	
Irregular limited, income work				
Student	354 (15.4)	28 (23.9)	382 (15.8)	
Other (not working, no income, etc.)	134 (5.8)	19 (16.2)	153 (6.3)	
	59 (2.6)	24 (20.5)	83 (3.4)	
Scene of violence				
Outside domestic	1600 (69.4)	113 (96.6)	1713 (70.8)	0.000*
Domestic	704 (30.6)	4 (3.4)	708 (29.2)	

[a] Data presented in absolute number (%) except stated otherwise, *Chi-Square test, ** Mann-Whitney test

Ninety-five-point two percent and 4.8% of the victims were physically and sexually assaulted, respectively. The ages of victims ranged from 18+ to 80 years, with a median of 30 years. The most affected age groups were 25-34 years (41.7%), with median 30 (18+ - 80), for physical assault and 18+ - 24 years (70.9%), with median 21(18+ -70), for sexual assault. Most of the VAW victims were housewives (64.4 %). Outside the house was the most common scene of violence 69.4% for physical assault and 96.6% for sexual assault. (**Table 1**)

Bruise and abrasion were the most frequently observed injuries on the VAW victims (70.7% and 51.6%, respectively) and among physical assault victims (73.4% and 53.2%, respectively). Most of the sexual assault victims did not have any injuries (70.9%). A single injury was found in almost half of the VAW

Table 2: Distribution of presence and site of injury, type of injury with type of violence among the victims

Variable	Type of violence		Total N (%)[a]	p-value
	Physical assault n (%)[a]	Sexual assault n (%)[a]		
Type of Injury				
Bruise	1690 (73.4)	21 (17.9)	1711 (70.7)	0.000*
Abrasion	1226 (53.2)	24 (20.5)	1250 (51.6)	0.000*
Laceration	161 (7.0)	2 (1.7)	163 (6.7)	0.026*
Burn	5 (0.2)	0 (0.0)	5 (0.2)	1.000***
Number of injuries, median	1 (0-3)	0 (0-3)	1 (0-3)	0.000**
No Injury	208 (9.0)	83 (70.9)	291 (12.0)	0.000*
Single	1180 (51.2)	23 (19.7)	1203 (49.7)	
2 injuries	850 (36.9)	9 (7.7)	859 (35.5)	
3 injuries	66 (2.9)	2 (1.7)	68 (2.8)	
Site of wound				
Head	1385 (60.1)	14 (12.0)	1395 (57.8)	0.000*
Upper extremities	1037 (45.0)	16 (13.7)	1053 (43.5)	0.000*
Lower extremities	469 (20.4)	7 (6.0)	476 (19.7)	0.000*
Neck	264 (11.5)	4 (3.4)	268 (11.1)	0.007*
Back	236 (10.2)	2 (1.7)	238 (9.8)	0.002*
Chest	153 (6.6)	2 (1.7)	155 (6.4)	0.034*
Abdomen	63 (2.7)	1 (0.9)	64 (2.6)	0.216*
Site of injury on the body, wound, median	1 (0-6)	0 (0-3)	1 (0-6)	0.000**
No injury	208 (9.0)	83 (70.9)	291 (12.0)	0.000*
Single site	1017 (44.1)	26 (22.2)	1043 (43.1)	
2 Areas	888 (38.5)	7 (6.0)	895 (37.0)	
3 Areas	147 (6.4)	1 (0.9)	148 (6.1)	
4 Areas	38 (1.6)	0 (0.0)	38 (1.6)	
5 Areas	5 (0.2)	0 (0.0)	5 (0.2)	
6 Areas	1 (<0.1)	0 (0.0)	1 (<0.1)	
Type of weapon				
Blunt	2032 (88.2)	34 (29.1)	2066 (85.3)	0.000*
Sharp	43 (1.9)	0 (0.0)	43 (1.8)	
Both	16 (0.7)	0 (0.0)	16 (0.7)	
Burns	5 (0.2)	0 (0.0)	5 (0.2)	
No injury	208 (9.0)	83 (70.9)	291 (12.0)	

[a] Data presented in absolute number (%) except stated otherwise, *Chi-Square test, ** Mann-Whitney test, ***Fisher's Exact test

victims (49.7%) and 51.2% of physical assault. The most common site of wound was the head (57.8%) in VAW victims and 60.1% in the physical assault victims. In sexual assault victims, the most common site of wound was the upper extremity (13.7%). Injury was found on a single body region in 43.1% of VAW victims and 44.1% of physical assault victims. Blunt weapon was the predominant among VAW victims, physical assault and sexual assault (85.3%, 88.2% and 29.1%, respectively). (**Table 2**)

Table 3: Distribution of perianal-genital forensic examination findings among the victims

Variable	Sexual assault (N = 117) n (%)
Female Genital	
Hymen tears	
Acute (partial/complete)	4 (3.5)
Old (partial/complete)	12 (10.2)
Acute and old	3 (2.7)
Erythema	5 (4.3)
No abnormal finding	93 (79.5)
Perianal	
Perianal erythema	0 (0.0)
Bruise and or abrasion	1 (1.17)
Reduce tone of anal sphincter	1 (1.17)
Anal laceration	0 (0.0)
Scar and Fold change	2 (1.7)
No abnormal finding	113 (96.6)

Discussion

Violence against women has become very common and is a serious problem nowadays. It is also illustrated by the number of VAW cases in Pekanbaru. This study presented the incidence of VAW victims who were examined in the Emergency Department Bhayangkara Hospital, Pekanbaru, based on referrals from the police. It has that the incidence of violence against women has increased across the years with an average of 484.2 victims/year. This trend was also observed in Thailand,[11] Canada,[3] and globally.[5] Increasing participation of women in the public arena, joblessness, jealousy, dowry- related issues, communication gap, customs and patriarchal family systems have been found to be the causes of VAW.[6,12]

Based on the average incidence, it is estimated that the prevalence of VAW in Pekanbaru is 1.65% among the woman in the study population. Our result was lower, as compared to that in Indonesia, 3.1% for urban areas.[6] This difference could be due to the different source of data collection, method of study or the number of victims. Our data only reported 2 forms of VAW (physical and sexual assault).

The most common type of violence against women was physical assault, which is consistent with the studies in Canada,[3] Ukraine,[5] Faisalabad[13] and South Africa,[14] which identified physical assault as the type of violence most commonly reported. Both physical abuse and psychological abuse can negatively impact womenôs health and quality of life.[15]

Domestic violence against women is common. In Indonesia, a National survey has reported that approximately 70% of violence against women occurs in domestic sphere.[6] The report of survey is higher than our study. This fact shows that many women do not want to report the violence they experienced in the domestic sphere, which is consistent with study by Hayati, et al,[8] which reported that the victim is more likely to blame herself for the assault, her traditional attitude to the gender role and justification of husbandôs abuse.

In present study, majority (40.7%) of the victims were of the age group 25-34 years, followed by (28.4%) the 18+-24 years group; 2/3rd of the victims were housewives. These results agree with the study in Canada,[3] Brazil,[16] and Ukraine.[5] This may be due to the fact that individuals of these age groups are more vulnerable to the physical and sexual violence at streets, work place, home, and even at the educational institutions. This age range is characterized by an important life stage of the women, with relation to their reproductive period and their attention and care for their children. Thus, it is necessary to combat and outline the subject of violence against women within all organizational levels of society, in such a way to involve individuals, families, communities, and the different social levels at the same time.[15]

Again, 70.7% of the victims had bruises, followed by abrasions (51.6%). Combined injuries were present in less than half of the

victims. This is similar with that in Faisalabad that reported that most women victims had soft tissue lesions, usually in the form of abrasions, scratches, teeth bites and bruises.[13,17] Almost half of the victims had injuries on two or more body regions with blunt weapon as the most common weapon of offence. The findings of this study indicate that VAW can lead to morbidity for the victims.

We did not observe any injury among majority of the sexual assault victims (70.9%), further a maximum of 3 body areas were involved. Injuries on the genitals involving vulva and vagina were noted in 6 (20.5%) victims, which were mainly old hymenal cleft (10.2%). Pattern of injury from perianal examination showed that less than 2 % victims were involved and that the common injuries were bruise and or abrasion, reduced tone of anal sphincter, scar and fold change. A study by Tariq, et al[13] suggested that the time of reporting for medicolegal examination after the sexual assault is very important. Late forensic examination will result in the loss of evidence of sexual assault.

Our study has some limitation. It was based on medicolegal report of VAW victims. It only showed physical and sexual assaults. Other type of violence such as emotional, psychological, persecution, and or exploitation cannot be known from the present data source. The history of perpetrators was also not available in the medicolegal report.

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References:

1. World Health Organization. Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence. WHO. 2013. 57p. Available from: http://www.who.int/iris/bitstream/10665/85241/1/WHO_RHR_HRP_13.06_eng.pdf. Accessed on March 20, 2017.
2. Tjaden P, Thoennes N. Full report of the prevalence, incidence, and consequences of violence against women. National Institute of Justice. 2000. 71p. Available from: https://www.ncjrs.gov/pdffiles1/nij/183781.pdf. Accessed on March 20, 2017.
3. Sinha M. Measuring violence against women: Statistical trends. Statistics Canada. 2013. Available from: http://www.statcan.gc.ca/pub/85-002-x/2013001/article/11766-eng.pdf. Accessed on March 20, 2017.
4. World Health Organization. Global plan of action. WHO. 2016. Available from: http://www.who.int/reproductivehealth/publications/violence/gpa-booklet/en/. Accessed on March 20, 2017.
5. Volosevych I, Konoplytska T, Kostiuchenko T, Mikhanchuk D, Martsenyuk T. The prevalence of violence against women and girl. United Nations Population Fund (UNFPA). 2014. Available from: http://ukraine.unfpa.org/sites/default/files/pub-pdf/GBV%20prevalence%20survey%20%20EN.pdf. Accessed on March 20, 2017.
6. WHO-SEARO. Indonesia: Country policies and strategies for combating GBV. WHO-SEARO. 2010. Available from: http://www.searo.who.int/entity/gender/data/indonesia.pdf?ua=1. Accessed on March 20, 2017.
7. National Commission on Anti-Violence Against Women of the Republic of Indonesia. Annual report National Commission on Anti-Violence Against Women of the Republic of Indonesia. 2017. Available from: https://www.komnasperempuan.go.id/catatan-tahunan-kekerasan-terhadap-perempuan-2017_komnas-perempuan/#more-15976. Accessed on March 20, 2017.
8. Hayati EN, Högberg U, Hakimi M, Ellsberg MC, Emmelin M. Behind the silence of harmony: Risk factors for physical and sexual violence among women in rural Indonesia. BMC Women's Health. 2011;11:52.
9. The Attorney General. Adult and child sexual assault protocols: initial forensic physical examination. 2015. Available from: http://myfloridalegal.com/webfiles.nsf/WF/JFAO-77TKCT/$file/ACSP.pdf. Accessed on March 20, 2017.
10. Afandi D. Visum et Repertum perlukaan: Aspek medikolegal dan penentuan derajat luka. Maj Kedokt Indones. 2010;60(4):188-195.
11. WHO-SEARO. Thailand: Country policies and strategies for combating GBV. WHO_SEARO. 2010. Available from: http://www.searo.who.int/entity/gender/data/thailand.pdf?ua=1. Accessed on March 20, 2017.

12. WHO-SEARO. South-East Asia Region. WHO-SEARO. 2010. Available from: http://www.searo.who.int/entity/gender/data/regional_sheet.pdf?ua=1. Accessed on March 20, 2017.

13. Tariq SA, Qasim AP, Naeem M, Naheed K. Pattern of female medicolegal cases attending the casualty department of a teaching hospital. JUMDC. 2014;5(1):20ï 5.

14. Jewkes R, Penn-Kekana L, Levin J, Ratsaka M, Schrieber M. Prevalence of emotional, physical and sexual abuse of women in three south african provinces. SAMJ 2000;91(5):201-8.

15. Ali TS, Krantz G, Mogren I. Violence permeating daily life: a qualitative study investigating perspectives on violence among women in Karachi , Pakistan. Int J Womens Heal 2014;4:577-85.

16. Bernardino Í de M, Barbosa KGN, Nóbrega LM da, Cavalcante GMS, Ferreira EF e, Avila S d. Violence against women in different stages of the life cycle in Brazil: an exploratory study. Rev Bras Epidemiol. 2016;19(14):740-52.

17. Balci YG, Ayranci U. Physical violence against women: Evaluation of women assaulted by spouses. J Clin Forensic Med. 2005;12(5):258-63.

Original Research Paper

Correlation of lip prints with gender and blood groups

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Abstract:

Context: Individual identification is a challenging task in forensic investigation. Lip prints are unique to a person and may be used as supportive evidence. Present study was aimed at proving that lip prints may be specific to gender & blood groups. *Materials & Methods:* An observational study was done on 100 medical students of both genders after taking approval from the Institutional Ethics Committee. Inter-commissural distance (ICD) of lips and lip prints types were recorded using standard techniques in relaxed state. Participants were stratified according to lip print types, blood groups and compared across the gender. *Results:* Both the blood groups O^{+ve} and B^{+ve} were present in equal proportion in males (33.3%), where as 28.6% of females were O^{+ve} and 27.1% were B^{+ve}. The most common lip pattern in females was Type I, while the most common type in males was Type I and IV. No significant association of lip prints types was found with gender (Chi =7.423; p=0.191) and blood groups. (Chi =30.60;p=0.435). ICD was significantly higher in males as compared to females (51.6±6.84 vs 45.82±3.86; p<0.001). *Conclusion:* The study confirmed the distinctiveness of lip prints in gender and blood groups but disapproved any significant correlation of lip prints with blood group and gender.

Key Words: Lip Print, Cheiloscopy, Blood Group, Inter-Commissural Distance

Introduction:

Individual identification is an important and challenging task in forensic investigation which is based on scientific principles. The study of lip prints, cheiloscopy, is linked to the fact that lip prints are unique to every person, except in monozygotic twins, and hence, may be used as supportive evidence.

It is a proven fact that lip prints recover after undergoing alterations like trauma, inflammation, herpes. The disposition and form of the furrows do not vary with environmental factors,[1] and are even claimed to be heredity by several researchers.[2] One of the most emerging methods of human identification, originating from criminal and forensic practice, is human lips recognition.[3] Traces of lipstick smears could be found left on drinking cups, glasses, cigarette butts, clothing, windows and doors, parts of the body and tissue papers[4,5] and may all be good significant forensic evidence in investigations of a sexual assault or homicidal cases.[6,7]

Inter labial gap during relaxed state can be used to assess lip competency which could be matched with past facial profile photographs or lateral cephalogram records for identification in mass disaster.[8] Also the extraction therapy of facial profile in adolescents will be more noticeable in females as their growth during adolescence varies with the gender. The knowledge may be useful in surgeries involving lip repair and related facial pattern & esthetic surgeries.[9] With the recent spurt in crimes involving this age group in India, assessment of different patterns of lip pattern among adolescent age group needs to be studied.

The present study was conducted to observe any correlation between the lip print patterns, blood groups and gender among medical students. The awareness of advanced

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techniques in crime detection has alarmed the criminals in to taking sufficient precautions like the use of gloves, etc. In such circumstances, identification of criminals using accurate methods like fingerprint analysis fail to establish a positive identity. Thus investigators have to rely on adjuvant techniques. Lips contain grooves which are permanent and unchangeable can be used to determine lip prints. The Indian scenario is such that there are frequent incidences of theft, rape, illiteracy, economic instability. The youth succumbing to its impulsive anger, nature, addictions, curiosity and peer pressure is indulging in criminal activities. Medical students of this age group are additionally loaded with stress, expectations and rigorous curriculum.

Materials and Methodology:

An observational study was conducted on 100 medical students of Himalayan Institute of Medical Sciences, Uttarakhand, over a period of 1 month after taking approval from the Institutional Ethics Committee. All the students were briefed about the purpose of the study and written informed consent was taken from them before undertaking the study. Students undergoing orthodontic treatment, dentures, braces; having congenital abnormalities, inflammation or trauma and known hypersensitivity to lipstick were excluded from subject selection.

The subjects were interviewed for collecting demographic and personal details. Their name, address, age in years (nearest to year), gender, and blood group, were recorded in the Case Proforma. Following the interview lip pattern for each subject was collected.

Procedure for Lip print: Lips of the subject were cleaned, he/ she was made to sit in a relaxed position and then lipstick was applied on the lips in a single motion. The subject was asked to rub both the lips to evenly spread the lip stick. A strip of cellophane tape was cut out with scissors. The glued portion of cellophane tape strip was placed over the lip and the subject was asked to make a lip impression gently in the normal rest position of the lips. The tape was then lifted carefully from the lip from one end to the other, avoiding any smudging of the print. The strip of cellophane tape was then stuck on to a piece of white A4 sheet for permanent record (If the print was not satisfactory, the above steps were repeated). The subject was provided with cotton and cleansing milk to clean the lips. The lip prints were then examined with the help of magnifying lens and analysis carried out by a single observer. The inter-commissural distance (ICD), in mm, of the lips in relaxed state was measured 3 times between the corners of the mouth by using an error free Vernier calipers and average measurement was recorded by a single observer.

All the lip patterns were analyzed for determining the types and observing the relationship between gender and blood group. [**Table 1**]

Results:

The study was conducted on 100 medical students (male n=30; female n=70) in HIMS, Uttarakhand. The following observations were made about the types of lip pattern and inter commissural distance among males and females. The mean age (years) of subjects among females was (20.1±0.78) and among males was (20.03±0.83). The mean inter commissural distance (mm) among females was lower (45.82±3.86), as compared to males (51.6±6.84). (**Fig: 1**)

Figure 1: Comparison of Inter Commissural Distance Among Females and Males

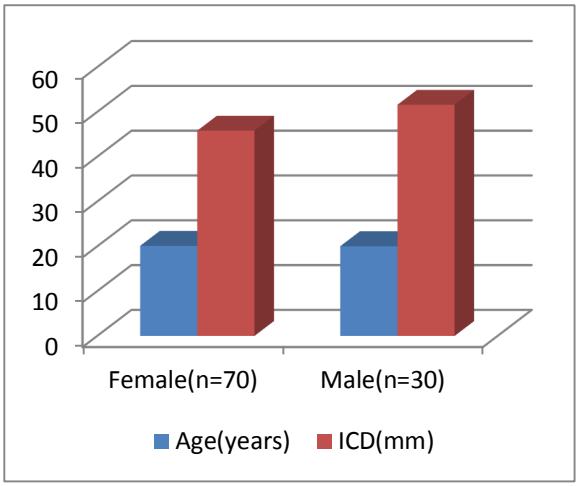
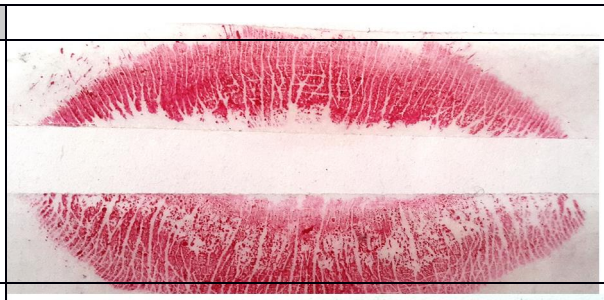


Table 1. Suzuki and Tsuchihashi's classification of Lip grooves [10]

Types	Pattern	
Type I	Vertical grooves	
Type I'	Partial length vertical lip grooves of type I	
Type II	Branched Grooves	
Type III	Intersecting Grooves	
Type IV	Reticular grooves	
Type V	Undetermined pattern	

The study showed that 28.6% of females had O^{+ve} blood group, followed by B^{+ve} (27.1%) and A^{+ve} (25.7%), while only 8.6% females had AB^{+ve} blood group. 33.3% of males had O^{+ve} as well as B^{+ve} blood group, followed by A^{+ve} (23.3%). (**Fig: 2b; 2a**) We further observed that 32.9% females had a lip pattern of type I, followed by type II (21.4%), IV (17.1%), I (11.4%), V (10%) while type III (7.14%) was the least observed. In males, 26.7% had type I and type IV lip patterns, followed by type II (23.3%) and III (16.7%). Only 6.7% of males had a lip pattern of type V. (**fig: 3b, 3a**)

Fig 2b. Distribution of ABO Blood Groups Among Females (n=70)

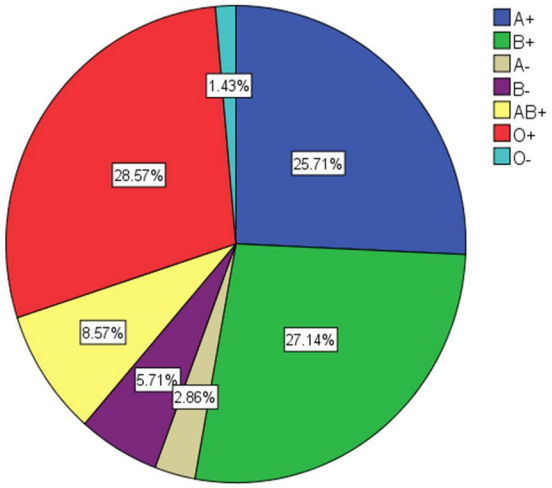


Fig 3a. Distribution of Lip Pattern Among Males (n=30)

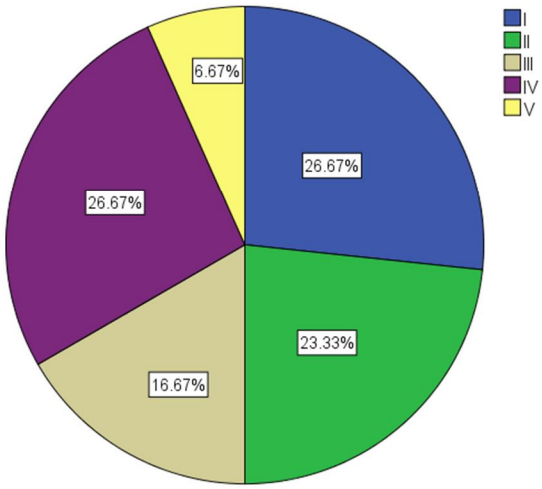


Fig 2a.Distribution of ABO Blood Group Among Males(n=30)

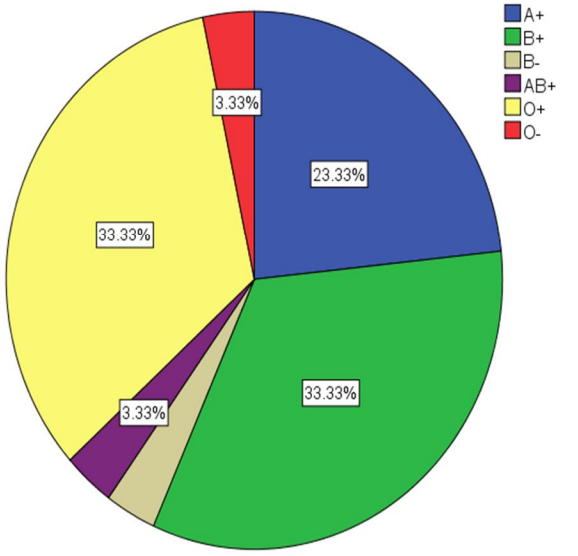


Fig3b. Distribution of Lip Pattern in Females (n=70)

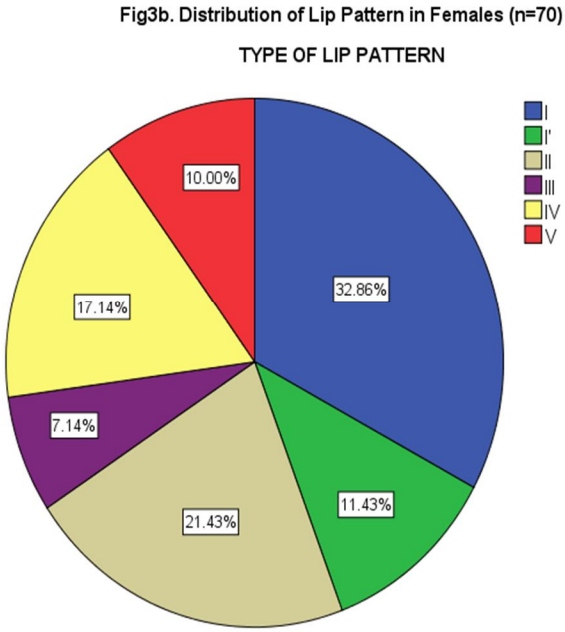


Table 2: Distribution of Types of Lip Prints Across Different Blood Groups among the Subjects (n=100)

	ABO Blood Groups						
Types of Lip Print	**A^+**	**A^-**	**B^+**	**B^-**	**AB^+**	**O^+**	**O^-**
I	8 (26.7%)	0 (0.00%)	11 (35.50%)	2 (6.50%)	1 (3.20%)	9 (29%)	0 (0.00%)
I'	4 (40.0%)	0 (0.00%)	1 (12.50%)	0 (0.00%)	0 (0.00%)	3 (37.50%)	0 (0.00%)
II	5 (23.8%)	1 (4.50%)	6 (27.30%)	1 (4.50%)	1 (5%)	8 (36.40%)	0 (0.00%)
III	3 (30.0%)	0 (0.00%)	0 (0.00%)	2 (20%)	2 (20%)	3 (20%)	0 (0.00%)
IV	4 (20.0%)	1 (4.80%)	10 (47.60%)	0 (0.00%)	1 (5%)	4 (19%)	1 (4.80%)
V	1 (11.1%)	0 (0.00%)	1 (12.50%)	0 (0.00%)	2 (25%)	3 (37.50%)	1 (12.50%)

*values are in frequency (Percentage of total)

Distribution of types of lip prints across different blood groups among the subjects (n=100) is shown in T**able 2.** On observing the association of blood group and lip pattern it was observed that the most common blood group observed in Type I lip print pattern was B^{+ve} , in Type I' it was A^{+ve},in Type II-O^{+ve} ,in Type III-A^{+ve} , in Type IV-B^{+ve} and in Type V-O^{+ve} .

On analysis of association of lip pattern with inter commissural distance and blood groups across gender, no significant association of lip pattern with the blood group was observed in both males (chi 4.71; p=0.31) and females (chi=1.14); p=0.88). Correlation of the inter commissural distance and lip pattern in both male and females was also found to be insignificant [female r =0.20(p= 0.08); male r =0.16(p = 0.37)]

Discussion:

India is a vast country with large ethnic variation and varied lip patterns. Several regional studies on lip prints were carried to stratify the pattern and prevalence of the same.[3,11,15] Our study in the age group of 19-25 years of young adult in northern region of India revealed that lip print type I was the most predominant among female subjects, while type I and type IV lip prints were the most predominant among males. Our results were in accordance with the study done on 106 students by Sandhu, et al,[3] comprising of 56 males and 50 females in the age group of 18-25 years. However the study was done in Punjabi population and only the middle part of the lower lip was taken as their study material for analysis of the lip.

Several other authors have reported different types of lip patterns among their study population. Augustine, et al.[1] reported that Type III pattern was the most common pattern among males and females. Vahanwalla, et al[11] studied lip prints in population from Bombay and found that the most commonly occurring lip print pattern in male gender was Type III and Type I in the female gender. Vats, et al[12] observed that the most common pattern was Type III in males and Type V in females in the Delhi & Haryana population. Patel, et al[13] studied lip prints in Udaipur population and found that the most common pattern was Type I in males and Type II in females. Bindal, et al[14] found that the most common pattern among the males and females was Type II in the Dehradun population. Mutalik, et al[15] reported that Type IV pattern was the most common among males and females of Manipal, Karnataka. Gupta, et al[16] found that the most common pattern was Type II in males and Type III in females in Lucknow.

The distribution of blood groups in our study was such that in almost equal percentage of females were either A^{+ve} , B^{+ve} & O^{+ve} (~33.3%); while only ~ 1% was O^{-ve} and none was AB^{-ve} . While in males, B^{+ve} , O^{+ve} & A^{+ve} were the commonest blood group (~ 30%) ande no none had AB^{-ve} blood group. The most

common lip pattern in females was Type I while in the males, it was Type I & IV. On observing the association of blood groups and lip patterns, it was found that the most common blood group observed in Type I lip print pattern was B^{+ve} , in Type I - A^{+ve}, in Type II - O^{+ve}, in Type III - A^{+ve}, in Type IV - B^{+ve} and in Type V - O^{+ve}.

No significant association of lip pattern with the blood group was observed in both males and females. The study also did not observe any significant correlation of the inter commissural distance and lip pattern in both male and females. The present study showed no significant correlation of lip prints with gender (r=7.423; NS) and blood groups (r=30.60; NS).This may be because the students came from different areas. The results of the current study are similar to those observed by Patel.[13] However, they recorded the similarities and dissimilarities among the 10 families with siblings and twin children. Also, our study showed similar results with the study conducted by Telagi, et al.[17] On analysis, they also found no correlation of lip print with gender and blood group. The variations in lip patterns as observed in our study may be attributed to the various regions from where the students were enrolled in the college. It is definitive that lip pattern remains the same throughout life apart from any physical trauma in the area. Hence, this can add value to lip print in the forensic science community as a powerful tool in personal identification.

It is hence concluded that in males having blood group O^{+ve} and B^{+ve}, the most predominant type of lip prints were type I and type IV. In females having blood group O^{+ve}, type I lip pattern was the most common. The study confirmed the distinctiveness of cheiloscopy but did not show any significant correlation of lip print with blood group & gender.

Limitations:

Due to the time limitation of one month, the study was conducted among 100 medical students only, who were of varied population where the ratio of males and females was not equal. Further studies with larger samples are required to obtain statistical significance of this correlation.

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We express our sincere thanks to our respected teachers Dr. Sanjoy Dass, Dr. Devinder Atal and Dr. Rattan Singh without whose constant guidance, support and help we would not have successfully completed it.

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References:

1. Augustine J, Barpande SR, Tupkari JV. Cheiloscopy as an adjunct to forensic identification: a study of 600 individuals. J Forensic odontosomatol 2008;27:44-52.
2. Kasprzak J. Possibilities of cheiloscopy. Forensic Sci Int 1990;46:145- 51.
3. Sandhu SV, Bansal H, Monga P, Bhandari R. Study of lip print pattern in a Punjabi population. J Forensic Dent Sci 2012;4:24-8.
4. Andrasko J. Forensic analysis of lipstick. Forensic Sci Int 1981;17:235-51. Available from: https://scidoc.org/IJFP.php Retrieved on:
5. Barker AML, Clarke PDB. Examination of small quantities of lipstick. J Forensic Sci Soc 1972;12:449-51. Available from: https://anglia.rl.talis.com/items/75D1A033-E7C6-0971-6F0B-BE2254114854.html. Retrieved on: 5th May 2016
6. Castelló A, Seguí AM, Verdú F. Luminous lip-prints as criminal evidence. Forensic Sci Int 2005;155:185-7.
7. Castillo A, Alvarez M, Verdu FA. New chemical aid for criminal investigation: dyes and latent prints. Color Technol 2002;6:316-8.
8. Karjodkar FR. Textbook of dental and maxillofacial radiology. 2nd Ed. New Delhi: Jaypee Publishers. 2011; pp. 929-6.
9. Nanda RS. The contributions of craniofacial growth to clinical orthodontics. Amer J Orthodontics and Dentofacial Orthopedics 2000;553-5. Available from: https://www.ajodo.org/article/S0889-5406(00)70197-1/pdf. Retrieved on: 5th May 2016.
10. Tsuchihashi Y. Studies on personal identification by means of lip prints. Forensic Sci 1974;3:233-48. Available from:

https://www.ncbi.nlm.nih.gov/pubmed/4858319. Retrieved on: 5th May 2016

11. Vahanwala SP, Parekh BK. Study of lip prints as an aid to forensic methodology. J Ind Dent Assoc 2000;71:268-71
12. Vats Y, Dhall JK, Kapoor A. Gender variation in morphological patterns of lip print among some north Indian populations. J Forensic Dent Sci 2012;4(1):19-23.
13. Patel S, Ish Paul, Madhusudan AS, Ramesh G, Sowmya GV. A study of lip prints in relation to gender, family and blood group. Intl J Oral & Maxillofacial Pathol 2010;1(1):4-7.
14. Bindal U, Jethani SL, Mehrotra N, Rohatgi RK, Arora M, Sinha P. Lip Prints as a method of identification in human being. J Anat Soc India 2009;58(2):152-155.
15. Mutalik VS, Menon A, Jayalakshmi N, Kamath A, Raghu AR. Utility of cheiloscopy, rugoscopy, and dactyloscopy for human identification in a defined cohort. J Foren Dent Sci 2013;5(1):2-6.
16. Gupta S, Gupta K, Gupta OP. A study of morphological patterns of lip prints in relation to gender of North Indian population. J Oral Biol Craniofac Res 2011;1:12-6.
17. Telagi N, Mujib A, Spoorthi BR, Naik R. Cheiloscopy and its patterns in comparison with ABO blood groups. J Forensic Dent Sci 2011;3:77-80.

Original Research Paper

UV Spectrophotometric Detection of Carbapenem Antibiotics in Forensic Samples

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Abstract:

In forensic samples, estimation of Carbapenem antibiotics has been done with the help of a simple, precise, cost effective U.V Spectrophotometric method, as described in the present study. Methanol was used as a solvent throughout the experiment. It was found that carbapenem antibiotics i.e., Meropenem, Doripenem, Imipenem and Etrapenem had 243, 211, 294, and 247 nm respectively, as absorption maxima. 2-20 microgram/ml was the range in which the Beerôs law was obeyed. The recovery values found in forensic samples for carbapenem antibiotics were less than or equal to 70%. Hence, quantitative determination of carbapenem antibiotics in forensic samples was done by the proposed method.

Key Words: Carbapenem, Forensic Samples, U.V Spectrophotometer

Introduction:

Carbapenems are highly effective ß-lactam antibiotics that have broad spectrum bacterial resistant activities.[1] Resistance towards hydrolysis by most ß-lactamase is a unique feature of these antibiotics.[2] They distort the structure and growth of bacterial cell wall by binding with penicillin binding proteins.[3]

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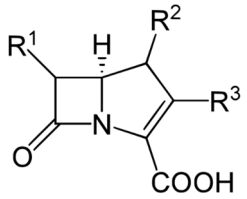
As per advancement in their nature and mechanism of action, they are broadly divided in four categories: Meropenem, Doripenem, Imipenem and Etrapenem.4 A general structure of Carbapenem class of antibiotics is shown in Figure 1.

An important task in forensic analytics include detection of any drug molecule in forensic samples. For forensic purposes, a suitable analytical method has to be available for analysis of drug(s) in drug delivery systems in dissolution studies (in vitro) and in biological samples (in vivo).[5]

Fig 1. General structure of Carbapenem Antibiotics



It is an important task to develop a simple, sensitive, accurate, precise and reproducible method for estimation of drug(s) in forensic samples in the absence of any such method for specific need.

The literature shows that carbapenem antibiotics have been analyzed by TLC,[6]

HPLC,[7-10] Electrochemical detection,[11] Polarography,[12] and Spectrophotometry.[13,14] Thus, the present study is an attempt to detect and determine a simple, accurate, sensitive, precise and reproducible UV method for carbapenem antibiotics (of different generations) in forensic samples.

Materials and Methodology:

Instruments and Materials:

The instrument used was a double beam thermo-helio-spectrophotometer with range of 190-1100 nm and band width of 1 nm (fixed) with room temperature between 20-25°C. Mettler toldeo analytical precision balance was used for quantitation. The Carbapenem pure drug was obtained from Indian Pharmacopoeia Commission (IPC) with 99.9% w/w assay value and was used without further purification. Different forensic samples included viscera, blood and gastric lavage. All the chemicals and reagents used were of analytical grade.

Preparation of standard stock solution:

A standard drug solution of all the carbapenem antibiotics was prepared by dissolving 10 mg of each carbapenem in 10 ml of methanol, and this was transferred into 100 ml volumetric flask. The volume was brought up to the mark with methanol to obtain a stock solution of each carbapenem with 100 microgram/ml final concentration. The solution was further sonicated for 15 minutes to obtain clear solution.

Preparation of working solution:

From above stock solution, a 2 ml sample was transferred into 10 ml volumetric flask and the volume was made up to the mark with methanol to prepare a concentration of 20 microgram/ml. The sample was further scanned by UV spectrophotometer in the range of 200-400 nm using methanol as a blank. The wavelength corresponding to the maximum absorbance was found to be 243, 211, 294, and 247 nm for Meropenem, Doripenem, Imipenem and Etrapenem respectively. This was further utilized to obtain a calibration curve.

Preparation of sample solution:

From stock solution, 1 ml volume of drug was spiked in 4 ml of forensic samples like blood, gastric lavage and viscera respectively. Therefore, the final volume of sample solution was 5 ml, with final concentration of drug in each sample found to be 4 microgram/ml as follows:

$$C_1V_1 = C_2V_2$$
$$20(1) = C_2(5)$$
$$20 = 5\,C_2$$
$$20/5 = C_2$$
$$4 = C_2$$

Where = C_1 = Spiking concentration of drug

V_1 = Spiking volume of drug

V_2 = Volume of sample at time of spiking

C_2 = ?

Preparation of calibration curve:

Various aliquots of carbapenem antibiotics were prepared from the stock solution (100 microgram/ml) ranging from 2-20 microgram/ml. The samples were analyzed with the help of UV spectrophotometer, using methanol as blank. The linearity of above mentioned samples (carbapenems) were observed in the **Figures 2-5** and **Tables 1-2.**

Fig 2: Calibration curve for Meropenem

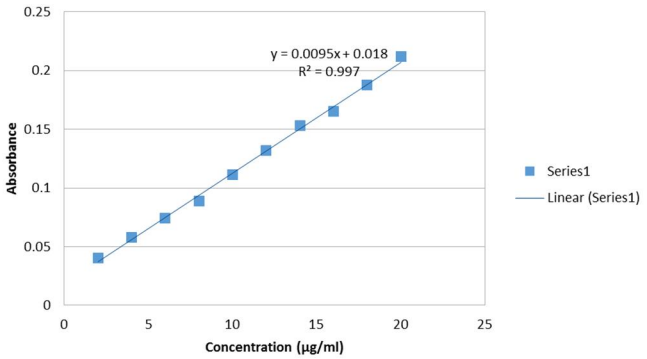


Fig 3: Calibration curve for Doripenem

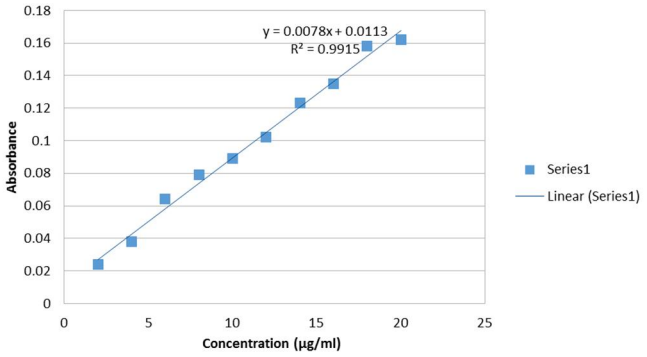


Fig 4: Calibration curve for Imipenem

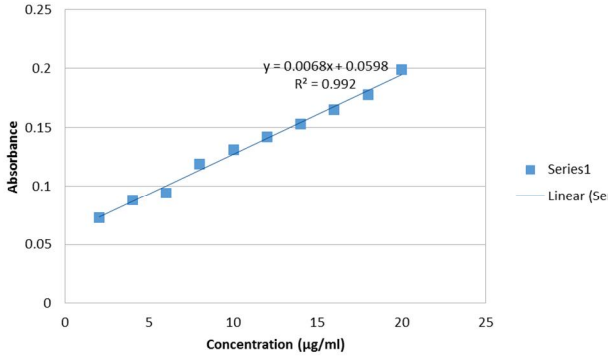


Fig 5: Calibration Curve for Ertapenem

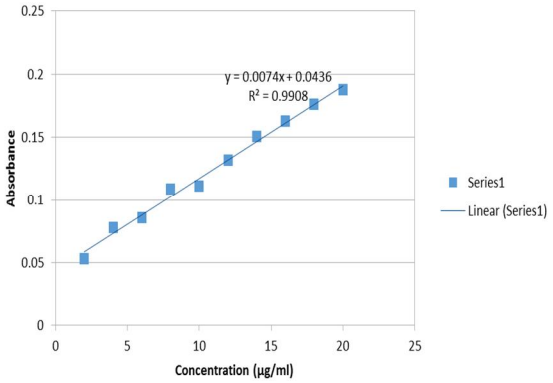


Table 1: Absorbance values of various Carbapenem Antibiotics at different concentration

Conc. (µg/ml)	Absorbance			
	Carbapenem Antibiotics			
	Meropenem	Doripenem	Imipenem	Ertapenem
2	0.04	0.024	0.073	0.053
4	0.058	0.038	0.088	0.078
6	0.074	0.064	0.094	0.086
8	0.089	0.079	0.119	0.109
10	0.111	0.089	0.131	0.111
12	0.132	0.102	0.142	0.132
14	0.153	0.123	0.153	0.151
16	0.165	0.135	0.165	0.163
18	0.188	0.158	0.178	0.176
20	0.212	0.162	0.199	0.188

Table 2: Concentration values determined of various Carbapenem Antibiotics in different forensic samples (Matrices)

Carbapenem Antibiotics	Matrices (Forensic Samples)					
	Gastric Lavage		Viscera		Blood	
	Absorbance	Conc. (µg/ml)	Absorbance	Conc. (µg/ml)	Absorbance	Conc. (µg/ml)
Meropenem	0.052	3.7	0.05	3.5	0.051	3.6
Doripenem	0.03	2.7	0.033	3.1	0.031	2.8
Imipenem	0.082	3.3	0.084	3.6	0.081	3.1
Ertapenem	0.071	3.7	0.072	3.8	0.07	3.6

Results and Discussion:

Each carbapenem antibiotic in methanol is linear in the concentration range of 2-20 microgram/ml when checked on the calibration curves. [**Fig 6-9**]. The % recovery values for the developed method was found to be specific as being greater than or equal to 70. The amount of drugs detected in forensic samples were in good agreement as per the results of the assay shown in **Table 3.**

Table 3: Percentage recovery of different Carbapenem Antibiotics in various Forensic samples

Carbapenem Antibiotics	Percentage recovery in Forensic Samples		
	Gastric Lavage	Viscera	Blood
Meropenem	94.4	88.8	91.6
Doripenem	67.8	78.57	71.42
Imipenem	82.8	90.2	79.1
Ertapenem	93.8	97.2	90.4

Absorption curves for Carbapenem Antibiotics

Fig 6: Absorption maxima for Meropenem (243 nm)

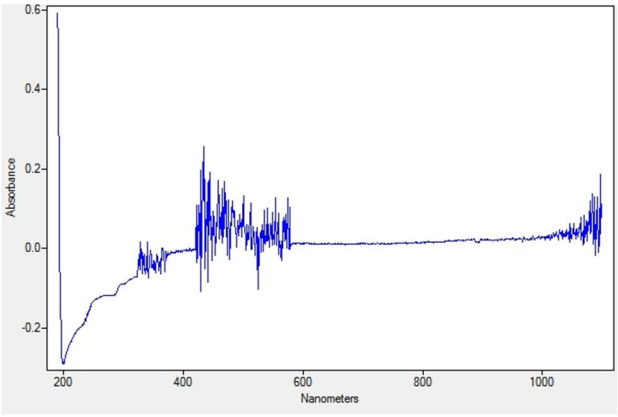


Fig 7: Absorption maxima for Doripenem (211 nm)

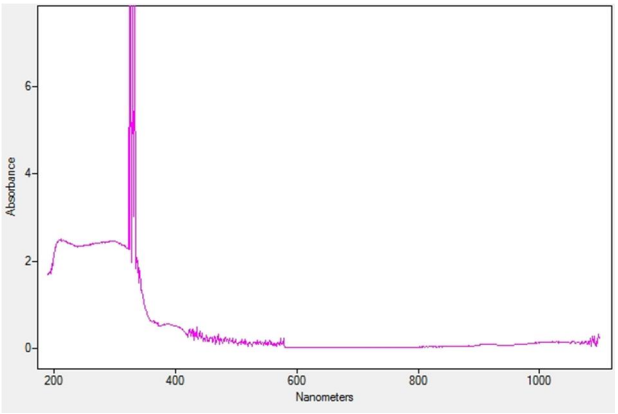


Fig 8: Absorption maxima for Imipenem (294 nm)

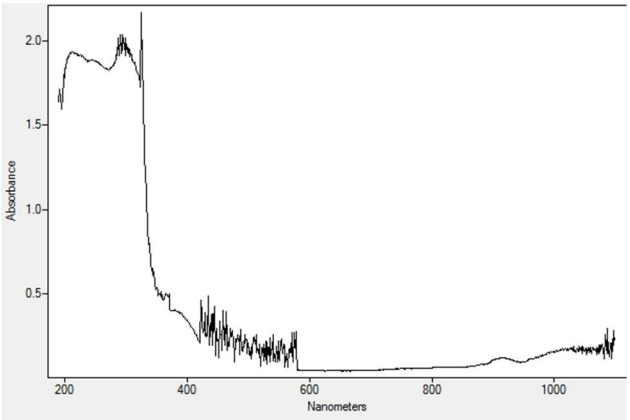
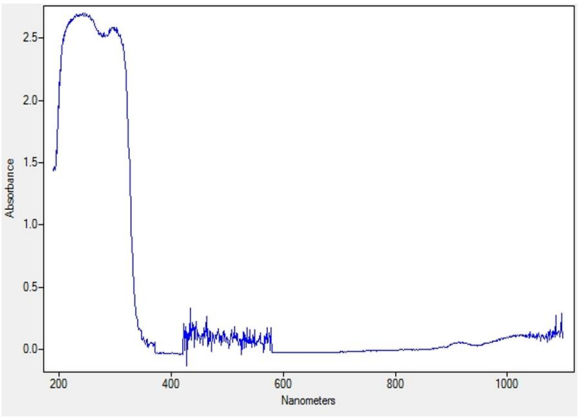


Fig 9: Absorption maxima for Ertapenem (247 nm)



Conclusion:

Simple, sensitive, precise, accurate and cost effectiveness of the proposed method can be concluded by the study. Also, estimation of different Carbapenem antibiotics in forensic samples can be done by applying this method.

Conflict of interest: None

Financial Assistance: None

References:

1. Tripathi KD. Essentials of medical pharmacology, 7th Edition, New Delhi. 2013;390-404.
2. Papp-Wallace, Enidimiani KM, Taracila A MA, Bonomo RA. Carbapenems: past, present, and future. Antimicrobial Agents and Chemotherapy. 2011;55(11),4943-60.
3. Nicolau D P. Carbapenems: a potent class of antibiotics. Expert Opinion on Pharmacotherapy,2007;9(1):23-37.
4. Kattan J, Villegas M, Quinn J. New developments in carbapenems. Clinical Microbiology and Infection, 2008;14(12):1102-11.
5. Carlin Michelle. Forensic Science: Roadside Drug Testing. Transactions of the institute of Measurement and Control, 2009;42(10): 306-309.

6. Mendez AS, Mantovani L, Barbosa F, Sayago CT, Garcia CV, Paula FR, et al. Characterization of the antibiotic doripenem using physicochemical methods: chromatography, spectrophotometry, spectroscopy and thermal analysis. Quimica Nova. 2011:34(9):1634-8.

7. Mendez AS, Steppe M, Schapoval EE. Validation of HPLC and UV spectrophotometric methods for the determination of meropenem in pharmaceutical dosage form. J Pharmaceutical & Biomededical Analysis 2003;33(5):947-54.

8. Legrand T, Chhun S, Rey E, Blanchet B, Zahar J, Lanternier F, et al. Simultaneous determination of three carbapenem antibiotics in plasma by HPLC with ultraviolet detection. J Chromatography 2008;875(2):551-6.

9. Verdier M, Tribut O, Tattevin P, Tulzo YL, Michelet C, Bentue-Ferrer D. Simultaneous determination of 12 -lactam antibiotics in human plasma by high-performance liquid chromatography with UV detection: application to therapeutic drug monitoring. Antimicrobial Agents and Chemotherapy 2011;55(10),4873-9.

10. Mantovani L, Sayago CT, Camargo VB, Silveira VF, Garcia CV, Schapoval EE, et al. Stability-indicating RP-HPLC method for analysis of the antibiotic doripenem in pharmaceutical formulationð comparison to UV spectrophotometry and microbiological assay. Acta Chromatographica 2012;24(3):367-82.

11. Nora H Al-Shaalan. Electroanalytical Determination of Doripenem using a Screen-Printed Electrode. American Journal of Pharmacology and Toxicology, 2012;7(1), 1-7.

12. Bersier PM, Bersier J, Sedelmeier G, Hungerbühler E. Polarography of penem carbapenem antibiotics and the azetidinone intermediate. Electroanalysis 1990;2(5):373-81.

13. Homoda AM, Kamel MS, Khaled E. New spectrophotometric microdetermination of carbapenem antibiotics derivatives in pharmaceutical formulations. J Taibah Univ for Science. 2016;10(1):19-25.

14. Singh DK, Maheshwari G. Development and validation of spectrophotometric methods for carbapenems in pharmaceutical dosage forms. Medicinal Chemistry Research. 2013;22(12):5680-4.

Original Research Paper

Study of Domestic Violence against Women in Rural Areas of District Bhandara, Maharashtra

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Abstract:

Background: Violence against women is now widely recognised as an important public health problem, owingto its health consequences. It goes unreported among many Indian communities on a regular basis.If we take a look at the violence experienced by the women, we will come to know thatfemales are exposed to violence even before theyare born,they are even killed 'in utero'. Even dowry demands leading to deaths are rampant in cities as well as villages. **Objectives:** This study was conducted to report the prevalence and causes of domestic violence against women from the rural areas of District Bhandara, Maharashtra. **Materials & Methodology:** The study was conducted on married females who attended the Pragati Mahila Samaj Family Counselling Centre, Bhandara, with their problems, between the period April, 2014 to March, 2017. After obtaining written informed consent, relevant information was recorded in a predesigned and pretested proforma.**Result:**Prevalence of domestic violence against women was found more common among OBCandSCcommunities,accounting for85.7% cases. Maladjustment with spouse was the major cause, 64.6%, followed by maltreatment by in-laws, 21.6%. Maltreatment for dowry demand at in-lawôs house accounted for 13.7% cases.Personality difference with spouse and alcohol abuse by spouse were found to be the two major reasons behind maladjustment with spouse. Mutual compromise on counselling of both parties settled the issue in majority of the cases.

Key Words: Domestic Violence; Violence against Women; Prevalence; Maladjustment; Maltreatment; Counselling

Introduction:

Violence against women is widely recognised as an importantpublic health problem, owing to its substantial consequencesfor women's physical, mental and reproductive health.[1-5]

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This recognition was strengthened globallyby resolutions of various international fora including the Fourth World Conference on Women in 1995 in Beijing.[6] In India, the problem has been highlighted after legislationagainst domestic violence in 2005, popularly known as theProtection of Women from Domestic Violence Act.[7] Research across the world has providedincreasing evidence of the problem of violence againstwomen.[8, 9]

India has several communities which are distinct intheir geography, language and culture. In several places of the country, violence faced by women on a regular basis goesunreported even in newspapers, whereas newspapersoften carry reports about young women being burnt aliveor dying due to unnatural causes in unnatural circumstances.[10]

Violence is said to occur if any act, omission or commission or conduct of the

respondent shall constitute domestic violence in case it—

(*a*) harms or injures or endangers the health, safety, life, limb or well-being, whether mental or physical, of the aggrieved person or tends to do so and includes causing physical abuse, sexual abuse, verbal and emotional abuse and economic abuse; or

(*b*) harasses, harms, injures or endangers the aggrieved person with a view to coerce her or any other person related to her to meet any unlawful demand for any dowry or other property or valuable security; or

(*c*) has the effect of threatening the aggrieved person or any person related to her by any conduct mentioned in clause (*a*) or clause (*b*); or

(*d*) otherwise injures or causes harm, whether physical or mental, to the aggrieved person.[11]

Violence is because of the force being used by the perpetrator. It is used to suppress the person and has got some motive. Generally, it is used to fulfill oneôs desire to show their strength or to feel that he is of a greater caliber compared to his wife.

The type of violence takes place in 3 forms; physical, mental and inculcation of fear.The position of the female is always secondary to the male because of the paternal dominance and the patriarchal society that we live in. But, it is not true to say that all females are deprived equally. It is usually based on her financial status, caste, religion etc., but still in the society, she is not given equal importance as her male counterpart. The idea of dependency on the male is cultivated in her since childhood and this leads tosubmissive attitude, illiteracy and lessens her thinking power, making her vulnerable at the hands of her husband, in-laws and the society. On a national level, only Meghalaya and Kerala have maternal dominance. The family name runs after the daughter and the right to property also goes to her.[12]

Aims and Objectives:

The purposeof the present study is to report the prevalence of domestic violence against women and toexamine various related issues fromrural areas of District Bhandara, Maharashtra. The term domestic violence is usually taken tomean partner abuse, specifically, violence perpetrated bymale partner. However, the present study deals withthe violence faced by women, perpetrated by their husbandsand other family members within their conjugalhomes.

Materials and Methodology:

The present study was conducted on married females who attended Pragati Mahila Samaj Family Counselling Centre, Bhandara, with their problems between the period April, 2014 till March, 2017. After achieving their confidence through counselling,written informed consent was obtained from them after explainingthe purpose and implications of the study. The desired information was recorded in a predesigned and pretested proforma. The collected data were analysed critically.

Results:

Prevalence of domestic violence against women was found most commonly among the OBC(Other Backward Communities) i.e., 53.5%, followed by SC(Scheduled Caste) community, 32.2%. ST (Scheduled Tribe), NT(Nomadic Tribe) and other Communities together accounted for 14.3% of cases. (**Table 1**)

Table1: Prevalence of Domestic Violence among different Communities

Year	Community					Total
	SC	ST	NT	OBC	Other	
Apr, 2014 to Mar, 2015	33	03	08	73	03	120
Apr, 2015 to Mar, 2016	43	01	10	51	03	108
Apr, 2016 to Mar, 2017	34	02	17	59	02	114
Total	**110 (32.2%)**	**06 (1.8%)**	**35 (10.2%)**	**183 (53.5%)**	**08 (2.3%)**	**342**

Table2: Causes of Domestic Violence

Cause of Domestic Violence	Apr,14 to Mar,15	Apr,15 to Mar,16	Apr,16 to Mar,17	Total
Dowry Demand	7	14	26	47(13.74%)
Marital Discord	86	75	60	221(64.62%)
In-laws	27	19	28	74(21.64%)
Total	**120**	**108**	**114**	**342**

Table3: Reasons behind Maladjustment with Spouse

Reason of Maladjustment	Apr,14 to Mar,15	Apr,15 to Mar,16	Apr,16 to Mar,17	Total
Personality difference	51	46	50	147
Parental Interference	27	19	28	74
Extramarital affairs	7	7	15	29
Alcohol abuse	24	32	90	146
Economic	0	0	0	0
Any other	11	4	01	16

Table4: Assistance Rendered to the Victims of Domestic Violence

Assistance Rendered	Apr,14 to Mar,15	Apr,15 to Mar,16	Apr,16 to Mar,17	Total
Referred forLegal Aid	28	18	21	67
Police assistance	4	15	17	36
Short Stay	0	1	0	1
Mutual Compromise	56	53	53	162

Marital discord or maladjustment with spouse was the major cause behind domestic violence, 64.6%, followed by maltreatment by in-laws, 21.6%. Maltreatment for dowry demand at in-lawsø house accounted for 13.7% of cases.(**Table 2**)

Maladjustment with spouse after marriage had more than one inter-related reasons. However, personality difference with spouse and alcohol abuse by spouse were found two major reasons behind maladjustment with spouse, followed by parental interference from either side.(**Table 3**)

In 162 cases, after counselling, domestic violence was settled by mutual compromise between the two parties whereas legal aid or police assistance was sought in 103 cases.(**Table 4**)

Discussion:

Estimates of prevalence of domestic violence within India vary widely (from 18% to 70%, with differences in study methodology), [10,13-22] and it was realized that the magnitude of the problem has not been accounted for well, from several parts of India. There are few studies covering the population across the country.[16-18,20]The Third National Family Health Survey revealed that there is a considerable variation across the states in the prevalence of domestic violence.[20] A closer scrutiny of the prevalence rates reveals that domestic violence is a country-wide phenomenon, with some variations between states, as these states differ from each other in overall socio-economic development and women's status.[20,23] A few community-based micro-studies are available from Northern[13,21]Southern[13,19] and Western states[10] of India. Also, the available community-based studies are limited to physical violence. The Third National Family Health Survey revealed that more than a third of women in India have been physically mistreated by their husbands or other family members.[20] Some community-based surveys suggested that physical violence has been experienced by 21 to 48% of women in different settings in India.[10,13,17,22]

The above estimates are corroborated by studies investigating reporting patterns of men.21 to 40% of men in different studies reported perpetrating physical violence.[14,15,21,22] Evidence on psychological violence is limited. Available community-based studies suggested that psychological violence ranged from 23% to 72%.[10,13,15,17]

A study conducted on domestic violence against women in Kerala revealed that majority (52%) of the victims belonged to Other Eligible Caste Category (OEC), followed by OBC (32.6%), SC (9.7%) and ST (3.7%).[24] In the present study, prevalence of domestic violence against women was found most commonly among OBC, followed by SCcommunities. (**Table 1**)

The same study revealed that major causes behind domestic violence were alcoholic nature of the husband-48.7%, financial constraints- 27%, extramarital affairs- 12.1% and dowry- 10.2%.[24] In the present study, marital discord or maladjustment with spouse was found to be the major cause behind domestic violence, 64.6%, followed by maltreatment by in-laws, 21, 6%. Maltreatment for dowry demand at in-laws house accounted for 13.7% of domestic violence.Maladjustment with spouse after marriage had more than one reasons in some cases. However, personality difference with spouse and alcohol abuse were found to be the two major reasons behind maladjustment with spouse, followed by parental interference from either side.(**Table 2 & 3**)

Counseling plays an important role in marriage litigation. People approach a counselor with varied expectations to find a cure for their problems, to take decisions for them or to change the partner. The task of the counselor is to help the partners to understand each other develop a communication link and respect each other.In the present study, in majority of the cases, 162, domestic violence was settled by mutual compromise between the two parties after counselling, whereas legal aid or police assistance was sought in 103 cases. (**Table 4**)

Conclusion:

The present study of domestic violence against women in rural areas of District Bhandara, Maharashtra suggests that domestic violence is more common in certain communities, possibly due to socio-economic and socio-cultural differences.Women are at more risk of violence from the husband than any other type of perpetrator. Social awareness and sensitization, financial empowerment of women and early intervention through counselling may help to reduce the magnitude of domestic violence.

Conflict of interest: None

Financial Assistance: None

References:

1. Garcia-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts C: WHOmulti-country study on women's health and domestic violence against women. Initial results on prevalence, health outcomes and women'sresponses Geneva: World Health Organization; 2005. Available from: whqlibdoc.who.int/publications/2005/924159358X_eng.pdf. Retrieved on: 6th June 2017
2. Mayhew S, Watts C: Global rhetoric and individual realities: linking violence against women and reproductive health. InHealth Policy in a Globalising World.Ed: Lee K, Buse K, Fustukian S. Cambridge: Cambridge University Press.2002:159-80.
3. Campbell J, Jones AS, Dienemann J, Kub J, Schollenberger J, O'CampoP, et al.: Intimate partner violence and physical health consequences. Arch Intern Med 2002; 162:1157-63.
4. Campbell JC: Health consequences of intimate partner violence.Lancet 2002; 359:1331-6.
5. Garcia-Moreno C, Heise L, Jansen HA, Ellsberg M, Watts C.Public health. Violence against women. Science 2005; 310:1282-3.
6. United Nations.The fourth world conference on women, Beijing, china. New York: United Nations; 1995. Available from: www.un.org/womenwatch/daw/beijing/pdf/Beijing%20full%20report%20E.pdf. Retrieved on: 6th June 2017
7. Kaur R, Garg S: Addressing domestic violence against women:an unfinished agenda.Indian J Comm Med 2008; 33:73-6.
8. Heise L, Ellsberg M, Gottmoeller M: A global overview of genderbased violence. Int J GynaecolObs2002; 78(Suppl 1):S5-14.
9. Heise L, Ellsberg M,Gottemoeller, M. **Ending Violence Against Women**. **Population Reports**, Series L, No. 11. Baltimore, John Hopkins University School of Public Health, Population Information Program, December 1999. Available from: https://vawnet.org/material/population-reports-ending-violence-against-wome. Retrieved on: 6th June 2017

10. Visaria L: Violence against women: a field study. Economic and Political Weekly 2000; 35:1742-51. Available from: https://www.researchgate.net /publication/262120635_Violence_against_Women_A_Field_Study. Retrieved on: 6th June 2017

11. The Protection of Women from Domestic Violence Act, 2005. Available from: ncw.nic.in/acts/TheProtectionofWomenfromDomesticViolenceAct2005.pdf. Retrieved on: 6th June 2017.

12. Living examples of matrilineal societies in India - Education Today News. Available from: https://www.indiatoday.in/education-today/gk-current-affairs/story/living-examples-of-matrilineal-societies-in-india-312344-2016-03-08. Retrieved on 6th June 2017.

13. Jejeebhoy SL: Wife-beating in rural India: a husband's right?Economic and Political Weekly 1998;33:855-62. Available from: http://www.womenstudies.in/elib/dv/dv_wife_beating.pdf. Retrieved on: 6th June 2017

14. Martin SL, Tsui AO, Maitra K, Marinshaw R: Domestic violence in northern India. Am J Epidemiol1999; 150:417-26.

15. Duvvury N, Nayak M, Allendorf K: Domestic violence in India: exploring strategies, promoting dialogue. Men masculinities and domestic violence in India: summary report of four studies Wasington, D.C.,International Centre for Research on Women; 2002. Available from: https://www.icrw.org/wp-content/uploads/2016/10/Domestic-Violence-in-India-4-Men-Masculinity-and-Domestic-Violence-in-India.pdf. Retrieved on: 6th June 2017

16. Hassan F, Sadowski LS, Bangdiwala SI, Vizcarra B, Ramiro L, De PaulaCS, et al.: Physical intimate partner violence in chile, egypt, india and the philippines. Inj Control SafPromot2004; 11:111-6.

17. International Clinical Epidemiological Network: Domestic violence in India: a summary report of a mutlti-site household survey. Washington, D.C., International Centre for Research on Women and the Centre for Development and Population Activities; 2000. Available from: https://www.icrw.org/wp-content/uploads/2016/10/Domestic-Violence-in-India-3-A-Summary-Report-of-a-Multi-Site-Household-Survey.pdf. Retrieved on: 6th June 2017

18. Jeyaseelan L, Kumar S, Neelakantan N, Peedicayil A, Pillai R, Duvvury N: Physical spousal violence against women in India: some risk factors. J BiosocSci2007; 39:657-70.

19. Krishnan S: Do structural inequalities contribute to maritalviolence? Ethnographic evidence from rural South India. Violence Against Women 2005; 11:759-75.

20. International Institute for PopulationSciences (IIPS): macro international.In National Family Health Survey (NFHS-3), 2005-06: India VolumeI. Mumbai: International Institute of Population Sciences; 2007. Available from: http://rchiips.org/nfhs/NFHS-3%20Data/VOL-1/India_volume_I_corrected_17oct08.pdf. Retrieved on: 6th June 2017

21. Stephenson R, Koenig MA, Ahmed S: Domestic violence and symptoms of gynecologic morbidity among women in North India. Int Fam Plan Perspect2006; 32:201-8.

22. Verma RK, Collumbien M: Wife beating and the link with poor sexual health and risk behaviour among men in urban slums in India. J Comparative Family Studies 2003; 34:61-74.

23. Jejeebhoy SJ, Sathar ZA: Women's autonomy in India and Pakistan:the influence of religion and region. Population and Development Review2001; 27:687-712.

24. A situational analysis of domestic violence against women in Kerala. Executive Summary. Centre for Women's studies & Development, Kochi, Kerala. September 2005. Available from:

Original Research Paper

Pattern of Non-Compressive Mechanical Injuries to Neck – A Prospective Study

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Abstract:

The present study was carried out in the department of Forensic Medicine, M. S. Ramaiah Medical College, Bangalore from October 2011 to March 2013 over a period of 18 months with a aim to know the pattern of non-compressive mechanical injuries to neck and the related socio-demographic profile.

During study period, of the 1478 cases which were subjected for postmortem examination, 133 cases showed non-compressive mechanical injury to the neck (9%). Males (82%) outnumbered females (18%). Age group between 21-30 years was affected more. Road traffic accidents (28.6%), railway injuries (26.3%) and drowning (18%) were the major causes of non-compressive mechanical injuries to neck. Incidence of injury by blunt force (63.2%) was far more common than obstructive force (30.1%) and sharp force (4.5%). Incidence of non-penetrating injuries (31.6%) was more than penetrating injuries (27%) to neck. The common types of injuries were abrasions (12.8%), decapitations (12%), thermal injuries (8.3%), followed by laceration (6.8%) and contusion (6.8%). Front of neck was more frequently involved, as compared to the back. In the front region left side was more commonly involved.

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Key Words: Pattern, Non Compressive Mechanical Injuries, Neck, Socio-Demographic Profile

Introduction:

Non-compressive mechanical injury to neck is defined as injuries which are produced by physical violence, where the force applied is blunt/ sharp/ firearm/ thermal/ chemical/ physical to neck and neck structures, except hanging and strangulation (which are considered as compressive mechanical injuries).[1]

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Compressive mechanical injuries to neck like hanging and strangulation have been studied extensively in the past. But non-compressive mechanical neck injuries, as a whole, have not been comprehensively studied.[2]

The anatomical and anthropometric factors are important and the tolerance limits of the human neck due to the hyperextension or hyperflexion are to be considered.[3] Many authors have studied injuries to neck by using different medico-legal parameters such as manner, type of force, type of injury etc and underestimated the incidence of non-compressive mechanical Injuries to neck.[3]

There is a significant rise in the non-compressive mechanical injuries to the neck in the recent times and the morbidity and the mortality related to it is also high. There is no recent data available regarding exact proportion of rise. Reasons for their linear growth over the decade and factors influencing it have not been studied. Thus, the present study has been having been taken up at our center.

In the present study, the following features of the non-compressive mechanical injuries to the neck region, like: manner of death (homicidal, suicidal, accidental or natural), various types of cases (RTA, railway injuries, assault, fall from height, fall of object, firearms, drowning, artefacts) and types of injuries (abrasion, laceration, contusion, incised wound, stab wound, chop wound, decapitation) produced externally along with internal neck structures injured, type of force involved (sharp, blunt, obstructive, therapeutic), their relationship with injuries on the other parts of the body, were studied.

Burns produced by thermal, chemical accidents and electrocution involving neck were also included in the study. Therapeutic, investigative and other related actions involving the neck structures, which may result in significant morbidity, were studied. Injuries following airway intubation, esophageal instrumentation and tracheostomy in those requiring prolonged airway maintenance, angiographic and other vascular invasive procedures may result in injury to local tissues or adjacent vital tissues resulting in death, were also studied, with special attention to their medico-legal interpretation and application.

Materials and Methodology:

The present study was conducted over a period of one and half year from October 2011 to March 2013, in the mortuary, Department of Forensic Medicine, M. S. Ramaiah Medical College, Bangalore, after obtaining approval from the Institutional Ethics Committee. During this period cases of non-compressive mechanical injuries to neck were dissected and examined as per standard forensic autopsy procedures and injuries were noted. All the necessary details pertaining to the cases were collected from the inquest report - police inquest report, witness or relative's statement, findings of post-mortem examination, hospital case sheet extracts, histo-pathological examination report, toxicological (chemical) analysis report, crime scene photographs and were entered in preformed Performa.

All cases of non-compressive mechanical injuries to neck were included in the study, whereas decomposed cases were excluded. Descriptive statistics comprising mean, standard deviation, proportion and percentage were used to describe the data. Prior ethical clearance was obtained.

Results:

During our study period, the following observations were made as for as pattern and various socio-demographic factors of non-compressive mechanical injuries to neck were concerned -

The percentage of non-compressive mechanical injuries to neck, in our study period was 9%. (**Table 1**)

Table 1: Proportion of Non-Compressive Mechanical Injuries During Study Period

Total number of Autopsies done between October 2011 to March 2013	1478
Total number of cases having Non-Compressive Mechanical Injuries	133
Percentage of cases having Non-Compressive Mechanical Injuries	8.99 %

The most common age group affected was between 21-30 years, accounting for 33% of total cases, followed by the 31-40 yrs group, accounting for 15%, and the 41-50 yrs group, 14.2%. (**Table 2**)

Table 2: Non-Compressive Mechanical Injuries to Neck Among Various Age Groups

Age in Years	Number of Cases	Percentage
1-10	12	8.6
11-20	14	10.2
21-30	43	33
31-40	20	15
41-50	19	14.2
51-60	12	8.6
61-70	7	5.6
71-80	2	1.6
Above 81	4	3.2
Total	133	100

Males outnumbered the females, with 109 cases (82%) and 89 cases (66.9 %) were from urban area. (**Table 3 & 4**)

Table 3: Non-Compressive Mechanical Injuries To Neck

Gender	Number of Cases	Percentage
Male	109	82
Female	24	18
Total	133	100

Table 4: Urban & Rural Distribution of Non-Comp Inj.

Residence	Number Of Cases	Percentage
Urban	89	66.9
Rural	44	33.1
Total	133	100

Accidental deaths accounted for 71.4% of cases, suicidal - 21.1% and homicidal - 7.5% cases. Accidental cases involved RTA, railway injurie, drowning and at working place. (**Table 5**)

Table 5: Manner of Death

Manner of Death	Number of Cases	Percentage
Homicidal	10	7.5
Suicidal	28	21.1
Accidental	95	71.4
Total	133	100

Laborers (30.1%), housewives (15.6%), students (13.5%) and children (12%) were the most commonly affected. Suicidal and homicidal cases were commonly seen among housewives. **(Table 6)**

Table 6: Occupation

Occupation	No. of cases	Percentage
Labor (coolie)	40	30.1
Housewife	21	15.6
Student	18	13.5
Children	16	12
Old age (>60 years)	10	7.5
Government Employee	9	6.75
Business man (Small scale)	5	3.75
Farmers	5	3.75
Electrician	3	2.25
Driver	2	1.5
Criminals (gang stars)	2	1.5
Bank employee	2	1.5
Total	133	100

Major proportion of non-compressive mechanical injuries were produced by RTA, railway injuries & drowning which accounted for 28.6%, 26.3% and 18% of total number of cases, respectively. Apart from this thermal injuries accounted for 9.1% cases, assault 6.8% and others 7.5% of cases. Other cases were fall of object, fall from bullock cart, choking cases, etc. (**Table 7**)

Table 7: Various Types Of Cases

Type of Cases	Number of Cases	Percentage
RTA	38	28.6
Railway Injuries	35	26.3
Assault	9	6.8
Fall From Height	5	3.8
Thermal	11	9.1
Drowning	25	18
Others	10	7.5
Total	133	100

For convenience, we divided the neck into four areas - right front, left front, left back, & right back. Left front region was the most commonly affected part with 18 cases showing injuries. Right front region was involved in 16 cases. (**Table 8**) Abrasions were the more common injuries with 17 cases (12.8%), followed by decapitation - 16 cases (12%), thermal injuries 11 cases (8.3%), laceration 9 cases (6.8%), and contusion 9 cases (6.8%). Apart from these 3 (2.3%) cases of incised wound, 1 case (0.8%) of stab wound and 1 case (0.8%) of chop wound were also observed on the neck. (**Table 9**)

Table 8: Non-Compressive Mechanical Injuries & Region of Neck Involved

Type of Injury	Rf	Lf	Lb	Rb	Rt & Lt Front	Lt Front & Back	Rt &Lt Back	All Regions Involved
Abrasion	9	6	1		3	1		
Laceration	2	3			3			2
Contusion	4	6	1		2		1	
Incised Wound		2			2			
Stab Wound		1						
Chop Wound					1			
Thermal Injury	1				3			7
Total	16	18	2		14	1	1	9

Rf- Right Front, Lf- Left Front, Lb- Left Back, Rb- Right Back, Rt- Right, Lt- Left.

Table 9: Various Types of Injuries

Type of Injury	No. of Cases	Percentage
Abrasion	17	12.8
Laceration	9	6.8
Abrasion And Laceration	1	0.8
Abrasion And Incised Wound	1	0.8
Abrasion And Decapitation	1	0.8
Contusion	9	6.8
Laceration And Contusion	1	0.8
Contusion And Decapitation	2	1.5
Incised Wound	3	2.3
Stab Wound	1	0.8
Chop Wound	1	0.8
Thermal	11	8.3
Decapitation	16	12

Decapitation was more frequently observed at the level of C3-C4, C4-C5, C5-C6; each accounting for 4 cases out of the 19 cases of decapitation, which itself accounted for 14.4% of all non-compressive mechanical injuries. (**Table 10**)

Table 10: Level of Decapitation In Railway Injuries.

Level of Decapitation	Number of Cases	Percentage
Atlanto-Occipital	2	1.5
C1-C2	1	0.8
C2-C3	1	0.8
C3-C4	4	3
C4-C5	4	3
C5-C6	4	3
C6-C7	3	2.3
Total	19	14.4

Again, obstruction to respiratory airways was observed in 67 cases (50.4%), followed by injury to vertebra and spinal cord in 60 cases (45.1%), strap muscles in 59 cases (44.4%), major vessels in 26 cases (19.5%) and others - 27 cases (20.3%) which included skin, subcutaneous tissues, nerves, lymphatic etc. (**Table 11**)

Table 11: Injury To Internal Structures of Neck

Injury to Internal Structures of the Neck	Number of Cases	Percentage (n= 133)
Major Vessels	26	19.5
Airways	67	50.4
Strap Muscles	59	44.4
Thyroid Gland And Cartilage	20	15
Hyoid Bone	12	9
Esophagus	19	14.3
Vertebra	60	45.1
Spinal Cord	60	45.1
Others	27	20.3

Sharp weapon produced injury in 6 cases (4.5%), blunt in 84 cases (63.2%), obstructive force in 40 cases (30.1%), other forces like electrocution in 3 cases (2.3%). (**Table 12**)

Table 12: Type of Force Involved in Producing Non-Compressive Mechanical Injury to Neck

Type of Force	Number of Cases	Percentage
Sharp	6	4.5
Blunt	84	63.2
Obstructive	40	30.1
Others	3	2.3
Total	133	100

During the period under study, a total of 33 cases of thermal injuries were observed, which included both burns and electrocution. Of these, neck was involved in 11 cases (**Table 13**)

Table 13: Thermal Injuries Which Involved Neck Region.

Thermal Injuries	Number Of Cases	Percentage
Burns	8	6.2
Electrocution	3	2.1
Total	11	8.3

Again, of the total 1478 cases studied, a total of 189 (12.5%) underwent various iatrogenic procedures, of which 100 cases (6.7%) were of central venous catheterization, 33 (2.2%) were of tracheostomy and 56 (3.8%) endotracheal intubation. In our study, no iatrogenic procedures resulted or contributed to death of the individual, except congestion in the surrounding areas. (**Table 14**)

Table 14: Iatrogenic Procedures Involving Neck Structures

Iatrogenic Cases	Number of Cases (n= 1478)	Percentage
CVP Line Mark	100	6.7
Tracheostomy Wound	33	2.2
Endotracheal Intubation	56	3.8
Total	**189**	**12.5**

Discussion:

Examination of Walker's data shows that, the mean head-neck weight was 6,075 gm. The mean head weight was 4,463 gm. and by

difference, the mean neck weight was 1,609 gm^2. This seemingly insignificant portion of the total body weight is important far beyond the ratio of weights since many vital structures which are vulnerable to many injuries are present in this narrow passage.[2]

The percentage of non-compressive mechanical injuries to neck, in our study period was 9%. A study conducted by Jani, et al observed the said percentage to be 3.53%.[3] Harvey, et al, in their study of 312 deaths at scene, observed that in 26 cases (8.3%) neck was involved.[3] When compared to the study conducted by Jani, et al, the incidence of non-compressive mechanical injuries to neck in our study was more by approximately 5% which may be due to more number of RTA and Railway injury cases at our center.

The common age group affected was the 21-30 years, accounting for 33% of total cases, followed by 31-40 years, 15% and 41-50 years 14.2%. Other workers had similar results.[3,5] Since 21-40 years of age group people were more active with active participation in work and travel, it may be the reason for more number of cases.

Males outnumbered the females in both our study and that by others.[3,5] Again, urban population was involved in 66.9% case. The reason for this could be increased urbanization and industrialization, which involved more transportation, occupation hazards, over time work and less safety measures.

Accidental deaths constituted 71.4% of cases, followed by suicides - 21.1% and homicides - 7.5% cases. Of the accidents, RTA was the most common, followed by railway injuries, drowning, etc. Laborers (30.1%) were most commonly affected, followed by housewives (15.6%), students (13.5%) and children (12%). Suicidal and homicidal cases were commonly seen among housewives. Sahoo, et al, in their study on pattern of injuries by railway deaths observed that of 39 cases, 30 (76.9%) were suicidal in manner.[6] Vanezis, in his study of 177 stab injuries, observed that in 43 cases (37%), neck was involved, of which 41(95.4 %) were homicidal and 2 (4.7%) were self-inflicted.[2] Mohanthy, et al. in their study on death due to traumatic railway injury, observed that of 88 victims, 17 were suicidal and 71 were accidental in nature.[7] Rouse, observed that of the 156 stab injuries 8 (5.1%) were self-inflicted and 148 (94.8%) were homicidal injuries.[8] Again, Iseh, et al observed that 19 cases of anterior neck injuries presented as cut throat, of which 10 (52.6%) were of attempted suicide, with known background of psychiatric illness, 5 (26.3%) were homicidal, 2 (10.5%) were from animal assault while 1 was as a result of RTA and another from fall on to a sharp object.[9] Prahlow, et al. reviewed 22 cases of accidental sharp weapon injury to the neck and found that half of the cases involved some type of motorized machinery.[10] Accidental cut throat injury in vehicular accident and at working place by wood cutting machines were observed by Naik, et al and Atal, et al.[11,12] The difference in the observations made by other workers and ours was due to difference in time, place and study population.

Most of the non-compressive mechanical injuries were due to RTA, followed by railway accidents and drowning, thermal injuries, assault, etc. A study by Vanezis on 49 suspected cases of neck trauma found that 65.3% cases were due to RTA, 16.3% cases were due to fall from height, 10.2% cases of low falls, etc.[4] Lalwani, et al, in their study of 174 cases of fall from height observed mechanical injuries on neck in 6 cases and that cervical spinal cord was involved in 12 cases.[13] Murthy observed that 7 out of 52 cases of fall from height had neck injuries.[14]

Left front region of neck was the most commonly affected part with 18 cases showing injuries, followed by right front region of neck. Two large stabs injury studies by Shirkey, et al. and Stein & Seaward showed that there was a predominance of left sided injury with an incidence of nearly 60%.[3]

Abrasions were the more common, 12.8%, followed by decapitation, 12%, thermal injuries, 8.3%, etc. Hu, et al. analyzed railway fatalities in Shanghai and observed that most of the injuries sustained were abrasions or contused abrasions, followed by the lacerations and fractures of the limbs and then decapitation.[15] In a study conducted by Inoue, et al. in japan, it was observed that of the 12

homicidal stab injuries, 4 involved neck region, stating that after chest, neck was the most common site for stab injuries in homicides.[16]

In our study decapitation accounted for 14.4% of all non-compressive mechanical injuries and all were seen in railway injuries. Mohanthy, et al., in their study on death due to traumatic railway injury, observed that of the 88 victims, 13 (14.7%) showed decapitation wound over the neck with or without associated fatal injuries.[7] A study conducted by Battistini, et al., in train related suicides in Milan, observed that of the 155 cases of self-inflicted death by impact with a train, 6 were of decapitation (3.9%).[17] A study conducted by Wasnik states that of the 173 cases of railway fatalities, crush injury to the neck in the form of decapitation was observed in 27cases (15.6%).[18]

Obstruction to respiratory airways was the most common internal injury, followed by injury to vertebra and spinal cord, strap muscles, major vessels, etc. Fry and Fry found only one case (1.8%) of carotid artery injury from blunt impact among a series of 54 carotid artery injuries while Rubio et al. found only 3% in their study.[19,20] Moaro's study of 200 consecutive RTA cases revealed that 57 victims (28.5%) had some form of carotid artery injury.[20] A retrospective autopsy study by Vanezis on 804 cases of general trauma revealed 104 cases (13%) with posterior neck injury due to blunt force impact.[2] A study by Shirkey, et al on a series of 225 cases of penetrating injuries to the neck found involvement of arteries and veins in 136 cases (60.4%).[3] Steven, et al, in their study evaluated 44 patients of neck wounds penetrating platysma and explored 21 cases, in which vessel was injured in 14 cases, oesophagus in 2 cases, spinal cord in 2 cases, and airway in 2 cases.[3]

Blunt weapon/ object was the most commonly involved in our study, followed by obstructive force. Bener, et al, in their study on victims of RTA, observed blunt trauma to neck in 57.1%, & penetrating trauma in 0.3%.[5] Penetrating trauma injuries in the neck constitutes 5-10% of the patients presenting in emergency.[22] Prahlow, et al, reviewed 22 cases of accidental sharp injury to the neck and found that half of the cases involved some type of motorized machinery.[10]

In our study, 12.5% cases underwent various iatrogenic procedures - 6.7% central venous catheterization, 2.2% tracheostomy and 3.8% endotracheal intubation. No iatrogenic procedures resulted or contributed in death of the individual, except congestion and extravasation in the surrounding tissues, rarely. Nowak, et al found that 23 of their 72 patients who required either long term endotracheal intubation/ tracheostomy/ both had significant laryngeal and tracheal lesions. The main abnormalities noted were vocal cord paralysis, tracheal stenosis, subglottic stenosis, glottic stenosis, and tracheomalacia.[23] An autopsy study of the hypopharynx and cervical esophagus of 103 patients who were subjected to intubation and/or endoscopy showed mucosal ulceration, hemorrhage and perforation in 60% cases.[24]

A study by Parate revealed that of the 160 cases of resuscitative or iatrogenic artefacts, IV line mark artefacts were present in 93.73% cases, CVP line mark artefacts in 53.75% and tracheostomy wound in 10 cases (6.25%).[1]

Conclusion:

The incidence and extent of injury to the neck region cannot be readily appreciated, many times. In cases where there were multiple injuries, not confined to the neck, (particularly in RTA) there may be tendency to concentrate on the more obvious lesions, thus overlooking or delaying the diagnosis of significant injuries to the neck and thus increasing the morbidity and mortality.

Acceleration and Deceleration forces acting on neck region was most common in RTA and in fall from height, where there were no external injuries to neck. The treating doctor should suspect injuries to neck and advice proper investigations like X-rays, CT scan or MRI so that life threatening neck injuries would be detected and treated at the earliest, thus decreasing the suffering.

In all suspected cases with neck injuries like in RTA, railway injuries, fall from height and fall of object - injury to cervical vertebrae, spinal cord and major vessels are common. In such

cases, observing the injury and its proper recording is of lot significance since more than scanning modalities, autopsy findings stand high in courtroom.

Limitations:

Ours was a postmortem study of non-compressive mechanical injuries to neck, where external and internal injuries were observed and recorded. The non-compressive mechanical injuries to neck in persons who were admitted to causality or ward and survived were not included in this study.

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References:

1. Reddy KSN. Mechanical injuries, Mechanical asphyxia: The essentials of forensic medicine and toxicology. 34th Ed. New Delhi: Jaypee Brothers Medical Publishers. 2017:170,315,336.
2. Vanezis P. Pathology of neck injury. Butterworth and CO., London.1989.1,126.
3. Jani CB, Gupta BD. An autopsy study of non-compressive mechanical injuries to the neck using multiple parameters. J Ind Acad Forensic Med 2002;24(4):130-5.
4. Ewing CL. Injury criteria and human tolerance for the neck. In: Saczalski K Ed. Aircraft crashworthiness. University Press of Virginia: Charlottesville; 1975. 141-151. Available from: www.dtic.mil/dtic/tr/fulltext/u2/a221557.pdf. Retrieved on 5th June 2017.
5. Bener A, Yassir SA, Mitra B. Incidence and severity of head and neck injuries in victim of road traffic crashes: In an economically developed country. Int Emerg Nursing 2009;17:52-9.
6. Sahoo PC, Kar SM. Pattern of injuries in railway deaths -A retrospective study in MKCG medical college, berhampur (ganjam). J Ind Acad Forensic Med 1998; 20(3):67-8. (IndMED http://medind.nic.in/imvw/imvw7984.html)
7. Mohanty MK, Panigrahi MK, Mohanty S, Patnaik KK. Death due to traumatic railway injury. Med. Sci. Law 2007;47(2):156-60.
8. Rouse DA. Pattern of stab wounds: a six year study. Med. Sci. Law 1994;34(1):67-71.
9. Iseh KR, Obembe A. Anterior neck injuries presenting as cut throat emergencies in a tertiary health institution in north western Nigeria. Niger J Med 2011;20(4):475-8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22288327. Retrieved on 5th June 2017.
10. Prahlow JA, Ross KF, Lene WJ WBS, Kirby DBBS. Accidental sharp force injury fatalities. Amer J Forensic Med Pathol 2001;22(4):358-66.
11. Naik SK, Atal DK, Murari A, Rani Y. Cut throat injury by vehicular accident. IJMS 2012;3(1):94-97.
12. Atal DK, Naik SK and Murari A. Accidental neck injury by wood cutting machine: A case report. J Clin Pathol Forensic Med 2010;1(1):5-7.
13. Lalwani S, Agnihotri AK, Talreja A, Murty OP. Pattern of injuries in fatal falls from height. A retrospective review. J Forensic Med Toxicol 1999;16(2):38-46.
14. Murthy VCR. Study of pattern of injuries in fatal cases of fall from height. Rajiv Gandhi university of health sciences. Bangalore. March 2008:45
15. Hu YP, Cao Y, Ma KJ. Analysis of the death cases in the urban rail traffic accident in shanghai. Fa Yi XueZaZhi, 2009; 25(3):198-9. Available from: https://www.ncbi.nlm.nih.gov/pubmed/19697779. Retrieved on: 5th May 2016
16. Inoue H, Ikedia N, Ito T, Tsuji A, Kudo K. Homicidal sharp force injuries inflicted by family members or relatives. Med Sci Law 2006;4(2):135-40.
17. Battistini A, Gentile G, Palazzo E, Zoja R. Train related suicides in Milan, Italy: analysis of cases 1993-2008. Med Sci Law 2009;49(3):185-90.
18. Wasnik RN. Analysis of railway fatalities in central India. J Ind Acad Forensic Med 2004;32(4):311-4.
19. Fry RE, Fry wj. Extracranial carotid injuries. Surgery 1980;88:581-7 Available from: https://www.ncbi.nlm.nih.gov/pubmed/7423378. Retrieved on: 5th May 2016
20. Rubio PA, Reul GJ, Beall AC. Acute carotid artery injury: 25 years experience. J Trauma 1974;14:967-73. Available from: https://www.ncbi.nlm.nih.gov/pubmed/4419022. Retrieved on: 5th May 2016
21. Moar JJ. Traumatic rupture of cervical carotid arteries: an autopsy and histopathological study of 200 cases. F S I 1987;34:227-44.

22. Marwah S, Godara R, Sandhu D, Sen J. Isolated spinal cord injury following suicidal stab wound in the anterior neck: An unusual case. The Internet J Emerg Intensive Care Med 2008;11(1). Available from: http://ispub.com/IJEICM/11/1/10832. Retrieved on: 5th May 2016

23. Nowak P, Cohn AM, Guidice MA. Airway complications in patients with closed head injuries. Amer J Otolaryngology 1987;8:91-6. Available from: https://www.amjoto.com/article/S0196-0709(87)80030-3/abstract. Retrieved on: 5th May 2016

24. Wolff AP, Kesseler S. Iatrogenic injury to hypopharynx and cervical esophagus: an autopsy study. Amals of Otology, Rhinology and Laryngology 1973;82;778-83. Available from: http://journals.sagepub.com/doi/abs/10.1177/000348947308200605. Retrieved on: 5th May 2016

Original Research Paper

Organo Phosphorus Poisoning: Prognostic Value of GCS Score & Other Clinical Indicators in Assessing the Final Outcome

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Abstract:

Organophosphorous [OP] poisoning has an important effect on community health. In Central India, in Vidarbha region of Maharashtra, large number of intentional Insecticidal or OP self-poisoning is common amongst farmers due debt ridden or natural calamities. In agriculturally dominant parts its accidental poisoning is also frequently encountered in clinical practice. The mortality rate in Central India due to OP poisoning is 15-30%. The present study was conceived to know, demographic profile of OP poisoning and the role of clinical indices in predicting the outcome. In the study, 106 cases of OP poisoning were analyzed and it was found that OP poisoning was more common in males; particularly in the age group of 21-30 years and that the manner of poisoning is commonly suicidal, through oral route, along with stray cases of accidental exposure during handling or spraying in the fields.

Clinical parameters were determined immediately after admission to the hospital prior to any treatment. In the present study, GCS was found to have a good co-relation with the outcome of the patients. Another clinical indicator, APACHE II, [Acute Physiological and Chronic Health Evaluation] also had a definite role in predicting the outcome; however GCS score was found to be better in terms of specificity and sensitivity, as measured by ROC curve. In addition, GCS scoring, particularly in primary and secondary health care situations, is more feasible in terms of its simplicity as against the elaborate and time consuming assessment required for determination of APACHE II score.

In view of the above, it was clear that GCS score, as a clinical indicator, can predict the outcome better than APACHE II. GCS scoring system, is simpler and less time consuming yet equally specific and sensitive, can be preferred above the APACHE II. The examination of GCS can help the clinicians to screen the patients according to the severity of poisoning and plan the treatment and referral modalities based upon the scoring pattern. Early clinical decision making with GCS shall ensure better outcome and reduce the mortality to a considerable level. The results of the study can be availed for ensuring effective clinical management and development of evidence based protocol for effective clinical decision making.

Key Words: Organophosphorous Poisoning, Insecticides, GCS Score, APACHE II Score

Introduction:

Poisons are subtle and silent weapons that can be easily used without violence and often without arousing suspicion. India, being a predominantly agrarian country, OP poisoning has become a common modality of poisoning because of its vast use, easy availability and affordability over the counter.[1] Organophosphate agents were discovered by Dr. Gerhard Schrader, a German scientist in 1936. He was investigating chemical agents in the search of more effective insecticides. The first of these compounds was named Tabun.[2] Acute poisoning with agricultural pesticides is an emerging global preventable public health

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problem, particularly in developing countries like India.[3]

The World Health Organization estimates that one million serious unintentional poisoning occurs every year in addition to two million cases of attempted suicides with pesticides.[4,5] According to data from National Crime Bureau of India, 5915 & 7060 cases of insecticide/ pesticide poisoning deaths were reported amongst 29 states and 7 union territories in the year 2014 and 2015, respectively. Maharashtra is the second highest state showing 1050 & 1042 cases of insecticide/ pesticide poisoning deaths, after Madhya Pradesh, in the year 2014 and 2015, respectively.[6]

The importance of pesticides in India can be understood from the fact that agriculture is a major component of the Indian economy: it contributes to 22% of the nation's GDP and is the livelihood of nearly 70% the country's workforce.[7]

Although no exact estimates are available from Indian hospital based data suggesting that it is the commonest cause of poisoning, OP compounds account for nearly half of the admissions to emergency. It causes most self-poisoning deaths in Southern & Central India.[8]

OP poisoning is the most common poisoning in India because it is easily availability, cheap and hence, is a source of both intentional & unintentional poisoning. It also possesses the potential to cause serious harm & even death in human beings; and can be taken by oral, respiratory and /or transdermal route.[9]

Important constraints in treatment of OP pesticide self-poisoning cases are the delay in reporting to the health care centre, incomplete data about the exact pesticide consumed, varied clinical presentation due to great variability in activity and action of the individual pesticides, etc. The severity of OP poisoning differs depending upon the compound and its quantity, the way the exposure occurred and the time at which treatment was initiated.[10]

GCS & APACHE II score are the parameters that help clinicians to identify advanced grade OP poisoning patients in the initial assessment in the casualty. GCS is a scoring system developed by Jennett and Teasdale to evaluate the neurological condition of the patient, particularly in patients with the head trauma, but it was reported in 1978 that it can also be used to define prognosis in non trauma patients.[11] APACHE II is a scoring system developed by Knaus, et al, in 1985. It is the most frequently used system in ICU and has been widely accepted as a measure of illness severity. It is important to check its validity in the local population. The score > 40 indicates a very high probability of death in the initial 27-72 hrs.[12]

Prompt recognition and aggressive treatment of acute intoxication is essential in order to minimize the morbidity and mortality from these potentially lethal compounds. Defining the factors that affect the prediction of mortality and prognosis in OP poisoning will help guide follow up and treatment in the intensive care unit.[13] Hence, the present study of the clinical scoring systems to know the prognostic outcome of OP poisoning patients admitted to the rural tertiary care centre i.e. Acharya Vinobha Bhave Rural Hospital Sawangi (Meghe), Wardha, was undertaken.

Aim:

The aim of the present study was to know the prognostic value of the clinical scoring systems in evaluation of the outcome of OP poisoning.

Objectives: To study

1. The OP poisoning with respect to its Demographic profile.
2. The role of prognostic value of prevalent clinical parameters in OP poisoning.
3. To predict the outcome in OP poisoning using clinical indices viz. GCS Score, APACHE-II score.
4. To evolve better criteria for predicting the outcome with clinical taken together in acute Organophosphorous poisoning.

Materials & Methodology:

The cross sectional prospective observational study was done after approval from the Institutional Ethics Committee and Doctoral Research Committee, on patients admitted to the tertiary care hospital in a rural set up of Vidarbha region in Wardha District of

Maharashtra, with history of exposure to OP compounds. A diagnosis of acute OP poisoning was made based on history of contact or ingestion of pesticides, with detailed history given by patient/ accompanying relatives or persons. After obtaining consent, clinical examination was carried out. Detail comprehensive medical nursing & intensive record was noted down. All the patients of acute OP poisoning followed up in casualty, OPD & ICU, with respect to their general condition, vital parameters and were monitored with reference to predictors, as proposed. They were also observed for length of stay and time interval between exposure & treatment received, to correlate with the final outcome.

Study population: The study included 106 patients of OP poisoning admitted to the tertiary care hospital in the rural set up of Vidarbha region in Central India from July 2013 to 2016 with the following Inclusion and Exclusion criteria:

Inclusion Criteria:

- Patients exposed only to OP compounds - confirmed by history, circumstantial evidence, clinical findings & laboratory investigations.
- Patients who had not received any kind of treatment before assessing the clinical severity.

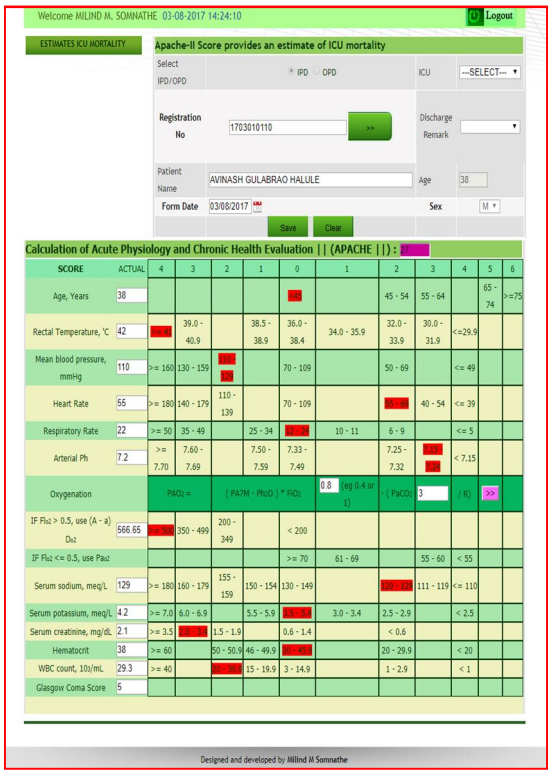
Exclusion Criteria:

- Patients consuming OP with some other drugs like alcohol, etc.
- Patients who had received the treatment prior to admission.
- No concrete evidence of time of exposure and lack of circumstantial evidence of organophosphorous poisoning.
- Patients of paediatric age group.

APACHE II Score:

APACHE II score was calculated by using dot.net 4.5 version Visual studio 2013. Technology used: Ajax (4.0 version), Angular J Query (3.2 version) and Bootstrap (2.0 version). Home based Software prepared by EDP section DMIMS used in HIS. (**Figure 1**)

Figure 1 APACHE II Score: Courtesy: EDP HIS Software



Statistical analysis was done by using descriptive and inferential statistics using Chi square test, Student's unpaired t-test, Pearson's Correlation Coefficient, Sensitivity and Specificity and ROC curve and the software used in the analysis were SPSS 22.0 version, EPI-INFO 6.0 version and Graph Pad Prism 6.0 version and $p<0.05$ is considered as level of significance. Chi square test was used for comparing frequencies, Student's unpaired t-test is used for comparing mean, Pearson's correlation coefficient is used for association of two quantitative data, and ROC curve is used to find area under the curve.

Observations and Results:

The present study included 106 cases of diagnosed OP poisoning. Majority of the patients were aged between 21-30 yrs, 51 (48.1%). Mean age of the patients was 30.10 ± 12.36 (14-65 years). (**Table 1**)

Table 1: Distribution of patients according to their age in years

Age Group(yrs)	No of patients	Percentage (%)
12-20 yrs	21	19.81
21-30 yrs	51	48.11
31-40 yrs	18	16.98
41-50 yrs	6	5.66
>50 yrs	10	9.43
Total	**106**	**100**
Mean ± SD	**30.10 ± 12.36(14-65 years)**	

Males constituted the majority, 74 (69.8%) and the M: F ratio was 2.2:1. (**Table 2**).

Table 2: Distribution of patients according to their gender

Gender	No of patients	Percentage (%)
Male	74	69.81
Female	32	30.19
Total	106	100
M:F Ratio	**2.2 : 1**	

Ninety four (88.7%) cases were of suicidal attempt with oral ingestion of OP agents, while 12 (11.32%) had accidental exposure due to inhalation or skin contact. (**Table 3**).

Table 3: Distribution of patients according to cause/ manner of contact

Cause/ Manner of contact	No of patients	Percentage (%)
Accidental	12	11.32
Suicidal	94	88.68
Total	**106**	**100.00**

The commonest route was oral ingestion, seen in 94 cases (88.7%); 8 (7.55%) cases were due to inhalation and 4 cases (3.77%) were due to inhalation or skin contact. (**Table 4**)

Table 4: Distribution of patients according to route of poisoning

Route of poisoning	No of patients	Percentage (%)
Oral	94	88.68
Inhalation	08	7.55
Inhalation & Skin Contact	04	3.77
Total	**106**	**100**

The clinical parameters are summarized in **Table 5**.

Table 5: Descriptive statistics for clinical findings

Clinical Findings	N	Min.	Max.	Mean	Std. Deviation
Pulse	106	46.00	136.00	88.73	17.87
RR	106	10.00	30.00	19.16	3.51
SBP	106	80.00	160.00	116.26	14.63
DBP	106	60.00	110.00	74.73	9.19
Mean BP	106	67.00	127.00	88.50	10.09
Arterial pH	106	5.70	7.90	7.29	0.32
SPO2	106	22.00	152.00	83.90	15.69
PaCO2	106	20.00	50.00	32.75	7.290
HCT Value	106	17.50	50.20	30.87	9.74
GCS Score	106	3.00	15.00	10.06	2.96
APACHE II Score	106	11.00	31.00	21.98	4.53

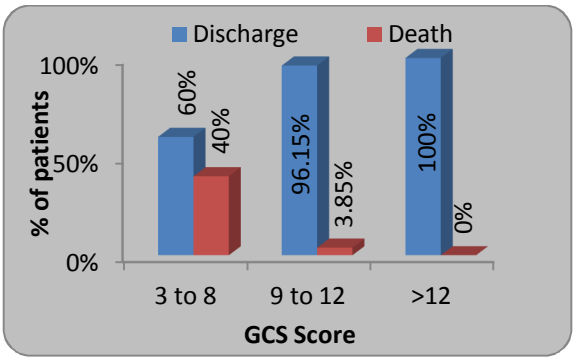
The mortality rate was 13.2 %, with death occurring in 14 patients. (**Table 6**)

Table 6: Distribution of patients according to outcome

Outcome	No of patients	Percentage (%)
Discharge	92	86.80
Death	14	13.20
Total	**106**	**100.0**

On evaluation of GCS score, it was observed that 40% deaths occurred if the score was < 8 and 3.9% death occurred if the value was 9-12 and no deaths, if GCS score was Ó12. The GCS Score was significant to the outcome of the patient (2- -value 26.14, p=0.0001, S). (**Graph 1**)

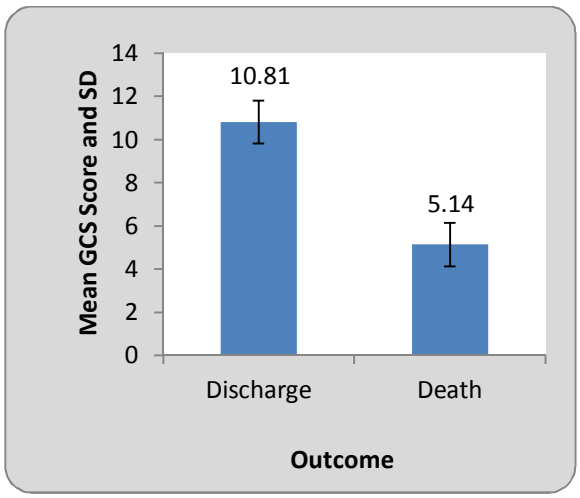
Graph 1: Distribution of patients according to GCS score with outcome



The mean GCS score for the patients who died was 5.14±2.24, and for those that were discharged, was 10.81±2.38. The GCS score is a good predictor of mortality and shows

statistical significance with the poor outcome. (t-value 8.72, p=0.0001, S). (**Graph 2**)

Graph 2: Distribution of GCS score according to outcome



On evaluation of APACHE II score, it was observed that if the score was Ó 30, it showed poor prognosis, with 90% deaths; while only 7.5% deaths in patients with score 21-30. If the score was Ò20 no death occurred. APACHE II was a significant predictor of mortality in OP poisoning (2- -value 57.79, p=0.0001, S), as shown in **Graph 3**.

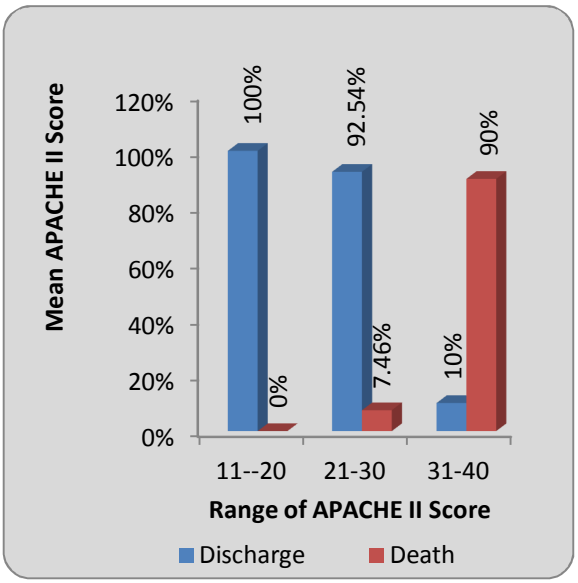
It was observed that GCS & APACHE II showed negative correlation and were significant (r value -0.19, P-0.006). (**Table 7**)

Table 7: Correlation between GCS Score & APACHE II Score; Pearson's Correlation Coefficient

	Mean	Std. Deviation	N
GCS Score	10.06	2.96	106
APACHE II Score	21.98	4.53	106
		GCS Score	APACHE II Score
GCS Score	Pearson Correlation	-	-0.19**
	p-value		0.006,S
	N	106	106
APACHE II Score	Pearson Correlation	-0.19	-
	p-value	0.006,S	

The specificity and sensitivity of the prognostic factors of organophosphorous poisoning was found out with best cut off point for GCS score and APACHE II score as 8 and 20, respectively.

Graph 3: Correlation of APACHE II score with outcome



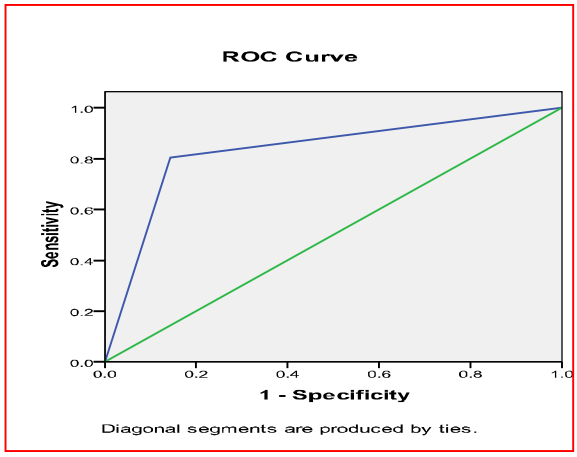
GCS showed sensitivity of 80.4% and specificity of 85.7%, while APACHE II showed less sensitivity but 100% specificity. (**Table 8 & Graph 4**)

Table 8: Sensitivity and Specificity of GCS Score and APACHE II score with outcome

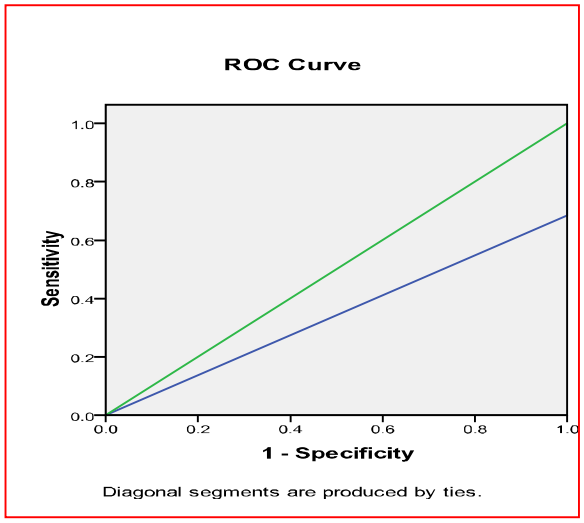
Parameters	Best Cut Off	Sensitivity (95% CI)	Specificity (95% CI)	AUC (95% CI)
GCS	8	80.43% (70.85-87.97)	85.71% (57.19-98.22%)	0.83 (0.71-0.94)
APACHE II Score	20	21.52 (22.23-42.04)	100 (76.84-100)	0.34 (0.21-0.46)

GCS Score

Graph 4: ROC curve of GCS Score and APACHE II Score with outcome



APACHE II Score



Mean APACHE II score for discharged patients was 22.01±4.48, while in the dead, it was 31.28±2.70. It shows the statistical significance to the poor outcome of the patient (t-value 7.513, p=0.0001, S). (**Table 9**)

Table 9: Distribution of APACHE II score according to outcome

Outcome	No of patients	Mean ±SD	t-value	p-value
Discharge	94	22.01± 4.48	7.513	0..0001,S
Death	12	31.28± 2.70		
Total	**106**	**23.23± 5.31**		

On multiple regression analysis of GCS and APACHE II score, it showed that GCS Score is the best to predict the poor outcome of OP poisoning. (t value- 8.848, p- 0.0001S). APACHE II also predicts the poor prognosis of the patient (t value- 7.977, p- 0.0001S). (**Table 10**)

Discussion:

OP compounds are largely used as insecticides or pesticides, all over the world. Because of their rampant use and easy availability and affordability, there is a gradual increase of suicidal and accidental poisoning.[14] They are commonly used in developing and agricultural countries, like India.[11] OP poisoning is a serious clinical entity and major health problem, which causes considerable mortality, though morbidity and mortality vary from one place to another. In India, the mortality rate varies between 15-30% and is the 4th major cause of mortality in rural India. [15,16] In the present study, the total mortality rate was 13.2% (14 deaths in 106 patients). The mortality rate due to Op exposure ranges from 10-25% in previous studies.[7,9,11,17]

The mean age was 30.10 ± 12.36 (14-65 years) and the age distribution showed that

Table 10: Multiple Regression Analysis for GCS Score, APACHE II Score, QTc Score, Serum Amylase score

Model		Unstandardized Coefficients		Standardized Coefficients	t	p-value
		B	Std. Error	Beta		
1	Outcome	1.107	0.228		-	-
	GCS Score	-0.064	0.007	-0.558	**8.848**	**0.0001,S**
	APACHE II Score	0.031	0.004	0.488	**7.977**	**0.0001,S**

most of the patients were of the 21-30 yrs of age (48.1%), followed by the 12-20 yrs age group (19.8%). This is because of young people working in the agricultural field, and secondly, students and housewives in this age group committing suicide due to easy availability of the OP compounds. This data was consistent with the results of previous studies.[10,17,18] Majority of the patients were males with M: F ratio of 2.2:1. This is due to males being more engaged in the agricultural fields. It is consistent with previous studies.[3,4,7,8,18]

Suicidal mode of poisoning by OP is common in developing countries, as well as other parts of the world. In the present study, suicidal poisoning was common, followed by accidental; 88.7% and 11.3%, respectively, and route of intake in all suicidal cases was oral, followed by inhalation or dermal contact, in accidental cases. These findings are consistent with previous studies.[7,19,20] This is due to easy availability of organophosphorous compounds as a household poisons.

Applicability of clinical scores like GCS, APACHE II in evaluation of OP poisoning has been used previously to identify the severity of poisoning. GCS is considered superior because it is easy to perform & does not require complex physiological and laboratory parameters.[21] It is used for outcome and recovery evaluation of patients admitted to ICU.[9] Initial assessment of GCS may help the clinicians to identify any advanced grade of OP poisoning, as stated by Akdur O.[10]Evaluation of GCS score at the time of admission in the present study shows significant correlation with the poor outcome. 40% of the patients with low GCS score of 3-8 showed mortality while those with score more than 9 showed only 3.9% mortality and there were no deaths if the score was > 12 (- 2-value 59.12, p-value=0.0001, S). The mean GCS for patients who died was 5.14±2.24 and for the discharged, it was 10.81 ±2.38 (t-value 8.72, p-0.001). The sensitivity and specificity of GCS was 80.4% (70.85-87.97) and 85.7% (57.19-98.22%), respectively, with AUC value of 0.83. It is consistent with previous studies: GCS was found to be sensitive and specific at predicting outcome, [11,21,22] It can be used as an effective tool for determination of severity of poisoning.[10] Coskun, et al[23] found median GCS score 6 in patients who died and score 15 in those who survived. It is a handy method for evaluation of need for intubation, which should be instituted in patients if GCS score is less than 9.[24]

Another prognostic assessment tool that has been used around the world is APACHE II system.[23] The APACHE II scoring system has been accepted to measure the severity of OP poisoning.[9,12] It uses a point score based on initial values of 12 routine physiological measurements, patients age, and medical history to provide a general measure of disease severity on a patient quantified within a range of 0-71.[25,26] In APACHE II evaluation, the mean value was found to be higher in non-survivor than in survivor - 21.83±6.94 and 10.03±6.28, respectively.[9] The present study confirms the findings, the mean APACHE II Score for the discharge patient was 22.01±4.48 and in those patients who died, it was 31.28±2.70 (t-value 7.513 and p- 0.0001, S). The sensitivity and specificity was 21.52 (22.23-42.04) and 100 (76.84-100), respectively and AUC value was 0.34 (0.21-0.46) and showed a significant correlation with the outcome of the patient with severe OP poisoning. Higher the score higher is the rate of mortality. Mortality was 90% in patients with score more than 30. The findings are consistent with the previous studies [4,9,12,27] The high score indicates high risk mortality.[12] Lee, et al predicted mortality in patients with OP poisoning and found that a score > 26 or higher was associated with the risk of death.[23] It is in conformity with the present research. It can be used as an alternative index of severity in patients with OP poisoning.

In the present study, Pearsonôs Correlation Coefficient between GCS and APACHE II showed a negative correlation but was significant between GCS and APACHE II (r value: -0.196, P-0.044 S) to predict the outcome of the patient

The multiple regression analysis showed that GCS Score was better than the APACHE II to predict the poor outcome of OP poisoning (t value- 8.848, p- 0.0001S) and APACHE II also

predicted the poor prognosis of the patient (t value- 7.977, p- 0.0001S).

Conclusion:

OP compounds are commonly used in developing and agrarian countries like India. The system of checks and monitoring on its purchase and use, by the government, needs to be strengthened in order to reduce the suicidal intentional poisoning as it affects the most productive age group of the society as evident from the present study.[5] Early and rapid diagnosis and prompt treatment may reduce the mortality rate due to OP poisoning. The mortality rate in the present study was 13.2%. Clinical parameters like GCS and APACHE II score are in vogue for predicting the outcome in Organophosphorous poisoning. The said Clinical indices were used in order to find out their suitability in terms of specificity and sensitivity for predicting the outcome.GCS score at the time of admission was found to have significant correlation with the poor outcome. The sensitivity and specificity of GCS was found to be 80.43 % and 85.71 % respectively and was found to predict the severity of poisoning effectively. APACHE II score can be another indicator of outcome with sensitivity and specificity, as measured from ROC, of 21.52 and 100 respectively. The scoreÒ20 predicted 100% recovery whereas score of 30 and above showed 90% mortality. The study demands a swing in emphasis in community education towards hazardous of the poisoning and importance of prompt treatment. The information of the study can be utilized for educating the target population to prevent the incidence of poisoning.

Conflict of Interest: None.
Financial Assistance: None.

References:

1. Udit Narang, Purvasha Narang; Om Prakash Gupta Organophosphorous poisoning: A social calamity. J Mahatma Gandhi Inst Med Sci 2015;20(1):46-51.
2. Richard A Trump .EMT-P: An in-depth review of organophosphate poisoning. Available from: http://www.emsvillage.com/article id=801. Retrieved on:??
3. Girish Thunga, Kishore Ganna Sam. Evaluation of incidence, clinical characteristics and management in organophosphorous poisoning patients in a tertiary care hospital. J Toxicol Environ Health Sci 2010;2(5):73-6 . [et al comes after names of 6 authors]
4. Pradeepkumar Hiremath, Pradeep Rangappa, Ipe Jacob, Karthik rao. Pseudocholinesterase as a predictor of mortality and morbidity in organophosphorous poisoning. Ind J Crit Care Med 2016;20(10):601-4.
5. Pyar Ali, Asma Anwer, Babar Bashir. Clinical pattern and outcome of organophosphorous poisoning. Journal of Liaquat university of Medical and heailth sciences 2012;11(1):15-8. [et al comes after names of 6 authors; Expand the name of the Journal]
6. Shou-Hsuan Liu, Ja-Liang Lin, Cheng-Hao Weng, Huang-Yu Yang, Ching-Wei Hsu, Kuan-Hsing Chen, Wen-Hung Huang, and Tzung-Hai Yen . Heart Rate-Corrected QT Interval Helps Predict Mortality after Intentional Organophosphate Poisoning. PLoS One. 2012; 7(5): e36576
7. Subash Vijaya Kumar, Md. Fareedullah Y. Sudhakar, Current review on organophosphorous poisoning. Arch Applied Sciences Res 2010;2(4):199-215. [et al comes after names of 6 authors]
8. Kailas N Chintale, sanjay V Patne, Sanjay S. Chavan. Clinical profile of organophosphorous poisoning patients at rural tertiary health care centre. Int J Advances in Med 2016;3(2):268-74.
9. Nastaran Eizadi-Mood, Ali Mohd. Applicability of different scoring systems in outcome prediction of patients with mixed drug poisoning induced coma. Ind J Anaesth 2011;55(6);599-604. [et al comes after names of 6 authors]
10. Akdur O, Durukan P, Ozkan S. Poisoning severity score, glasgow coma scale, corrected qt interval in acute organophosphorous poisoning. Hum Exper Toxicol 2010;29(5);419-25. [et al comes after names of 6 authors]
11. Basar Cander, Ali Dur. Mesur Yildiz. The prognostic value of the Glasgow coma scale, serum acetylcholinesterase and leukocyte levels in acute organophosphorous poisoning. Annals Saudi Med J 2011;31(2);163-6. [et al comes after names of 6 authors]

12. Saad Ahmed Naved, Shahla Siddiqui. APACHE-II score with mortality and length of stay in an intensive care unit. J Coll Physicians Surgeons Pakistan 2011;21(1);4-8. [et al comes after names of 6 authors]

13. Eizad Mood, Sanghaei M. Predicting outcome in organophosphorous poisoning based on APACHE-II and modified APACHE-II scores. Hum Experi Toxicol 2007;26(7);573-8. [et al comes after names of 6 authors]

14. Makwava Prakash V, Odedara Ram V, Shah Harsh D.Acute organophosphorous poisoning and clinical admission score association among patients admitted in emergency ward of a tertiary teaching hospital of medical college. J Pharnaceut and Biochem Scie 2012;7(17):1-5.

15. Hemani Ahuja, Ashu Sara Mathai, Aman Pannu, Rohit Arora. Acute poisonings admitted to a tertiary level intensive care unit in Northern India: Patient profile and outcomes. JCDR 2015;9(10):UC 01-04.

16. Batra AK, Keoliya AN, Jadhao JU. Poisoning: An Unnatural cause of morbidity and mortality in Rural India.J Assoc Physicians India; 2003; 51; 955-59.

17. Shadnia S, Okazi A, Aklaghi N et al. Prognostic value of long QT interval in acute and severe organophosphate poisoning. Journal of Medical Toxicology, December2009, Volume 5(4); 96-99.

18. S. Agarwal , V. Bhatnagar et al. Impairment in clinical indices in acute organophosphorous insecticide poisoning patients in India.Internet Journal of Toxicology, 2006, Volume 4(1); page-31-36.

19. Wim van der Hoek, Flemming Konradsen. Risk factors for acute pesticide poisoning in Sri Lanka. European Journal of Tropical Medicine and International health; June 2005;Volume 10; No. 6; 589-96.

20. Tzeng- Jih Lin, Donald- D Jiang, Hon-Man Chan, Dong-Zang Hung et al.Prognostic factors of Organophosphate poisoning between death and Survival groups.Kaohsiung Journal of Medical Sciences; April 2007; vol 23; no.4; 176-81.

21. Chi-Feng Hsu, Ming-Jen Tsai, Kun-Chuan Chen, Ren-Chieh Wu et alCan mortality from agriculture pesticide poisoning be predicted in the emergency department? Findings from a hospital based study in eastern Taiwan.Tzu chi Medical Journal; 25; (2013); 32-38.

22. J.O.J Davies, M. Eddleston & N.A.Buckley. Predicting outcome in acute organophosphorous poisoning with a poison severity score or the Glasgow coma scale. QJM- An international journal of Medicine, volume 101 (5), March 2008 ; 371-79.

23. R Coskun, K.Gundogan, GC Sezgin. A retrospective review of intensive care management of organophosphate insecticide poisoning: Single centre experience. Nigerian journal of Clinical Practise; Sep-Oct 2015; Volume 18; Issue 5; 644-50.

24. Nalan Kozaci, Yuksel Gokel, Ayca Acikalin, Salim Satar. Factors affecting the prognosis in Acute Insecticide Intoxications containing organic phosphorous. The Journal of Academic Emergency Medicine; 2012; 11; 93-7.

25. Kim Y-H, Yeo J-H, Kang M-J, Lee J-H, Cho K-W, Hwang S-Y, Hong C-K, et al. Performance assessment of the SOFA, APACHE II scoring system and SAPS II in intensive care unit organophosphate poisoned patients. J Korean Med Sci 2013;28:1822-6.

26. Xinkuan WU, Wei Xie, Yuelei Cheng, Qinglong Guan. Severity and prognosis of acute Organophosphorous Pesticide Poisoning are indicated by C - reactive protein and Copeptin Levels and APACHE II score. Journal of Experimental and Therapeutic Medicine; 2016;11;806-10.

27. Eun-Jung-Kang, Su-Jin Seok et al. Factors for determining survival in Acute Organophosphate poisoning. The Korean Journal of Internal Medicine December 2009; Volume 24 (4), 362-67.

Original Research Paper

Socio Demographic Pattern of Head Injury Cases in Vehicular Accidents

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Abstract:

The term accident has been defined as an occurrence in the sequence of events which usually produce unintended injury, death or property damage. Considering the increasing proportion, there was a theme by WHO on World Health Day on Road safety in 2004 slogan saying, ñRoad safety is no accidentò1 Head injury is a morbid state, resulting from gross or subtle structural changes in the scalp, skull and or the contents of the skull, produced by mechanical forces.2 This study was conducted to know the socio-demographic pattern of head injury victims of vehicular accidents in a tertiary care government hospital in Mumbai region.

Key Words: Head Injury, Vehicular Accident, Socio Demographic Pattern

Introduction:

The term accident has been defined as an occurrence in the sequence of events which usually produce unintended injury, death or property damage.[3] Vehicular accidents can be defined as 'An event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. They involve high human suffering and socioeconomic costs in terms of premature deaths, injuries, loss of productivity, and so on.[4]

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In developing countries, including India, there is a decline of some communicable diseases, while non-communicable diseases and injuries are on the increase. In this changing scenario, injury and violence is a leading cause of death and disability. This change is palpable across the country and no city is an exception to this change.[5]

World Health Organization (WHO), in its first ever Global Status Report on Road Safety, pointed that speeding, drunk driving and low use of helmets, seat belts and child restraints in vehicles, as the main contributing factors for vehicular accidents.[6]

Among the common causes of vehicular accidents, apart from the normal chaos on the roads, special mention should be drawn towards poorly maintained and congested roads, poor condition of vehicles, poor adherence of traffic rules, inexpert drivers not maintaining lane discipline, use of mobile phones while driving in zigzag pattern, etc. Lack of awareness towards wearing of helmets and new generation high speed vehicles, together increase the burden. Some researchers have addressed the issues of the effect of alcohol in traffic accidents.[7]

Aims and Objectives:

To study the socio demographic profile of head injury cases in vehicular accidents.

Materials and Methodology:

The present study was conducted at the mortuary of a tertiary care government hospital in Mumbai Region from 1st January 2014 to 31st December 2015. Cases of vehicular accidents with head injury were included in study. Ethical clearance was obtained from the Institutional Ethics Committee. The data was compiled, tabulated and analysed statistically.

Observation and Results:

Maximum cases were of the age group 21- 30 years, 54 (22.5%), followed by 31-40 years 52 (21.6%). Least were from above 71 years age, 6 (2.5%). (**Table 1**)

Table 1: Age wise distribution of head injury cases

Age group	No of cases	Percentage (%)
0-10 years	20	8.3
11-20 years	18	7.5
21-30 years	54	22.5
31-40 years	52	21.67
41-50 years	44	18.33
51-60 years	30	12.5
61-70 years	16	6.67
71 years & above	6	2.5
Total	**240**	**100**

On considering the gender profile, males [200 (83.3%)] were predominant. The sex ratio of male to female was 5:1 (**Table 2**)

Table 2: Gender Profile among head injury cases

Sex	Number	Percentage (%)
Male	200	83.33
Female	40	16.67
Total	240	100

When considering the socioeconomic status of the cases, maximum cases [76 (31.7%)] were from lower middle class, followed by [65 (27.1%)] the upper middle class. (**Table 3**)

Table 3: Socioeconomic status wise distribution

Socio-economic status	Total cases	Percentage(%)
Upper	34	14.1%
Upper Middle	65	27.08%
Lower middle	76	31.66%
Upper lower	39	16.25%
Lower	26	10.8%
Total	240	100%

About location wise distribution of victims of vehicular accidents, most of the victims were from Urban area 174 (72.5%). (**Table 4**)

Table 4: Location wise distribution of cases in case of RTA

Place of RTA	Number of victims	Percentage (%)
Rural area	66	27.5
Urban area	174	72.5
Total	240	100

Discussion:

Vehicular accident injuries are one of the leading causes of deaths, hospitalizations, disabilities and socio economic losses in India, especially in metropolitan cities with liberalized economic reforms, industrialization migration and changing values of the large, middle class young and middle age sections of the society. The motorization phenomena in India have been rapid and marked since last decade.

In our study, a total 240 cases of head injury victims due to vehicular accidents were studied, of which maximum cases belonged to the age group 21- 30 years. Similar results were found in studies conducted by Mohanty, et al,[8] Patel, et al,[9] Rao, et al.[10] The productive age group is mostly affected. Being productive, they are exposed to outside environment and travel more common than other age group so more prone to accident. Similarly, dislike for traffic rules and safety measures increases the risk.

As regards the sex profile, majority of the victims were males; which corresponded with the study by others.[11-13] Males are involved in heavy labour, major industries, constructions, travelling, as well as drivers. So most of the time is spent outside and hence they are more prone to accidents.

Again, majority of victims in our study were from lower middle class. In contrast to our study, maximum victims were from middle class in a study conducted by Akhade, et al[11] and Gururaj, et al.[12] Most of the lower middle class people have two wheelers. The risk increases subjectively on alcohol use, non use of helmet, not following speed limit etc.

Location wise, maximum victims were from the urban area. Similar findings were seen in studies conducted by Ahmed, et al[15] & Singh, et al.[16] Main reason is that the use of vehicles is much more in urban region, in addition to heavy traffic, which further increases the burden. Roads are much better in urban areas so youngsters are found who cross speed limit and invite accidents.

Conflict of interest: None
Financial Assistance: None

References:

1. Available from: http://www.who.int/mediacentre/news/releases/2004/pr24/en/. Accessed on: 12/04/2017
2. Vij K. Textbook of forensic medicine and toxicology principles and practice. 4th Ed. Reed Elsevier India private limited; 2008: 351.
3. Singh H, Dhattarwal SK. Pattern and distribution of injuries in fatal road traffic accidents in rohtak haryana J Ind Acad Foren Med. 2004;26(1):20-3.
4. Transport Research Wing, Ministry of Road Transport and Highways. Road accidents in India 2011. New Delhi: Ministry of Road Transport and Highways, Government of India; 2012. Available from: http://morth-roadsafety.nic.in/WriteReadData/LINKS/201273e6793f-92ad-4014-aef3-c438c29004dc.pdf. Accessed on: 12/04/2017
5. Guru raj G, Injuries in India: A national perspective in: burden of disease in india. national commission on macroeconomics and health. Ministry of Health and Family Welfare. Government of India, 2005a, 325-47 Available from: http://www.who.int/macrohealth/action/NCMH_Burden%20of%20disease_(29%20Sep%202005).pdf. Accessed on: 12/04/2017
6. Available from: http://www.dw.com/en/india-has-the-highest-number-of-road-accidents-in-the-world/a-5519345-1. Accessed on: 12/04/2017.
7. Levitt Steven DE, Porter J. How dangerous are drinking drivers? J Political Economy 2001;109(61):1198-237.
8. Mohanty MK, Kumar TS, Mohanram A, Palimar V. Victims of homicidal deaths ï analysis of variables. J Clin Forensic Med 2005;12(6):302-4.
9. Patel DJ, Agnihotram G. Study of road traffic accidental deaths (RTA) in and around bastar region of chhattisgarh. J Ind Acad Foren Med 2009;32(2):110-2.
10. Rao D, Mukerjee S. A study of pattern of injuries in road traffic collisions. J Punjab Acad Foren Med Toxicol 2010;10:14-6.
11. Swapnil P. Akhade, Kiran R. Rohi, Manoj B. Parchake, Rajesh V. Kachare, Sunil Kadam, Chandrakant R Dode. Socio-demographic profile of head injury victims of fatal vehicular accidents in semi urban region of maharashtra J Ind Acad Foren Med 2015;37(2):119-23
12. Stella J, Cooke C, Sprivulis P. Most head injury related motorcycle crash deaths are related to poor riding practices. Emergency Med 2002;14(1):58-61. Available from: https://www.ncbi.nlm.nih.gov/pubmed/11993836. Accessed on: 12/04/2017
13. Shobhana SS, Jagadeesh N. Pattern of fatal head injuries autopsied at Vydehi hospital Bangalore: 5 years study. J Evidence Based Med Healthcare 2014;1(10):1310-19.
14. Gururaj G. Road traffic deaths, injuries and disabilities in India. Natl Med J India. 2008;21(1):14-20.
15. Md. Ziya Ahmad, R. N. Karmakar. An epidemiological study of acute head injury and its evaluation by ct scan. J Ind Acad Foren Med 2014;36(2):173-5.
16. Singh YN, Bairagi KK, Das KC. An epidemiological study of road traffic accident victims in Medico-legal autopsies, J Ind Acad Foren Med 2005; 27(3):166-9.

Original Research Paper

Evaluation of Intracranial Pathologies Causing Sudden Deaths and it's Survival Time: An Autopsy Study

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Abstract:

Sudden and unexpected death is an indication for further investigation in the form of medico-legal autopsy. The present study was a prospective study undertaken at a tertiary health care centre with the objective of studying the untimely deaths. In a series of consecutive medico-legal autopsies, 189 cases of sudden death were reported. Evaluation of these cases included complete medico-legal autopsy, including toxicological and histo-pathological examination. There was a definite influence of age and gender on sudden deaths. The frequency of intracranial pathology leading to sudden unexplained and unexpected death was determined. Of the 189 cases of sudden death, 22 (12%) were due to intracranial pathologies. Amongst these, there were 9 cases of subarachnoid haemorrhage (SAH), 4 of cerebral edema, 3 of Intracerebral haemorrhage (ICH), 3 of combined SAH & ICH and 3of Meningitis. We also observed the mean survival time, which was 6 hours and 50 minutes in sudden deaths due to intracranial pathologies.

Key Words: Sudden Death, Intracranial Pathology, Subarachnoid Haemorrhage, Survival Time

Introduction:

The diagnosis and definition of sudden death are variable, but the generally recognized definition is based on the length of time between the onset of symptoms and death.[1,2] The World Health Organization (WHO) definition of sudden death, according to the International classification of diseases, version 10 (ICD-10) is death, non-violent and not otherwise explained, occurring less than 24 hours from the onset of symptoms.[2]

As many authors differ with this definition, in the present study, we have followed the easily acceptable definition given by Apurba Nandy: Sudden death is a death which is not known to have been caused by any trauma, poisoning or violent asphyxia, and where death occurs all of a sudden or within 24 hours of the onset of the terminal symptoms.[3] While it is true that many sudden deaths are not necessarily unexpected, and some unexpected deaths are not necessarily sudden, it is extremely important that in these cases autopsies be done, and that too meticulously, as the findings in such cases may have profound effects on the lives and welfare of the family of the deceased, law enforcement agencies, hospital authorities and private corporations, including insurance companies. Also the study of sudden death gives a differential diagnosis of cause of death and helps to make a logical choice of the most likely cause of death, which will help to improve the mortality statistics. Sudden deaths occur in

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all age groups: in infants (where it is called sudden infant death syndrome), in children and youths, in adults and in elderly.[4-11]

Sudden death may occur as a result of rapid bleeding into one or more of the intracranial compartments i.e. extradural, subdural, subarachnoid, intraventricular spaces or into brain substance. The causes vary, depending upon age and anatomical location of the haemorrhage.[12]

There has been some uncertainty about the frequency with which ruptured intracranial saccular aneurysms are associated with either instantaneous or very rapid death. Early medical literature, based on surveys of large numbers of patients who died before or on arriving at a hospital, found that 60% of the patients died immediately after rupture of the aneurysm.[13,14] The mean age was 46 years and at necropsy, there was massive subarachnoid haemorrhage in 96% of the cases, subdural haemorrhage in 22%, and intracerebral haemorrhage in 43%. In addition, patients with saccular aneurysms of posterior part of the circle of Willis or arising from the internal carotid artery, showed a greater tendency to die at the time of rupture than those with aneurysms arising from other arteries.[14]

At autopsy, the diagnosis of massive subarachnoid haemorrhage is self evident. However, because of the large amounts of freshly formed blood clots, it is often difficult to locate the saccular aneurysm unless the brain is examined when fresh. The subarachnoid membrane should be removed with forceps and the ventral surface of the brain washed with isotonic saline. Even with the use of a dissecting microscope, it may not be possible to identify the source of subarachnoid haemorrhage in at least 5-10% cases, raising the possibility that the cause is rupture of a small saccular aneurysm, which had been completely obliterated by the blow out of the blood vessel.[12] The present study was undertaken to determine pattern of intracranial pathologies leading to sudden deaths and its survival time.

Material & Methodology:

The present study was conducted in the department of Forensic Medicine and Toxicology, in a tertiary care teaching institute in Maharashtra. Persons who had died suddenly and/ or unexpectedly, and had been subjected to medico-legal autopsy were included in this study. The criterion for selection of cases was as per definition of sudden death.[3]

The cases, where after medico-legal autopsy, the cause of death turned out to be unnatural or could not be ascertained, were excluded from the study. Before commencing the autopsy, history about the onset of symptoms and their duration before death i.e. survival time was obtained from the relatives, accompanying persons and/ or clinical records.

A thorough and meticulous postmortem examination was carried out in every case and the whole organ or pieces of organ, showing gross pathologic changes were preserved for histo-pathological examination in 10% formalin. Thickness of 3-5mm was kept for fast and better fixation; slides were prepared and stained with Haematoxylin and Eosin. Toxicological analysis was carried out in all cases to rule out poisoning. After the receipt of histo-pathological and chemical analysis report, final opinion as to the cause of death was inferred. The findings were recorded and analyzed statistically.

Results:

In this study, of the 189 cases of sudden death, 171 (90%) were male. It was observed that 2 cases belonged to age group of upto 10 years, 3 were in the range of 11 - 20 years, 17 belonged to 21 - 30 year age group, and in the 31 - 40 years age group, there were 44 cases. Fifty one and 53 cases belonged to 41 - 50 and 51 - 60 years age group, respectively. Maximum cases of sudden deaths were in the 51 - 60 years age group; minimum number were in the age group of upto 10 years. (**Table 1**)

Twenty two cases were of intracranial pathologies. Of these, 9 (7 male, 2 female) were due to SAH, 3 (2 Male, 1 Female) were due to ICH, 3 were due to SAH with ICH, 4 due to Cerebral edema and 3 were due to Meningitis. (**Table 2**)

Table 1: Number of sudden death cases according to age and gender

Sr. No.	Age in Years	Males		Females		Total Cases	
		No.	%	No.	%	No.	%
1	<10	1	0.5%	1	0.5%	2	1%
2	11-20	1	0.5%	2	1%	3	1.5%
3	21-30	10	5%	7	4%	17	9%
4	31-40	42	22%	2	1%	44	23%
5	41-50	49	26%	2	1%	51	27%
6	51-60	51	27%	2	1%	53	28%
7	61-70	14	7%	2	1%	16	8%
8	> 70	3	1.5%	0	0	3	1.5%
Total		**171**	**90%**	**18**	**10%**	**189**	**100%**

Table 2: Intracranial pathologies according to gender and different age groups

Sr. No	Age Groups (Years)	SAH			ICH			SAH with ICH			Cerebral Edema			Meningitis			Total		
		M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
1	<10	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1
2	11-20	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	1	1	2
3	21-30	1	1	2	0	1	1	0	0	0	2	0	2	0	0	0	3	2	5
4	31-40	1	0	1	1	0	1	0	0	0	1	0	1	0	0	0	3	0	3
5	41-50	2	0	2	1	0	1	1	0	1	0	0	0	1	0	1	5	0	5
6	51-60	2	0	2	0	0	0	2	0	2	0	0	0	1	0	1	5	0	5
7	61-70	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
8	>70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**7**	**2**	**9**	**2**	**1**	**3**	**3**	**0**	**3**	**4**	**0**	**4**	**3**	**0**	**3**	**19**	**3**	**22**

As shown in **Table 3,** the minimum survival period in sudden deaths due to SAH was 35 minutes and the maximum survival period was 14 hours and 45 minutes; with a mean of 6 hours and 11 minutes. The minimum survival period in deaths due to ICH was 1 hour and 5 minutes and the maximum was 9 hours and 45 minutes; with a mean of 5 hours and 13 minutes. Again, the minimum survival period in deaths due to combined SAH & ICH was 1 hour and 25 minutes and maximum was 20 hours and 45 minutes; with mean of 11 hours and 5 minutes. Minimum survival period in deaths due to cerebral edema was 1 hour and maximum was 1 hour; with mean of 1 hour. Similarly, minimum survival period in deaths due to meningitis was 2 hours and maximum was 16 hours and 45 minutes; with mean of 9 hours and 22 minutes.

Discussion:

In the present study, a total 189 cases of sudden death were studied, of which 171 were male. The male to female ratio was 9:1. Maximum cases (28%) were in the age group 51- 60 years & minimum (1%) were in the age group of less than 10 years. We found definite influence of age on the incidence of sudden death, as it is increased clearly in old age spectrum. The above findings are similar to the findings of Zanjad & Nanandkar[15] and Nofal & Abdulmohsen.[16]

Table 3: Survival time in sudden deaths due to intracranial pathologies

Sr. No.	Diseases	Survival time (Hours: Minutes)								
		Male			Female			Total		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
1	SAH	00:35	14:45	06:32	02:00	08:10	05:05	00:35	14:45	06:11
2	ICH	01:05	09:45	05:25	04:50	04:50	04:50	01:05	09:45	05:13
3	SAH with ICH	01:25	20:45	11:05	-	-	-	01:25	02:45	11:05
4	Cerebral edema	01:00	01:00	01:00	-	-	-	01:00	01:00	01:00
5	Meningitis	02:00	16:45	09:22	-	-	-	02:00	16:45	09:22

Subarachnoid haemorrhage was the most frequent cause leading to sudden death, accounting for 40.9% of all intracranial pathologies noted during autopsies. This finding is similar to the findings of Omae, et. al.[17] The overall mean survival period in sudden deaths due to intracranial pathologies was 6 hours and 50 minutes.

Limitations of the Study:

The authors hereby acknowledge that the conclusions drawn from this study may not necessarily be applicable to the general population because the study was based on medico-legal autopsies performed on cases of sudden deaths in a tertiary health care center to the exclusion of those for which autopsy was not performed.

Conflict of interest: None
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References:

1. Di Maio VJM, Di Maio DJ. Forensic pathology, 2nd Ed. London: CRC Press.; 2001.
2. International classification of diseases (ICD-10). Geneva, World Health Organization, 2005. Available from: http://www.who.int/classifications/en. Accessed on 10 May 2017
3. Apurba Nandy: Principles of forensic medicine including toxicology. 3rd Ed. Kolkata: New Central Book Agency (P) Ltd. 2010 pp,226-9.
4. Eckart RE, Scoville SL, Cambell CL, Shry EA, Stajduhar KC, Potter RN et al. Sudden death in young adults: A 25 year review of autopsies in military recruits. Annals of Internal Medicine 2004;141(11):829-34.
5. B. Morentin, B. Aguilera, P. M. Garamendi, M. Suarez-Mier. Sudden unexpected non-violent death between 1 and 19 years in north Spain. Archives of Disease in Childhood. 2000;82:456-61.
6. Amital H, Glikson M, Burstein M, Afek A, Sinnreich R, Weiss Y. et al. Clinical characteristics of unexpected death among young enlisted military personnel: results of a three-decade retrospective surveillance. Chest. 2004;126:528-33.
7. Drory Y, Turetz Y, Hiss Y, Lev B, Fisman EZ, Pines A et al. Sudden unexpected death in persons less than 40 years of age. Amer J Cardio 1991;68:1388-92.
8. Kramer MR, Drori Y, Lev B. Sudden death in young soldiers. High incidence of syncope prior to death. Chest 1988;93:345-347. Available from: https://doi.org/10.1378/chest.93.2.345.Accessed on 10 May 2017
9. Abu-Rashid N, Al-Jirf S, Bashour H. Causes of death among Syrian children using verbal autopsy. Eastern Mediterranean Health Journal. 1996;2:440ï 448. Available from: http://www.who.int/iris/handle/10665/116907. [ccessed on 11 May 2017
10. Mesleh RA, Kurdi AM, Sabagh TO, Algwiser AA et al. Changing trends in perinatal deaths at the Armed Forces Hospital, Riyadh, Saudi Arabia. J Obs & Gynaecol 2001;21:49-55.
11. Quigley F, Greene M, O6Connor D, Kelly F et al. A survey of the causes of sudden cardiac death in the under 35-year-age group. Irish Medical Journal, 2005;98:232-5.
12. Black M, Graham DI. Sudden unexplained death in adults caused by intracranial pathology. J Clin Pathol 2002;55(1):44-50
13. Dinning TAR, Alconer MA. Sudden or unexpecte d natural death due to ruptured intracranial aneur ysms: survey of 250 forensic cases. Lancet 1953;799ï 801. Available from: https://doi.org/10.1016/S0140-6736(53)90467-X. Accessed on 11 May 2017
14. Freytag E. Fatal rupture of intracranial aneurysms. Arch P athol 1966;418ï 24. Available from: https://www.ncbi.nlm.nih.gov/pubmed/5933816. A ccessed on 11 May 2017
15. Zanjad NP, Nanandkar SD. Study of sudden unexpected deaths in medico-legal autopsies. J Ind Acad For Med 2006;28(1):27-30
16. Nofal HK, Abdulmohsen MF. Influence of age, gender and prodromal symptoms on sudden death in a tertiary care hospital, eastern Saudi Arabia. J Family Community Med. 2010;17(2):83-.6
17. Omae T, Ueda K, Hasuo Y, Tanaka K. Sudden unexpected deaths in a Japnese community Hisayama study. Jpn Circ J. 1983;47(5):554-561. Available from: https://www.ncbi.nlm.nih.gov/pubmed/6854912 Accessed on 11 May 2017

Original Research Paper

Assessment of the Post-Mortem Interval Using Entomological Evidence From Northern India

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Abstract:

Background: Insects help forensic experts in revealing proper evidences in death of a human being and also as a tool for crime investigations. The species of insects vary from place to place, depending on the climatic and geographic pattern or milieu.

Objectives: To determine the time since death in a specific region by forensic entomology.

Materials & Methodology: Cases brought to the mortuary for conducting post-mortem examinations formed the study population. Entomological evidence in the form of eggs, pupae, etc, from 38 cases were included in this study. Autopsy was conducted to determine the mode, manner and the cause of the death. Time since death was calculated from post-mortem findings and with the help of entomologic evidence.

Results: Maximum (32%) study subjects were in the 31-40 years age group. Cases with decaying stage were seen in the majority of cases with temperature range of 31-35^{0}C. Skeletonization was seen in temperature ranging 26-30^{0}C. Hatching was delayed in autumn and in winter. Time since death calculated by using entomological evidence in 79% of cases was accurate or had a minimal range difference compared to the different methods as mentioned in the autopsy reports.

Conclusion: In medico-legal investigations, entomological evidence proved to be a trustworthy technique in calculating the time since death, not only in the early stages, but also in advance stages of corpse decomposition.

Key Words: Forensic Entomology, Post-mortem Interval, Post-mortem Register

Introduction:

Entomological evidence is legal evidence in the form of insects or related artefacts, and is a field of study in forensic entomology or medico-criminal Entomology. Insects help forensic experts in revealing proper evidence in death of a human being and also as a tool for crime investigations. Entomological evidence is most commonly applied in estimating the post-mortem interval (PMI) i.e. the duration between death and post-mortem.[1-3]

In an untimely demise or homicide, insect evidence collected from and around the body of the deceased should be properly safeguarded and examined by a trained forensic entomologist, which would help in determining the time since death.[4] Entomological evidence and its implications has been given a great importance by workers around the globe in solving criminal cases.[5,6]

In India, forensic entomology is a field which is largely ignored. The challenges encountered while dealing with the species of

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insects vary from place to place, depending on the climatic and geographic pattern or milieu. Therefore, it was planned to conduct a study with the objective to determine post-mortem interval in a specific region by forensic entomology.

Materials and Methodology:

The present cross-sectional study was planned and executed by the Department of Forensic Medicine and Toxicology, MMIMSR, Haryana, during November 2011 to August 2013. Cases brought to the mortuary for conducting post-mortem examinations formed the study population. Purposive sampling technique was adopted. We included 38 cases of human corpses having entomological evidence in form of insects, eggs, pupae etc.

Detailed proforma, inferred evidence from the inquest papers and from the people accompanying the dead body, post-mortem examination findings and insect evidence were used as study tools. The Proforma was designed in consultation with experts in the field. All the necessary information was recorded in this proforma. Following details were captured Demographic information including age, sex, date, case number, police station, last seen date and time found, the date on which the person went missing, exact time when the body was removed from the scene of crime and the details of site where the body was found, were also recorded. Other important particulars like scene of death area/ aquatic/ exposure of body were recorded in detail. Scene temperature, stage of decomposition, evidence of mutilation, number of preserved dead samples, number of preserved live samples and injuries if present was also recorded with extreme caution to strengthen the data.

Material evidence in the form of eggs, larvae, pupae and insects, were collected. Insects - live and dead, were collected for the study. 70% alcohol was used as preservative in preserving the dead samples. The larvae, before preservation, were killed by placing them in hot water for few seconds. Separate jars with food and air was used for live samples. Circumstantial evidence was also collected from the relatives and the people accompanying. Autopsy was conducted to determine the mode, manner and the cause of death. Time since death was calculated from post-mortem findings and with the help of insect evidence.

Results

Observations were made from 38 cases, having insect evidences of various stages. Males (92%) outnumbered females (8%). Maximum (32%) study subjects were 31 - 40 years old, followed by the age group of 21 - 30 years and 41 ï 50 years (21%, each). Age group and gender-wise, maximum males (12) were seen in age group 31-40 years. Maximum (47%) bodies were found in the aquatic areas. (**Table 1**)

Table 1. Profile and Pattern of Study Subjects

Variables		No.	Percentage
Gender	Male	35	92.1%
	Female	3	7.9%
Age group (in years)	<20	4	10.5%
	21-30	8	21.1%
	31-40	13	34.2%
	41-50	8	21.1%
	>51	5	13.1%
Area where the bodies were found	Aquatic	18	47.4%
	Rural	17	44.7%
	Urban	3	7.9%
Decomposition stage	Decaying	23	60.5%
	Bloating	14	36.8%
	Dry/skeletonization	1	2.6%
Clothing	Entire	21	55.3%
	Partial	13	34.2%
	None	4	10.5%

Sixty one percent cases were in active stages of decomposition, 37% in bloating stage and 3% in dry stage i.e. in skeletonization stage. On analyzing the oldest stage and the decomposition stages together, maximum number of cases with late larval stage, late stage larva & pupa, beetles & pupa and only pupa were seen in active decaying bodies, maximum number of cases with eggs and early stage larva were seen in bloating cases. In 55% of cases, clothes were completely present, in 34%, clothes were partially present and in 11%, clothes were completely absent. (**Table 1**)

Maximum number of decaying cases (14) were seen in summer and minimum in autumn and in spring (1 each). Bloating cases was seen maximum (7) in summer and

minimum in rainy and in spring (1 each). Only one dry /skeletonization case was seen in rainy season. (**Table 2**)

Table 2. Distribution of Study Subjects According to Their Decomposition Stage & Seasonal Variation

Cross tabulation		Decomposition stage			Total
		Decay-ing	Bloat-ing	Dry/ skeletonization	
Season	Winter	2	2	0	4
	Summer	14	7	0	21
	Rainy	5	1	1	7
	Autum	1	3	0	4
	Spring	1	1	0	2
Total		23	14	1	38

Drowning was detected as the cause of death in maximum number of cases (42%). Maximum (55%) cases were seen in summer whereas and minimum (5%) were seen in spring season. Maximum number of drowning cases (10) were seen in summer and minimum number of cases (1 each) were seen in autumn, spring and in winter. (**Table 3**)

Egg stages were seen maximum in summer and one case was seen each in rainy, autumn and spring. In cases with early larval stage, maximum cases were in summer and minimum in autumn. Late larval stages & pupa were seen maximum in summer and minimum in rainy season. (**Table 4**)

Table 3. Season Wise Distribution of Study Subjects

Season	Frequency	Percent
Winter	4	10.5
Summer	21	55.3
Rainy	7	18.4
Autumn	4	10.5
Spring	2	5.3
Total	38	100.0

Maximum number of cases (10) with decaying stage were seen with temperature range of 31-35^{0}C. In cases in bloating stage, maximum number of cases (10) were seen with temperature range of 26-30^{0}C. Dry/ Skeletonization was seen in temperature ranging 26-30^{0}C. (**Table 5**)

In the present study, there were total seven cases where no fly stages were found. In these seven cases no entomological evidence was found even after the required time since death had crossed, although the cases were in favourable condition for oviposition of the flies. It was observed that in three cases the eggs hatching period was between 18-21hours in summer were as the hatching was delayed in autumn and in winter season.

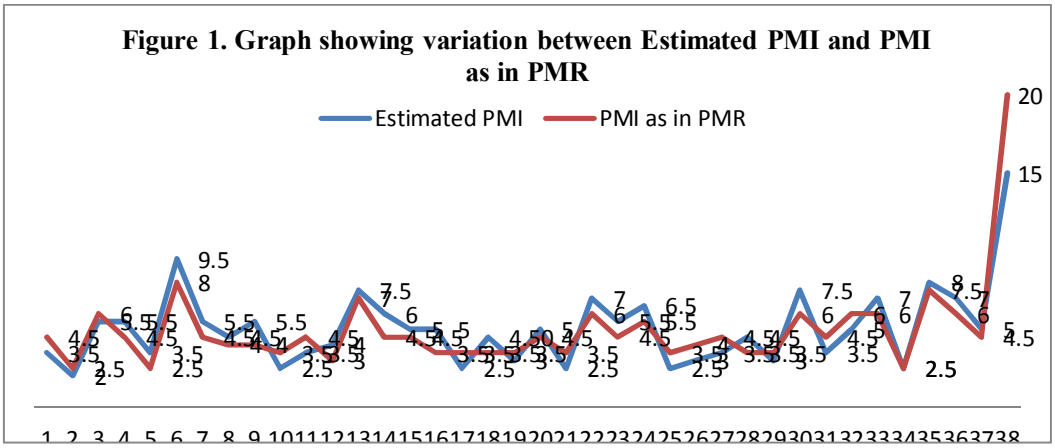
Forensic entomology was used as a scientific tool to calculate post-mortem interval. This post-mortem interval was then compared with post-mortem interval from post-mortem register. Variations were noted down.

Table 4. Cross-tabulation of Old-Stage With Different Seasons

Cross tabulation		Season					Total
		Winter	Summer	Rainy	Autumn	Spring	
Old stage	Egg	0	2	1	1	1	5
	Early larval stage	2	5	2	1	0	10
	Late larval stage	2	8	2	1	0	13
	Late larval stage & pupa	0	2	1	0	0	3
	Beetles & pupa	0	1	0	1	1	3
	Beetles & late larval stage	0	1	0	0	0	1
	Pupa	0	2	0	0	0	2
	Beetles & shell	0	0	1	0	0	1
Total		4	21	7	4	2	38

Table 5. Cross-tabulation of Average Temperature Range & Decomposition Stage

Cross tabulation		Decomposition stage			Total
		Decaying	Bloating	Dry/Skeletonization	
Average temperature range	15-20	2	2	0	4
	21-25	0	1	0	1
	26-30	9	10	1	20
	31-35	10	1	0	11
	>36	2	0	0	2
Total		23	14	1	38



There was no much difference between estimated post-mortem interval, as measured by entomological methods and as in post-mortem register. (**Figure 1**)

Formulae to calculate the age of insects

Analysis of data gathered in our study, when subjected to mathematical manipulation, has generated following formulas for calculation of ages of insects. (**Table 6**)

Table 6: Formulas to calculate the age of insects

Stages of life cycle	Formula to calculate age (A) of the stage (in days) (F is temperature in °C, ln is inverse log)
Adult Fly	A = 70 – 18 ln F
Pupa	A = 55 – 15 ln F
3rd instar Larva	A = 30 – 8 ln F
2nd instar Larva	A = 24 – 7 ln F
1st instar Larva	A = 19 – 5 ln F

Discussion:

The post-mortem interval can be determined by two primary methods with the help of entomological evidence. Insect succession, mainly of arthropod species, on a corpse is one method in determining the PMI.[7] Insects are attracted to the putrefied remains in a well known pattern depending on the different stages of putrefaction.[8,9] The use of either approach will also depend on factors such as season, climate, and location of the corpse and treatment of the corpse. Factors like temperature, humidity, clothing (present or absent) and type of burial also affect the rate of progression of insects.[10]

The insect activity was found to be directly related to the rate and different stages of decomposition. The above findings were consistent with the study of Schoenly,[11] who analysed studies from the statistical data of eleven decomposed bodies around the world. Fuller,[12] described decomposition in three different stages where the first stage is the combination of fresh and bloating stage. Bornemissza[13] divided decomposition into five different stages - fresh, bloated, active decaying, advanced decaying and skeletal remains. In summer and in rainy season, the rate of decay is faster as compared to winter and spring. This clearly agrees with previous decomposition studies done on dogs and rabbits.[14]

Forensic entomologists used to calculate the PMI with a belief that the blow flies are neither active and do not lay eggs at night.[15] Estimating the PMI could change to a maximum of 12 hours due to the absence of oviposition at night. This method got modified when Greenberg[5] reported that the calliphorid species had nocturnal oviposition, which was used as an indicator for estimating the time.

Success rate of nocturnal oviposition was seen in 33% of cases or less by Singh and Bharti,[16] which was observed in the cases left in open space, while nocturnal oviposition was present in cases kept indoors. The insect species were similar to the ones identified by Maryland[17] in his study. From the above mentioned studies, it proves that the species of the calliphorid family lay eggs in the day and during the night.

Insect invasion did not have any significant difference or developmental difference in cases of poisoning, as most of the poisons are not absorbed by skin and the time between the consumption of poison and the time of death is less. This comes in cohort with other studies.[18,19]

Conclusion:

Findings of the present study indicate that PMI from entomological evidence was quite helpful in estimating the apparent time of death in Post-mortem report. In medico-legal investigations the utilization of entomological evidence proves as a handy tool in calculating the PMI in early and in late stages of decomposition.

References:

1. Byrd JH, Castner JL. Eds. Forensic entomology: the utility of arthropods in legal investigations. 1st Ed. CRC Press; 2009: 11.
2. Catts EP, Goff ML. Forensic entomology in criminal investigations. Annual Review of Entomology 1992;37(1):253-72.
3. Mann RW, Bass WM, Meadows L. Time since death and decomposition of the human body: variables and observations in case and experimental field studies. J Foren Sci 1990;35(1):103-11.
4. Tracqui A, Keyser-Tracqui C, Kintz P, Ludes B. Entomotoxicology for the forensic toxicologist: much ado about nothing? Int J Legal Med 2004;118:194-6.
5. Greenberg B, Kunich JC. Entomology and the law: flies as forensic indicators. Cambridge University Press; 1st Ed. 2002:pp 124.
6. Campobasso CP, Disney RHL, Introna FA. Case of megaselia scalaris (diptera: phoridae) breeding in human corpse. Aggarwal's Internet J Foren Med Toxicol 2004;5:3-5. Available from: ttp://anilaggrawal.com/ij/vol_005_no_001/pdf/forensic_entomology_special_issue_high_resolution.pdf, Accessed on 20-04-2017
7. Schoenly K, Reid W. Dynamics of heterotrophic succession in carrion arthropod assemblages: discrete seres or a continuum of change? Oecologia 1987;73:192-202. Available from: https://www.ncbi.nlm.nih.gov/pubmed/28312287. Accessed on 23-04-2017.
8. Reed HB Jr. A study of dog carcass communities in tennessee, with special reference to the insects. American Midland Naturalist 1958; 59: 213-245. Available from: https://www.jstor.org/stable/pdf/2422385.pdf?seq=1#page_scan_tab_contents. Accessed on 27-05-2017.
9. Payne JA. A summer carrion study of the baby pig sus scrofa linnaeus. Ecology 1965;46:592-602. Available from: https://esajournals.onlinelibrary .wiley.com/doi/abs/10.2307/1934999. Accessed on 12-06-2017.
10. Buchan MJ, Anderson GS. Time since death: a review of the current status of methods used in the later post mortem interval. Can. Soc. Forensic Sci. J 2001;34:1-22.
11. Schoenly K. Statistical analysis of successional patterns in carrion- arthropod assemblages: implications for forensic entomology and determination of the post mortem interval. J F S 1992;37(6):1489-513.
12. Fuller ME. The insect inhabitants of carrion: a study in animal ecology. The Insect Inhabitants of Carrion: A Study in Animal Ecology.1934(82). Available from: https://www.cabdirect.org/cabdirect/abstract/19341000744. Accessed on 14-06-2017.
13. Bornemissza GF. An analysis of arthropod succession in carrion and the effect of its decomposition on the soil fauna. Australian J Zoology 1957;5:1-12. Available from: https://www.publish.csiro.au/zo/ZO9570001. Accessed on 14-06-2017.
14. Tantawi TI, ElKady EM, Greenberg B and El Ghaffar HA. Arthropod succession on exposed rabbit carrion in alexandria, egypt. J Med Entomol 1996;33(4):566-80.
15. Nuorteva P. Sarcosaprophagous insects as forensic indicators. In: Forensic Medicine, a Study in Trauma and Environmental Hazards, Vol. II: Physical Trauma, Tedeschi CG, Eckert WG and Tedeschi LG, Eds., Saunders, Philadelphia 1977;3:1072-95 Available from: https://ci.nii.ac.jp/naid/10030579665/. Accessed on 25-06-2017.
16. Singh D, Bharti M, Singh T. Forensic entomology in the indian perspective. J Punjab Acad Sci 1999;1:217-20.
17. Introna F, Suman TW and Smialek JE. Sarcosaprophagous fly activity in maryland. J F Sci 1991;36(1):238-43.
18. Turchetto M and Vanin S. Forensic evaluations on the crime case with monospecific necrophagous fly population infected by two parasitoid species. Aggrawal's Internet Journal of Forensic Medicine and Toxicology, 2004;5 (1):12-18.
19. Pien K, Laloup M, Pipeleers-Marichal M, Grootaert P, De Boeck G. Toxicological data and growth characteristics of single post-feeding larvae and puparia of Calliphora vicina (Diptera: Calliphoridae) obtained from a controlled nordiazepam study. Int J Legal Med 2004;118:190-3.

Review Research Paper

Rape is an Injury Caused in Hostile Environment: Suicidal, Homicidal or Accidental

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Abstract:

Rape is an injury. Too much has been discussed and debated about rape in the society, media news rooms, court rooms, seminars, conferences, roads, political speeches, public demonstrations, etc. All these public discussions end with a highly intellectual note with a pseudo sense of fear that it is a ñMind Setò problem. We found it quite amazing and surprising that it is now classified as 'penetration, insertion, manipulation and application' and discussed in these terms among the medical fraternity, police personnel, lawyers and judges; stressing upon the need to have more deterrent laws; worried about what justice shall be delivered. Everybody is shouting and searching for a solution to this problem/injury in the form of law and justice, after the rape has been committed, but nobody is concerned about the cause and manner of rape (injury). Present study is just an attempt to look from the eyes of forensic medicine specialist about the medico-legal aspects of the injury i.e. Rape.

Key Words: Rape, cause & manner of injury, problem, mindset.

Introduction:

Rape[1] is a horrifying crime, but what is the meaning of this horrifying act of rape? For years, researchers have investigated the attacks, the attackers, the survivors, and the personal and institutional ramifications on the victim-survivors.

The causes and reasons for rape are deeply entrenched in our social structure. Researchers have explored some of the motivations and circumstances which lead men to rape. We have learned that men rape out of anger and a need to overpower, dominate, and humiliate the feminine gender. We have also looked at some of the historical attitudes from which today's beliefs and stereotypes have evolved.

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In general, definitions of rape vary from saying that it is a loss of control or power over your sexual urges, to being a total attack against the whole person, affecting the victimôs physical, psychological and social identity.[2] Legal definitions of rape stress the use or threat to use violent force for sex, or sex without consent.[3] Researchers then explain that rape is a depersonalization, a terror, a perverse objectification of sex.[4]

However, we must look beyond both rapist's motivations and history if we are to truly understand the act of rape objectively, and moreover, being in the medical fraternity, we have to assess both the physical and mental aspects of rape and blend it with the circumstances surrounding the act to arrive at a logical conclusion. Thus, shifting from the legal definitions,letôs focus on the issue from the eyes of a medical professional. Rape may be defined as an injury that may be to the body, mind or reputation in a hostile environment.

Discussion:

Rape is an injury caused illegally to body, mind and reputation. The injuries sustained by the alleged rape victim may be

abrasions, bruises, lacerations, defence wounds, fabricated wounds and penetrating wounds.

The ***weapon or object responsible*** for these injuries could be bodyweight as a whole, hands, fingers, nails, lips, tongue, teeth, penis or any other man made mechanical object or weapon used for such purpose.

As regards the ***nature of injuries*** - they could be simple or grievous, depending upon whether they satisfy the provisions of S. 320 IPC or not.

Next, the question arises about the ***manner of causation of injuries*** sustained by the rape victim. Here we would like to introduce the concept of ***Hostile environment*** which could be suicidal, accidental or homicidal - depending upon the circumstances of the case.

What is this **hostile environment?** Hostile environment is an immediate or proximate influence which can render an individual susceptible to relatively benign environment encountered in normal, everyday or common experiences and under these hostile influences the involved parties i.e. the man, an alleged rape accused or the woman, an alleged rape victim, commit an offence or get into act which could be accidental, suicidal or homicidal to them or one can say, as consequence of this act, both parties sustain certain injuries which could be homicidal or accidental or suicidal in nature. As either of these involved parties may come forward and allege or complain that the act of rape was committed or occurred or happened ñby mistakeò (accidentally) or with "mutual consentò (suicidal to them later on) or with an element of intent and revenge (leading to homicide).

To say that the rape was an **accidental** injury, both the alleged victim and accused may claim that the act took place in a hostile environment that is accidental (1). He or she didnôt know how it happened (2). That it was neither non-consensual nor by force (3), that they were under the influence of some drug (4), that they were not willing for it but it happened .

To bring rape under the domain of **suicidal** injury**,** both the alleged victim and accused may insist that (1) both of them knew the consequences of the act but it happened, (2) that it was consensual and no undue use of force was used, (3) that they were willing for it and it happened, (4) it was well intended and premeditated and (5) that they were under the influence of some drug.

Now, to bring the charge of **homicidal** rape injury, plea may be taken that:

1. It was a deliberate action of alleged accused.
2. That he was looking for an opportunity.
3. He meant it.
4. That he was willing for it.
5. That he was under the influence of some intoxicant.
6. His move is predesigned, well intended, motivated.
7. That he completed the act without her consent and against her will by use of force.

Here, the call for forensic medicine expertise may settle the issue of **accidental hostile environment** by making use of his knowledge of forensic psychiatry to evaluate mental demeanour of both the alleged victim and accused, their willingness or non-willingness for the act, intent and premeditation for the act and the circumstances surrounding the act. He will examine the bodies of both involved parties to find out any use of force or injuries, manner of causation of injuries to assess whether they are accidental in nature and degree of intoxication. After a thorough evaluation, he may reach a conclusion that some level of romantic interest existed between the alleged victims and accused who had taken their sexual activity as appropriate that falls somewhere between consent and denial and which have occurred during prearranged social engagement. Thus, accidental rape is a form of acquaintance rape in which there has been some sort of romantic or potentially sexual relationship between the two parties. Acquaintance rape also includes rapes in which the victim and perpetrator have been in a non-romantic, non-sexual relationship, for example as co-workers or neighbours. Accidental rape concept is particularly more prevalent on college campuses, where it frequently occurs in situations involving alcohol or other date rape[5] drugs, or the execution of

drug facilitated sexual assault (DFSA).[6] Thus, this level of romantic interest between the attacker and the victim, and in which sexual activity would have been generally seen as appropriate, is what separates accidental rape from a socially acceptable sexual relationship. It is a rape occurring during a pre-arranged social engagement. Thus, to summarise, Accidental Rape may be defined as "an act of sexual intercourse that falls somewhere between consent and denial."

The role of Forensic expert in such cases will be to carry out the forensic psychiatry evaluation of the alleged assailant and victim, how the incidence occurred, willingness or non-willingness, intent/ premeditation. He will also examine the bodies to detect any intoxication, detect any force / injuries, manner of causation of injuries.

Forensic psychiatric evaluation may be done to settle the issues of suicidal hostile environment, to see whether acting parties were reasonable enough and mentally competent to justify their claim that they were in complete control of the environment, it was a consensual act and that they knew the consequences of the act; ótutô it happened, that were willing for it, took plea of degree of intoxication and was well intended and premeditated. Physical examination and laboratory investigations will settle the issue of any use of force in the form of injuries or no injuries present on the body, their manner of causation - whether suicidal in nature, side by side, ruling out whether any of these injuries could be self inflicted (fabricated) or sustained in self-defence and also the degree of intoxication/inebriation. After thorough evaluation, the expert may justify his rationale of ***suicidal hostile environment*** that both the partners, though in complete control of the circumstances, took ódeliberateô steps by getting ówacutelyô emotional/ took the help of intoxicant (inebriant) which could have more likely lessened their inhibitions, could have made it more comfortable and easier for them to be carried away, knowing fully well the consequences of their act.

This category also consists of situations where one of them is either acting to get favours out of the other. This also covers the domain of false accusations which may be to make money in a civil suit; to even the score if the spouse/ boyfriend/ girlfriend cheats on the other; vent his/ her anger for being rejected in love; to even the score in cases of revenge; and of course there is just mental illness which causes all kinds of erratic behaviour.

Another hostile environment is in the cases of ñstatutory rape,ò[7] where the individual knows that he will be charged with rape even if consensual, because the law deems so; such behaviour can only be called suicidal.

Third scenario which fits into this category is sexual gratifications in lieu of certain favours like promotions etc. that may later turn into rape charges. Fourth scenario which fits in this scenario is of adultery[8] cases in which, for the sake of social respect on being caught, the lady may levy charges of rape against the male partner. Another scenario worth mentioning is indulging in sexual activity with a mentally challenged person which is against the law.[9] Again, another hostile environment could be the yearning to get a better sex partner in cases of pregnancy; long absenteeism; dissatisfaction; need to satisfy one's own physical needs/ desires. All these are potential honey traps.

Among the juvenile partners, other hostile environment/ conditions include provocative dressing, movies acting as guides on how to live oneôs life, television viewing without parental guidance, viewing pornography, experimentation to relieve boredom with drugs and alcohol, bad peer company, lack of moral education either by schools or parents. Here, the role of parents is of foremost importance, as their guidance and vigil is the foundation on which the future of the child lies.

In all the above mentioned scenarios, one thing is common i.e. the person is in full knowledge of the consequences but in disregard to them, in an irrational manner, he builds for himself a hostile environment which ultimately forces him to a rash, negligent act or even further lead to death of the victim.

These are cases where the third type of grouping of cases occur i.e. ñhomicidal". ñHomicidal Rapes,ò which in our opinion, are the classical cases of rapes with extreme degrees of force being used leading to injuries - more often grievous than simple. The

objective of the rapist is to humiliate the victim physically as well as mentally and achieve sexual gratification from it. The sole purpose of this kind of attack in the perpetratorôs mind is the assassination of the victimôs physical and psychological persona or profile. The motivation behind such an attack can be purely vindictive, due to some disease or sometimes to prove oneôs virility in the eyes of likeminded perverts/sociopaths. The victim is left with irreparable harm physical, mental or both.

To prove this irreparability comes the role of Doctors who have a vital role to play in these kind of cases where they have to assess the injuries - their type, manner and causation, the ñweaponò used and the time since injuries. This would be the treating & the medicolegal role of a Doctor for the physical injuries suffered by the victim. The psychological treatment is where doctor/ psychiatrist have a colossal responsibility in not only repairing the damage caused to their psyche by the attack but also making them accept the incident and coming to terms with it..

Homicidal Rapes are often difficult to prove, even in this climate of evolving technology of DNA and ñrape kitsò[10] To be ruled a homicidal rape, the genital area must be examined for signs of tearing, scratching and bruising. The sensitivity of such a case requires the forensic medicine expert to be proficient in examining sexually derived injuries and determining whether rape occurred, or if results are consistent with consensual sexual behaviour. Examinations would include inspection of the genitali, the presence or absence of seminal fluid, venereal disease and/ or pregnancy. The evidence compiled by a medical examination may be able to either confirm or deny the rape.[11]

In these kind of sexual offenses, where there is little more to go on than an accusation, the exhaustive analysis of forensic medicine experts may be the turning point in a criminal case.[12] Due to the brutality of such rapes and the complications that often arise, it is imperative that the findings presented to the court contain the highest level of medical certainty, accuracy, knowledge and skill ensuring that expert investigation of homicidal rape can be held to the highest standards and levels of integrity by the court.

But it is equally true that not "All sex is rape" and neither "All men are rapists".

Also, the hostile environment which leads to ñan environment in which rape is prevalent and in which sexual violence against women is normalized and excused in the media and popular culture perpetuated through the use of sexist language, the objectification of womenôs bodies, and the glamorization of sexual violence, thereby creating a society that disregards womenôs rights and safetyòshould be discouraged.

Analysis and Inference

Thus, to summarise, many women become victims of rape (date rape, sexual harassment, etc). They end up suffering trauma and have depression problems. Many of them end up being traumatised for their whole lives. Being raped is something you would not wish for anybody.

Also, the Hostile Environment which leads to ñan environment in which rape is prevalent and in which sexual violence against women is normalized and excused in the media and popular culture perpetuated through the use of sexist language, the objectification of womenôs bodies, and the glamorization of sexual violence, thereby creating a society that disregards womenôs rights and safety,òshould be discouraged.

The evidence which is established by medical examination will either deny or confirm the allegations.[13] The injuries observed by doctors in case of rape may not inform whether they are consistent with those found or resultant of consensual or non consensual sexual activity and such fact finding lies within the domain of medico-legal specialist, whose services are very often avoided or ignored, though he is well equipped with his knowledge of clinical forensic medicine and forensic psychiatry for checking mental demeanor, consent, willingness, intent and motivation.[14]

Injuries may result from valid consent during orgasm, sadistic sexual response, and pre-coital foreplay, post-coital quarrels resulting from dissatisfaction or other expectations not forthcoming, self inflicted injuries for the purpose of adding fuel to an untrue claim of rape. Allegations of consent

given out of fear may also result in injuries though slight or nonexistent but could be made evident if seen from the eyes of forensic medicine practitioner.

Consent given for sex could be the outcome of fear fraud threat intoxication, mental ability. Mental ability or incompetence/ drug intoxication, testing are subjected to medical evaluation and interpretation.

Consent given out of drug intoxication though self administered could be raised as an excuse/ allegation of rape where in forensic medicine specialist, with his vast knowledge in forensic toxicology would testify whether or not the amount of drug is consistent with a degree of intoxication that would make sex probable or improbable or impossible. The focus of physical examination should be on the amount of force applied/ injuries inflicted, manner of injury causation, if the injuries are self inflicted or fabricated injuries.

The amount of injuries present will depend on the degree of force used which would lead to injuries more of grievous than simple; often leading to the death of the victim. But if the victim does not die due to "penetration, insertion, application, manipulation or touching"' then it is a simple case of ógrievous injury' and should be treated as such without the fuss and hype surrounding an alleged case of rape.

The objective evidence of all these injuries can be found - like in penetration with penis, there may be presence of semen and/ or injuries over the body in general, and genital region, in particular. Similarly, insertion by any object/part of body will lead to characteristic signature injuries. The clause of application, manipulation and touching is not easy to prove medically as no tell tale signs would be present on the body of the victim, although defense injuries may be present and may be an important clue in such cases.

Similar is the issue with duration of injuries which will always be in a range and whether the injuries sustained during the alleged act were inflicted or fabricated or defensive in nature, will always be debatable in the Court of Law.

Conclusion:

Unfortunately, there is no direct cause or pattern behind this heinous crime. Neither can it be predicted nor treated. It can only be prevented through constructive means and spreading awareness in the society rather than creating a misconceived and misinterpreted wall of pseudo thrill and misadventure around it.

To summarize, it is the outcome of hostile environmental influences and not just a mindset problem which results in loss of control over one's sexual urges, which further affects the victimôs physical/ psychological/ social identity, resulting in rape injuries, both physical and mental. It seems as though without a complete effort by society as a whole, the circumstances leading to the creation of these hostile environment leading to injuries (Rape) will continue to occur. However, the society can make a positive start by looking at rape victims as victims and not a party to the crime.

Doctors should look at it as an investigation based purely on medical facts and also from the view of a care provider. Police should have a neutral viewpoint towards a fair investigation, r the media (both print and electronic) should have patience, unbiased attitude and leave the judgment to those who have the jurisdiction based upon simple relevant facts.

As there is no place for õemotionsò in court and the Indian Penal Code; why we had termed these injuries as grievous, has to be clearly defined and this can be done on the basis of the 8th clause of Sec. 320 IPC, if no other clause seems justifiable, as this trauma can certainly be endangering the life of victim or causing severe bodily pains to the victim or having her take prolonged bed rest for more than 20 days.

Here comes the role of a Forensic Medicine Specialist who can objectively assess all the mental and physical needs of a victim and suggest various means to prevent it occurring with someone else and treating the unfortunate victim

Conflict of Interest: None

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References:

1. Available at: https://en.wikipedia.org/wiki/Rape. Accessed on 3rd May2017.

2. Weis K; Borge SS. Victimology and rape - the case of the ligitimate victim. University of California, Berkeley. Issues in Criminology 1973;8(2):71-115.
3. Available at: http://www.prsindia.org/uploads/media/Criminal %20Law, %202013/Criminal%20Law%20(A),% 202013.pdf; Accessed on 3rd May 2017.
4. Wrinkler C. Rape as social murder. Available at: https://www.jstor.org/stable/3032794. Accessed on 3rd May 2017.
5. Susan B. Against our will: men, women, and rape. Pelican Books, 1986.pp:11-13.
6. Available at: https://en.wikipedia.org/wiki/Drugfacilitated_sex ual_assault. Accessed on 3rd May 2017.
7. Available at: https://www.ageofconsent.net/world/india. Accessed on 3rd May 2017.
8. Available at:
9. http://www.supremecourtcases.com/index2.php ?option=com_content&itemid=54&do_pdf=1&id =941. Accessed on 3rd May 2017.
10. Margaret C , Tallant Brian "Trauma treatment with clients who have dual diagnosis: Developmental disabilities and mental illness ". Available at: Developmental Disabilities and Mental Illness-CiteSeerXPDF; citeseerx.ist.psu.edu. Accessed on 3rd May 2017.
11. Available at: https://www.rainn.org/articles/rape-kit. Accessed on 3rd May 2017.
12. Harish D, Kumar A, Singh A. The ministry of health & family welfare guidelines regarding consent & examination of a female survivor of sexual offences ï an overview. Available at: http://medind.nic.in/jbc/t15/i1/jbct15i1p50.pdf. Accessed on 3rd May 2017.
13. Russel S. Fisher RS, Petty CS. Forensic pathology: a handbook for pathologists. The Forensic Pathology Committee, College of American Pathologists. 1977: 92-100
14. Wetli CV, Mittleman RE, Rao VJ. practical forensic pathology,1988: 81-86
15. Wecht Cyril H., Collom Wellon D. ; Legal Medicine Annual ;Appleton-Century-Crofts, Educational Division, Meredith Corporation, New York; Medical Evidence in Alleged Rape; 1969:269-286

Case Report

T-Acute Lymphoblastic Leukemia/Lymphoma, an Unexpected Cause of Sudden Death

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Abstract:

Sudden unexpected death due to undiagnosed hematological malignancy is a rare cause of death with only few case reports available in the literature. We report a case of sudden death of a 16 year old asymptomatic boy with no significant past medical history. Suspecting foul play, and death due to blunt trauma, autopsy was carried out which lead to the diagnosis of T-acute lymphoblastic leukemia/lymphoma. The cause of death was attributed to intracerebral hemorrhage.

This case highlights the importance of considering hematological malignancies in the differential diagnosis in cases of sudden death with evidence of unexplained hemorrhagic diathesis and emphasizes on the value of routinely collecting peripheral blood/bone marrow samples in EDTA during an autopsy to enable accurate diagnosis.

Key Words: Sudden Death, Healthy Child, Undiagnosed Acute Leukemia, Hematological Malignancy.

Introduction:

Undiagnosed hematological malignancies (HM) are rare but important causes of sudden death in the pediatric age group.[1-3] Patients often present with minimal signs and symptoms, which do not trigger any suspicion of the underlying cause. Recognition of these signs by a forensic pathologist is vital for preliminary diagnosis and adequate specimen collection.

Case Report:

A 16 year old asymptomatic boy, with no significant past history, was found unconscious in the morning by his parents with froth mixed with blood oozing out from his nose. He was immediately rushed to the hospital, however was pronounced brought dead on arrival. Two contusions, each measuring approximately 4 x 3 cm in size, were noted on left temple and right eye, respectively. Suspecting foul play and death due to blunt trauma, autopsy was ordered by the investigating officer and carried out by a resident in the Forensic Medicine department of the institute.

At autopsy, it was found that body was of average built and height, measuring 163cms. On internal examination, no effusion was present in the layers of scalp. Skull was intact. On cutting open, brain measured 1226grams (g) and on cut section, revealed numerous foci of hemorrhages ranging up to 2.5cm in diameter, involving cerebral hemispheres and cerebellum. Both the right and left lungs were grossly edematous and congested, with froth mixed with fluid exuding on compression; and weighed 438g and 394g, respectively. Heart weighed 256g and was grossly unremarkable. Liver and spleen were mildly enlarged and congested and weighed 1934g and 483g, respectively. Both right and left kidneys were grossly swollen and congested with indistinct cortico-medullary junction and weighed 150g and 105g, respectively. Small and large intestine grossly appeared unremarkable with presence of fecal matter in the lumen. Multiple matted mesentric lymphnodes (LN) were noted. Representative tissue pieces from brain, lung, liver, spleen, kidney, LN and intestine were sent for

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pathological examination however no samples from peripheral blood (PB) or bone marrow (BM) were taken.

Sections from brain on microscopic examination revealed large areas of intracerebral hemorrhage (ICH), with prominent infiltration of meninges by small to medium sized blasts, superficially invading the brain parenchyma and causing prominent distension of blood vessels and necrosis (**Figure 1a**). Leukemic infiltrates and leukostasis were also noted in the glomerular capillaries and interstitium of kidneys, causing acute tubular necrosis (**Figure 1b**) and mucosa & submucosa of small intestine causing ischemic necrosis (**Figure 1c**). Sinusoids of liver were also infiltrated by these atypical cells (**Figure 2a**). Diffuse effacement of architecture of LN with perinodal involvement (**Figure 2b**), lung and spleen was observed with infiltration by these atypical cells. Immunohistochemistry (IHC) confirmed the diagnosis of T ï acute lymphoblastic leukemia/Lymphoma (T-ALL) with atypical cells positive for CD3 (**Figure 2c**) and negative for CD20, anti-myeloperoxidase (MPO), CD117 and CD10.

Figure 1 a: Infiltration of meninges by small to medium sized blasts along with distension of blood vessels. Inset showing extensive necrosis of brain parenchyma along with atypical cells (arrow) (H&E, 100X).

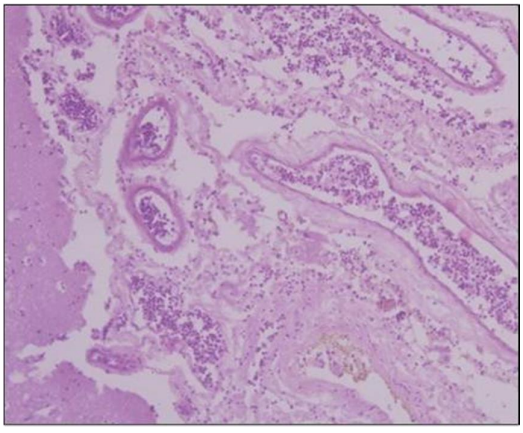


Figure 1 b: Section from kidney showing evidence of acute tubular necrosis (arrow) (H&E, 400X).

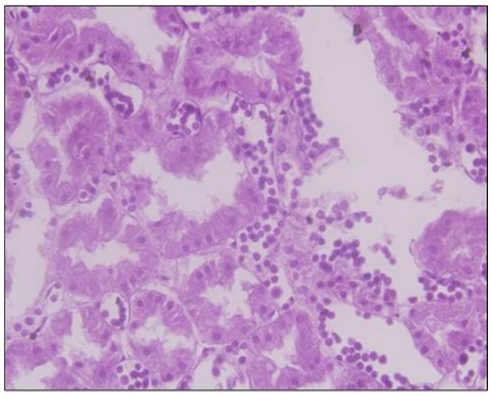


Figure 1c: Leukemic infiltrates causing leukostasis in vessels of submucosa (arrow) of small intestine causing ischemic necrosis (H&E, 200X).

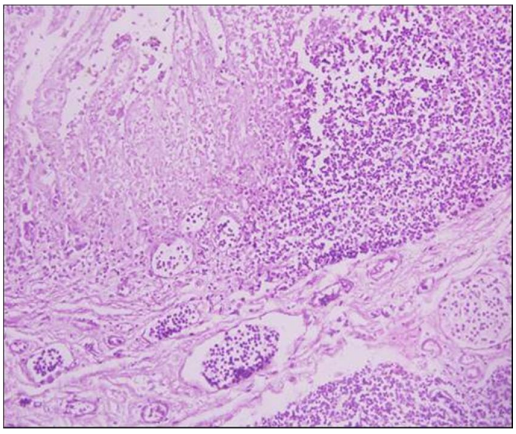


Figure 2a: Section from liver showing leukemic infiltrate in the sinusoids (H&E, 400X).

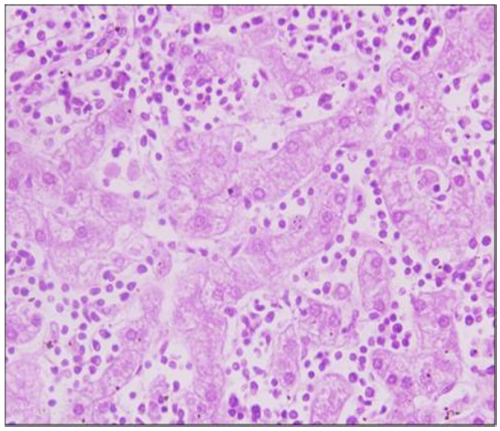


Figure 2b: Sections from lymph node shows diffuse effacement of its architecture with presence of atypical cells along with extranodal extension (inset) (H&E, 100X).

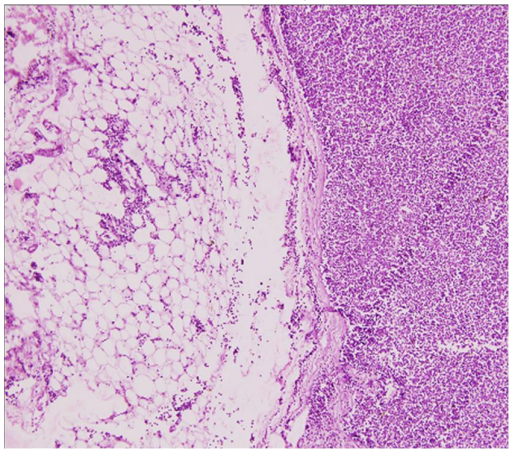
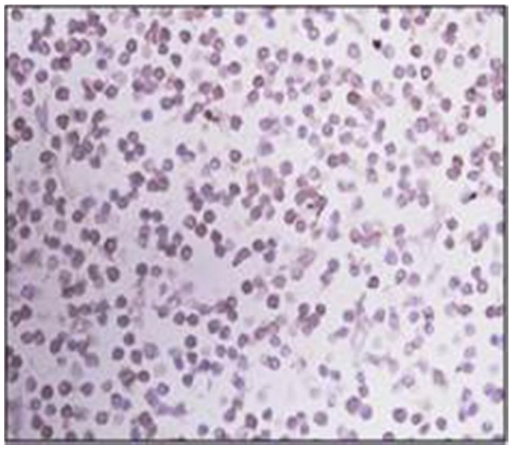


Figure 2c: Tumor cells show membranous positivity with CD 3 (Avidin Biotin, 400X).



However, due to non-availability of PB and BM sample, their evaluation could not be done. Cause of death was attributed to ICH and necrosis due to T-ALL.

Discussion:

Autopsy received with a history of sudden death in any age group warrants probing various likely causes of death; infections being the most common of them. Patients usually present with fever of variable duration before death and collection of body fluids (cerebrospinal fluid and blood) and respiratory samples for cultures in these circumstances should be performed on initiation of autopsy to identify a possible infectious etiology.[4] In the present case, the patient was afebrile, hence infectious etiology was not suspected and therefore these samples were not taken.

Developmental/genetic anomalies are also associated with sudden death however these cases usually present in infancy or early childhood. The present case was a teenager and therefore this was an unlikely possibility.

Vascular malformations and primary brain tumors often lead to ICH, leading to sudden death.[5] Occasional case reports of sudden death due to various other neoplastic causes like Wilmôs tumor,[6] medulloblastoma,[3] paraganglioma,[7] hemangioendothelioma,[8] adenocarcinoma,[9] etc, have been reported in the literature. Though ICH/multi visceral hemorrhage was noted in the present case, there was no mass lesion noted anywhere in the body and therefore this possibility was also ruled out.

Rarely, undiagnosed HM can cause sudden death in the pediatric age group and should be considered even in the absence of mass forming lesion.[4] The child often presents with subtle signs and symptoms; like contusions and nasal bleed, in the present case. Leukemic cells are known to upregulate the expression of adhesion molecules and secretes proteins causing endothelial defects and thrombi formation in multiple organs.[4] The parenchymal hemorrhage often results from vascular rupture by thrombi or associated ischaemic necrosis in affected areas.[10] Therefore, presence of multi visceral involvement on autopsy should trigger suspicion of a possible hematological cause and a PB and BM sample must be taken in such cases for examination and meticulous search for atypical cells in various organs should be done on microscopy.

T ï ALL constitutes 15% of ALL in childhood and often presents with mediastinal mass;[11] our patient had no mass forming lesion anywhere. Though cases of ALL (unspecified) and acute myeloid leukemia (AML) causing sudden death have been occasionally reported in the literature; T-ALL causing sudden death is extremely rare, and to the best of our knowledge, this is only the third case being reported in the literature.[4,12]

Although leukostasis-related complications with involvement of lungs and

brain are commonly seen with AML, T-ALL cases can only show such a feature in presence of hyperleukocytosis.[4] Though in the present case, PB and BM examination was not done due to non-availability; the presence of multi-organ involvement with ICH indicate a good possibility that peripheral smear would have shown hyperleukocytosis. Release of tissue factor from involved liver and tumor lysis syndrome due to high breakdown of rapidly proliferating tumor cells are complications in these scenarios and could also have contributed to the death of the patient.[11]

Conclusion:

The present case highlights the fact that children can often present with no or minimal signs/symptoms even in the presence of significant disease. Adequate awareness amongst Forensic pathologist is must for correct identification of these signs/symptoms. Unexplained haemorrhagic diasthesis in any form, must be looked with high index of suspicion and a possible hematological cause should be considered when it is present with multi visceral involvement.Autopsy in such cases must include PB and BM samples. A diligent search for atypical cells on microscopy should be done in such cases.

Conflict of Interest: None
Funding: Nil

References:

1. Taggart MW, Craver R. Causes of death, determined by autopsy, in previously health (or near-healthy) children presenting to a children's hospital. Arch Pathol Lab Med 2006;130:1780-5.
2. Krous HF, Chadwick AE, Isaacs H Jr. Tumors associated with sudden infant and childhood death. Pediatr Dev Pathol 2005;8:20-25.
3. Somers GR, Smith CR, Perrin DG, Wilson GJ, Taylor GP. Sudden unexpected death in infancy and childhood due to undiagnosed neoplasia: an autopsy study. Am J Forensic Med Pathol 2006;27:64-9.
4. Maggie M. Stoecker, Endi Wang, Samuel Simmons. Sudden death due to undiagnosed t lymphoblastic leukemia/lymphoma in a 5-year-old boy. Am J Forensic Med Pathol 2012;33: 314-6.
5. Byard RW, Bourne AJ, Hanieh A. Sudden and unexpected death due to hemorrhage from occult central nervous system lesions. A pediatric autopsy study. Pediatr Neurosurg 1991;17:88-94.
6. Zakowski MF, Edwards RH, McDonough ET. Wilms'tumor presenting as sudden death due to tumor embolism. Arch Pathol Lab Med 1990;114:605-8.
7. Hutchins KD, Dickson D, Hameed M, Natarajan GA. Sudden death in a child dueto an intrathoracic paraganglioma. Am J Forensic Med Pathol 1999;20:338-42
8. Lunetta P, Karikoski R, Penttilä A, Sajantila A. Sudden death associated witha multifocal type II hemangioendothelioma of the liver in a 3-month-oldinfant. Am J Forensic Med Pathol 2004;25:56-9.
9. Schwartz MG, Sgaglione NA. Gastric carcinoma in the young: overview of the literature. Mt Sinai J Med 1984;51:720-23. Available from: https://www.ncbi.nlm.nih.gov/pubmed/6335567?dopt=Abstract. Accessed on 14th January 2017.
10. Muslimani A, Chisti MM, Wills S. How we treat tumor lysis syndrome. Oncology (Williston Park). 2011;25:369-75. Available from: https://www.ncbi.nlm.nih.gov/pubmed/21618960. Accessed on 14th January 2017.
11. Borowitz MJ, Chan JKC. T lymphoblastic leukemia/lymphoma. In: Swerdlow SH, Campo E, Harris NL, et al, eds. WHO Classification of tumours of haematopoietic and lymphoid tissues. 4th ERd. Geneva, Switzerland: IARC Press; 2008:176-8.
12. Taggart MW, Craver R. Causes of death, determined by autopsy, inpreviously health (or near-healthy) children presenting to a children's hospital. Arch Pathol Lab Med 2006;130:1780-5.

Case Report

Langerhans Cell Histiocytosis: A Rare Differential Diagnosis for Child Abuse – A Case Report With A Forensic Standpoint

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Abstract:

There are various forms of child abuse - physical, sexual, psychological and starvation. The physical form being more common, presents with clinical findings such as bruises, multiple fractures of varying ages, subdural haemorrhages, retinal haemorrhages, abdominal injuries etc. Some naturally occurring diseases also have external features similar to those mentioned above. We present a case of a 13yr old male child, who was admitted with a head injury after an alleged history of fall in his school. Bruises of varying ages were present all over the body along with signs of abdominal injury, following which, a suspicion of child abuse was made. The blood coagulation profile was well within normal limits. However, following the death of the child, the autopsy findings, together with the previous medical history of the child, established it to be a known case of Langerhans cell histiocytosis. The present case report stresses on establishing a case of child abuse with utmost precision and expertise and also the need to exclude all the possible non-traumatic etiologies which mimic child abuse.

Key Words: Child Abuse; Bruises; Langerhans Cell Histiocytosis; Natural Disease; Misdiagnosis.

Introduction:

Abuse or mistreatment forms a very important medico-legal issue pertaining to children and adolescents. Among the various forms of child abuse, the physical form accounts for the maximum number of cases with clinical findings varying from superficial bruises to internal hemorrhage in various tissues. Child abuse has always been a mind-boggling issue among the physicians because of the similarity of its features with many natural diseases.[1-3] A case of physical abuse is usually diagnosed on the basis of injuries viz., bruises, fractures, burns etc.

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Among the various mechanical injuries, the multi-colored bruises are often the indicator of chronic physical violence and are easily noticeable. But, on the contrary, bruise-like lesions may occur in several clinical diseases. There are various conditions viz. skeletal disorders, cutaneous anomalies and certain cultural practices which can mimic child abuse.[4,5] A case report in the literature also points towards the role of thrombocytopenia in the causation of unilateral subdural hemorrhage. Therefore, it is the duty of the medical experts (paediatricians and forensic specialists), the investigating team and the child welfare organisation, to carefully rule out the non-traumatic causes before concluding a case of child abuse.

One such rare natural disease is the Langerhans cell histiocytosis (LCH), where there is an uncontrolled monoclonal proliferation of Langerhans cells, a distinctive cell of monocyte-macrophage lineage.[6,7] The disease mostly affects the paediatric population with an incidence of approximately 5 per million.[8,9] Males are more commonly affected than the females.[10] The common clinical features of this disease include painful

bone swelling, scaly erythematous lesions to red papules, lymphadenopathy, lung nodules, hepatomegaly, splenomegaly and pancytopenia.[11-15]

In this article, we discuss a case of a child with LCH who suffered an accidental traumatic injury and surprisingly presented with injuries of varying ages on the body. Initially, there arose a suspicion of child abuse but based on, past medical history and a thorough investigation, child maltreatment was ruled out.

Case Report

Clinical history:

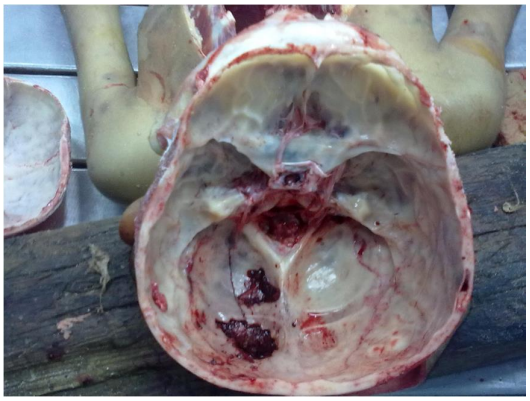
A 13-year-old male child was brought for autopsy by the investigating officer with a history of fall at school. At the time of admission to the hospital, he was diagnosed with head injury, along with abdominal injuries. Several multi-colored bruises were also documented on the body of the child. Ultrasonography of the abdomen revealed pelvic hematoma and peri-splenic fluid collection. A radiological diagnosis of an acute extradural hematoma in the left posterior cranial fossa was made at the time of admission of the patient. The neurosurgeon had performed a craniotomy to remove the extradural hematoma. The fundal examination was normal. The blood coagulation profile was within normal limits. The child succumbed to his injuries on the 5th postoperative day. The presence of multi-colored bruises, head injury and abdominal injuries aroused suspicion of child abuse and hence was made a medico-legal case and the body was sent for postmortem examination. The parents agreed to donate the organs of their brain-dead child and both the cornea and bilateral kidneys were harvested legally.

Autopsy findings

At autopsy, multiple irregular bruises, some discrete and others confluent, of different time periods, were noted on the head, the front of chest, the front of the abdomen and all the limbs (**Figure I**). An operated wound was present over occipital region of the scalp, which on exploration, revealed two small craniotomy defects, along with a fissured fracture of the occipital bone. (**Figure II**) The superior wound was a horizontally placed teardrop shaped craniotomy defect observed in the left cerebral fossa just superior to the groove of transverse sinus, the tip being pointed laterally. Another small irregular craniotomy wound was noticed just inferior to the groove of the left transverse sinus. A linear fracture line of the inner table was seen radiating forwards and downwards from the lower margin of the former craniotomy defect. A thin layer of extradural haematoma was noticeable at the craniotomy site, which was further visualized clearly following the removal of the skull vault. On reflection of the dura, the brain was edematous, with the inferior surface of the cerebellum contused and lacerated. On sectioning the brain stem, pontine hemorrhage was documented.

Figure I : Multiple bruises of varying ages over the chest and upper limbs.

Figure II: Craniotomy defects in the left posterior cranial fossa observed after opening of skull cap

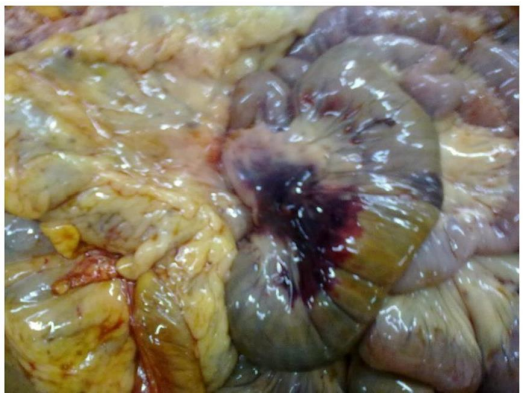


Multiple petechiae were observed over the visceral surface of all the lobes of both the lungs with hemorrhagic consolidation in the lower lobes. The right ventricle of the heart showed hemorrhagic spots at the tip of

papillary muscles (**Figure III**). Extravasation of blood was noted in the mesentery and greater omentum (**Figure IV**). Both the kidneys had been harvested. The pattern of injuries noted lead to a suspicion of repeated physical maltreatment. But on the contrary, the child had a past history of Langerhans cell histiocytosis and had undergone chemotherapy and surgery for LCH and cryptorchidism respectively. Following a thorough scene investigation by the police officials, any foul play was ruled out. The cause of death, in this case, was given as cranio cerebral damage consequent to blunt trauma to head in a known case of LCH.

Figure III:Tip of the papillary muscle of the right ventricle showing hemorrhagic spots

Figure IV: Mesentery showing hemorrhagic areas



Discussion

The present case shows that the diagnosis of child abuse is very cumbersome and requires meticulous verification of facts and circumstances. With the blood coagulation profile being normal, and no traumatic abuse history forthcoming, the bruises of multiple ages could have been due to the manifestation of the disease per se, with some contribution from the resuscitation procedures. Since there was no discontinuity in the outer table of the occipital bone, it could be safely presumed that the inner table fracture discovered at autopsy could not have been detected even at the time of surgery. Also, no damage/ defect in the dura mater underneath the EDH site was detected, which would have otherwise lead the extradural haemorrhage to seep into the subdural space. The EDH could have been due to the rupture of small meningeal branches of the vertebral artery. Though the fracture was not diagnosed clinically or radiologically, may be because of its location, the damage to the cerebellar lobes corresponded to the fracture site. The skull fracture and EDH were the results of blunt trauma to head consequent to a fall.

In the absence of any coagulation disorder, the different coloured bruises which were seen on the body of the deceased could have been due to the manifestation of LCH per se. Though the cause of death was attributed to the head injury, the coincidental presentation of multicolored bruises over the body, non-submission of past medical records as well as the details of the current incidence at the time of admission made the clinician suspicious and hence tagging the case as medico-legal.

The incidence of witnessed fall occurring in the school and the circumstantial evidence collected by the investigation officer later, ruled out any foul play. This was supplemented by the review of the previous medical history of the child being treated for LCH and thus justifying the absence of histopathological examination in this case.

LCH continues to perplex a majority of the physicians because of its relatively low incidence.[8-10] It becomes an obligatory responsibility of the medical team to remain alert to the occurrence of the disease to lessen the period of pre-management as well as to minimise the sufferings of the caretakers and the patient due to the wrong diagnosis of child abuse.

Before concluding a case of child abuse, all the necessary information from the parents, investigative agencies or any related persons must be taken into account. From the

medical perspective, major coagulation disorder along with other natural diseases which mimic child abuse should be excluded, preceding a diagnosis of the later.[11] In the present case, the bleeding disorders had been ruled out. Thus an integrated, broad-spectrum technique in the assessment of injuries is very much crucial when multiple injuries of different ages are suspected.

Conclusion

LCH is a relatively rare disease which may present with non-traumatic multi-aged bruises, leading to suspicion of child abuse. Due to the lack of database and recognized guidelines in inferring the bruising patterns in suspected child abuse the, administration of justice may be hampered. Thus, the authors suggest for the development of the same, and in turn helping the innocent and the accused get their consequent dues from the society.

To conclude, the members of the medical society play a pivotal role in the documentation of abuse and are accountable for providing the proof of abuse to authorities concerned with child welfare to decide upon the further course of action in the best interest of the child. A misdiagnosed case of child abuse leads to unnecessary sufferings to the parents or the care taker. Thus, superfluous effort must be ensured for the proper administration of justice and the welfare of the child.

References:

1. Brill PW, Winchester P, Kleinman PK. Differential diagnosis. I. Diseases simulating abuse. In Diagnostic imaging of child abuse, 2nd Ed. Eds Kleinman PK. St. Louis: Mosby Yearbook; 1998:178-96.
2. Boos SC: Conditions that mimic child abuse. In Child abuse and neglect: guidelines for identification, assessment, and case management. Eds Peterson MS, Durfee M, Coulter K. Volcano, CA: Volcano Press; 2003:65-8.
3. Keller K, Barnes P: Rickets vs. abuse: a national and international epidemic. Pediatr Radiol 2008,38:1210-6.
4. Laposata ME, Laposata M. Children with signs of abuse: when is it not child abuse? Am J Clin Pathol 2005;123(Suppl 1):S119-S124.
5. Ravanfar P, Dinulos JG. Cultural practices affecting the skin of children. Curr Opin Pediatr. 2010;22(4):423ï 31.
6. Bansal YS, Mandal SP, Murali G. Non-traumatic unilateral subdural hemorrhage in a case of thrombocytopenia. J Punjab Acad Forensic Med Toxicol 2009;(9)114-6.
7. Gatter K, Delsol G, Warnke R. The Diagnosis of lymphoproliferative diseases. New Jersey Wiley-Blackwell. 2011.p. 261-264.
8. Dahnert W. Radiology review manual. Philadelpia, 8th ed. PA: Lippincott Williams & Wilkins; 2017.p.1684-1686.
9. Hann IM, Smith OP. Pediatric hematology.3rd ed. NewYork,NY:Wiley-Blackwell;2006.p.343-351.
10. Allen CE, Ladisch S, McClain KL. How i treat langerhans cell histiocytosis. Blood. 2015;126(1):26-35.
11. Sibert J .Bruising, coagulation disorder, and physical child abuse. Blood Coagul Fibrinolysis. 2004 May;15 Suppl 1: S33-9.
12. Cunningham MJ, Curtin HD, Jaffe R, Stool SE. Otologic manifestations of Langerhans' cell histiocytosis. Arch Otolaryngol Head Neck Surg. 1989;115(7):807-813.Available from: https://jamanetwork.com/journals/jamaotolaryngology/article-abstract/617805?redirect=true
13. Callebaut W, Demedts M, Verleden G.Pulmonary Langerhans' cell granulomatosis (histiocytosis X): clinical analysis of 8 cases. Acta Clin Belg. 1998;53(5):337-43.
14. Kluge G, Sorge I, Bierbach U, Hirsch W.Scapula as an uncommon site of Langerhans cell histiocytosis in an infant. Pediatr Int. 2010;52(1):142-4.
15. Battistella M, Fraitag S, Teillac DH, Brousse N, de Prost Y, Bodemer C. Neonatal and early infantile cutaneous langerhans cell histiocytosis: comparison of self-regressive and non-self-regressive forms .Arch Dermatol. 2010;146(2):149-56.

Case Report

Dead Man Returns From Funeral Pyre: Conflagrated Remains Speak Out Murder - A Case Report

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Abstract:

Murder, though it has no tongue, will speak with the most miraculous organ. Disposal of dead bodies, for the purpose of destroying evidence of crime, has been an age old practice. Time and again, killers have come up with innovative ideas to evade conviction. The present case is of a man, slaughtered by his own kin and rushed to the cremation grounds. Following an anonymous tip, the police found the dead body burning on a pyre, salvaged what was left and then a careful and through post-mortem examination ascertained the corpus delecti. Barely any finding could be made out on the body but for that one homicidal injury which sealed the fate of the criminals.

Key Words: Charred body, Homicide, cut-throat, Corpus delecti

Introduction:

For a crime to be definitely established, the dead body has to be recovered in order to set the corpus delecti. The corpus delecti is the essence of crime, the fact of a criminal offence and includes the body of the victim.[1] Keeping this forethought in mind, a near perfect murder would be one wherein the perpetrator commits the crime and gets away with it for the want of recovery of the dead body and no positive evidence of such crime ever been committed. Difficulties arise when such evidences are destroyed or the body of offense concealed.[2]

Nowadays, with the increased accessibility to melodramatic crime-based soaps and serials and criminal violence presented to the general TV viewers along with the social media and online accessibility to intricate details of committing such crimes, the culprit goes to lengths to ensure the apt disposal of the dead and clean up their tracks. Consequently, newer methods are used by criminals for not only disposal of dead body, but also identity of the deceased. However, cremation is a technique as old as humanity itself.[3] Forensic anthropologists have increasingly been called upon to investigate human remains that were burned as a part of legitimate and legal cremation process as well as illegal use of a crematory.[4] The authors in the present case highlight the suspicious circumstances of disposal of a dead body and the trail of evidence that led to conviction of the accused.

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Case History

The case is of a charred body ñrescuedò by the police from a burning funeral pyre as shown in **Photo 1**. The police had received an anonymous tip that a resident of village from an adjoining district was killed in a family scuffle and was hurried to the cremation ground for funeral and disposal. The recovered dead body was extensively charred. The body was first sent to the Government General Hospital from where it was referred to our facility for expert autopsy and opinion.

The body was received as charred remains of torso of a male individual (**Photo 2**). It was emitting characteristic roasted meat like smell. The remains comprised of a charred torso with burnt and exposed scapulae, both

Photo 1: Funeral pyre at the scene of crime

Photo 2: Cremains brought for Post mortem examination

clavicles and the pelvic girdle. The anterior abdominal wall was missing and the thoraco-abdominal viscera were lying exposed, burnt, cooked up and commingled and could be identified individually with difficulty. (**Photo 3**) Complete vertebral column with all the vertebrae were intact. The laryngo-tracheal structures were burnt and charred with upper one third of the same missing. (**Photo 4**) The hyoid bone was intact. The right clavicle was intact and hence was salvaged for DNA profiling. Available muscles over the upper aspect of anterior and posterior chest wall were cooked up and showed irregular heat ruptures. The right and left lungs, along with heart, were shrunken into a blackish cooked up mass. The stump of penis along with prostate were cooked up, but identifiable. Rest of the body parts were missing. A partially burnt piece of cloth was recovered from the right axillary fold having a peculiar petroleum like odour**.**

Despite the described extensive charred condition of the dead body it was possible to identify an incised wound of size 11 x 1 cm, with clean cut margins, present over the right side of neck, situated 1.5 cm lateral to midline, just below and lateral to the spinous

Photo 3: Cooked up abdominal viscera

Photo 4: Charring of skin over anterior aspect of neck along with a gaping cut throat wound exposing the underlying thyroid and tracheal cartilages

process of 7th cervical vertebra, with faint ecchymosis present in the deeper tissues, as shown in **Photo 5**. The underlying muscles and vessels were clean cut.

Photo 5: Trachea showing a gaping cut-throat wound

The body of T1 vertebra showed an oblique sharp cut of size 2 x 0.5 cm over its right lateral aspect with infiltration of blood in its bony trabeculae. The cause of death in this

case was opined as cut-throat injury which was homicidal in manner with the burns and charring being post-mortem in nature.

Discussion and Conclusion

In the presented case, the man under influence of alcohol, attempted to intimidate family members with a meat cleaver to extort money. During the brawl, the murder weapon was snatched from him and used on the assailant himself. The hot blooded homicide was swiftly attempted to be concealed and the dead body was hastened to the cremation area for the last rites. As later investigated by the police, the body was burnt using petrol, taken out from nearby motorcycles. That could have been all the last rites the departed soul would have received but for the swift action of police and a thorough forensic investigation, justice was delivered.

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Conflict of Interest: None.

References:

1. Reddy KSN, Murty OP. The essentials of forensic medicine and toxicology. New Delhi, Jaypee publishers, New Delhi 33rd Ed. 2014:55
2. Sheikh MI. Investigation of concealed homicide and establishment of positive identification. J Clin Pathol Forensic Med.2011; 2(1):38-40
3. Wells TS. Remarks on Cremation or Burial? Br Med J 1880: 461-463. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2241250/pdf/brmedj04900-0001.pdf. Accessed on: 2nd January 2018
4. Brickley M, Ferllini R. Forensic anthropology: Case studies from Europe. Charles C Thomas publishers Ltd, Springfield, Illinois 2007:69

Case Report

Fatal Case of Vitriolage by an Unusual Agent: Formic Acid

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Abstract:

Vitriolage or acid attack is not an uncommon crime in various states of India. The victims are usually hapless females and youngsters. Usually, mineral acids like sulphuric acid or nitric acid are being used to commit this heinous crime. This case report intends to bring to light a newer entity, formic acid (an organic corrosive acid) that was used as a vitriolage agent, which resulted in death of the individual.

Key Words: Formic acid, Vitriolage, Homicide, Suicide

Background:

Vitriolage is defined as an act of throwing a corrosive on to the body of a person with the intention of injuring or disfiguring her/him out of jealousy or revenge resulting in burning and dissolution of the victimøs skin, connective tissue and even bones.[1] The motive behind such a ghastly act could be turning down of love or marriage proposal, jealousy, resistance of sexual advances, dowry disputes or even personal enmity, but rarely would result in death of the victim. The gravity of the crime also increases, taking into account the fact that many a times, such acts occur in broad daylight and in public places whereby other innocent onlookers can also sustain corrosive burns.

Sulphuric acid, which is otherwise called as oil of vitriol, is commonly used for this purpose, hence the name vitriolage was derived and this dates back to the industrial unrest of Glasgow in 1820øs.[2] The immediate consequences of acid attack include permanent loss of vision, permanent disfiguring of face along with long term psychological, social and economic repercussions. Hence it comes under the ambit of grievous hurt and is dealt with serious punishments, especially under the Criminal Law Amendment Act, 2013. [3]

Corrosive substances erode and destroy any surface they come in contact with. The mechanism of action of corrosives or caustic substances is a) extraction of water from tissue b) coagulation of tissue proteins and c) conversion of haemoglobin to hematin. Commonly used agents for vitriolage are strong mineral acids - namely sulphuric acid (used in automobile batteries), nitric acid and phenol. [4]

Formic acid, a saturated monocarboxylic acid was discovered in the seventeenth century by Sheffield. Formic acid (HCOOH) is a strong corrosive acid and produces extensive tissue burns with coagulative necrosis. [4]

Formic acid is used as an inexpensive acidifying agent in textile and rubber industries. In the form of dilute solution (85%), it is used in rubber industry as a coagulant of latex.[5] It is also used in agriculture industry as hay preservative.[6, 7] It is used in tanning and dyeing of leather and in certain textile dyeing process.[8] Estimated fatal dose of formic acid is 30 mg or 30 ml, when consumed orally. Exposure limit is 5 ppm. Corrosive effect occurs by 2 gm.[9] The elimination half life of formic acid is about 2.5 hrs.[1]

Most victims of deliberate self harm or accidental consumption of formic acid suffer from corrosive burns to the gastrointestinal tract and the severity depends upon the quantity and strength of acid consumed. It ranges from superficial ulceration, hemorrhage to perforation. Atleast some of them would sustain corrosive skin burns which would

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require skin grafting if the victim survives. In case of vitriolage with formic acid, there is discolouration and staining of skin and clothing along with trickle marks as in any other case of acid attacks. Sometimes, wide area of skin may be involved, showing evidence of splashing, spilling or pouring of acid. Brownish black scab formation occurs later. Such burns usually heal with scar formation, which can mar the beauty of face or cause contracture with limitation of movement of a joint.

Death in formic acid poisoning occurs due to shock. Other causes of death are oesophagitis, mediastinitis, gastritis, perforation of stomach and asphyxia following oedema of glottis.[10] Death occurs rarely in cases of acid attack and may be the result of shock, toxaemia or infection, especially if extensive areas are involved.

Case Report

On 14th December 2015, a 29 year old female was brought to a local hospital following alleged history of burns and was declared dead on arrival. The same night, her neighbour was found dead in his house, hanging from roof ceiling. On police investigation, it was revealed that the neighbour, out of personal grudge with the lady, had poured some corrosive onto her while she was taking a shower. The male culprit, when confronted by the locals, committed suicide in his house.

Autopsy findings

An adult female of length 163 cm, showing corrosion of face, including eyes and all external body orifices. Scalp also showed corrosion and scalp hair was moist, having a pungent smell. Rigor mortis was fully established all over the body. Postmortem staining at back was fixed. There was no sign of decomposition.

Epidermal to dermo - epidermal chemical burns were present on whole of face, forehead, whole of neck, front and back of trunk (sparing some areas), both buttocks and all four limbs (sparing small areas). Some of these burns showed brownish black discoloration, thickened base and charring. There were also multiple linear vertical areas of erythema on front of trunk and base. (**Figs 1, 2 & 3**) These were suggestive of corrosive trickle. (**Fig1**) Approximate body surface area affected by burns was 55%.

Figure 1: Corrosive trickles on front of trunk

Figure 2: Corrosive burns on face and torso

Figure3: Corrosive burns on back of body

Stomach was half filled with soft rice and vegetable pieces, having no unusual smell. Mucosa was eroded and congested. Peritoneal cavity contained 50 ml of reddish fluid. Urinary bladder was empty. All other internal organs were congested, otherwise they appeared normal. Samples of blood, viscera, skin and scalp hair were preserved and sent for chemical analysis. Skin sample from burn site was also sent for histopathological examination.

Opinion as to cause of death was given as death was due to chemical burns. Final opinion was reserved pending lab investigation results.

Discussion

Formic acid or methanoic acid is a commercially available strong organic acid and is being widely used in rubber plantations throughout Kerala. On skin contact, it produces severe pain and brownish skin discolouration. Full thickness burns result, having sharply defined edges, which usually heal slowly with scar formation. Inflammation,

blistering and ulceration result from contact of this acid with the skin. On contact with eye, it causes conjunctival oedema and corneal ulceration. Corneal damage almost always results in blindness.[11]

In this case, formic acid was detected in scalp hair sample and not in the other samples (skin, blood or viscera). Skin sample showed second degree burns. Final opinion was given as death was due to formic acid burns.Formic acid does not have any peculiar feature like xanthoprotic reaction of nitric acid, which helps in identifying the corrosive agent. It was not detected from viscera and blood samples, which also proves absence of systemic poisoning. The fact that formic acid was not detected from the skin sample could be explained by the fact that formic acid is easily biodegradable. Manner of death in this case was homicidal, which was supported by the history. Mechanism of death in this case could be the neurogenic shock triggered by the severe and intense pain following burns to the dangerous areas like face and neck.

Conclusion

Vitriolage still remains a rarity in Kerala, though it is not an uncommon occurrence in other parts of India. That may be the reason why formic acid poisoning, though reported widely as suicidal or even accidental cases, has not been reported as homicidal and that too as an agent for vitriolage. Still rarer is a case of formic acid vitriolage leading to sudden death of the victim. One patient, reported from France died after formic acid and hydrofluoric acid burns.[12] Sujathan studied twenty four fatal cases of formic acid poisoning which came for medico-legal autopsy. Twenty one cases were suicidal and the rest three were accidental.[13]

The mechanism of sudden death in formic acid vitriolage is no different from any other strong corrosive agent. The cutaneous burns occurring in such cases, on histopathological examination reveal either a coagulative necrosis which is characteristic of an acid burn or a liquefactive necrosis which is characteristic of an alkali burn. Only clue pointing towards the agent responsible for such burns is obtained from chemical examination of scalp hair, clothes etc which can retain the corrosive agent for longer periods.

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References:

1. Vij K. Text book of forensic medicine and toxicology principles and practice. 5th Ed. Elsevier; India. 2003p.462.
2. Pillay VV. Modern medical toxicology, 4th Ed. Jaypee. New Delhi. 2013. p.39-40.
3. Sudhansu SS. Vitriolage & its current law: two case reports. Scholars Journal of Medical Case Reports 2015; 3(2):145-48.
4. Available from: http://clinchem.aaccjnls.org/content/5/6/635.2. Accessed on 5th April 2017
5. Available from: http://shodhganga.inflibnet.ac.in/bitstream/10603/32495/8/08 chapter%201.pdf. Accessed on 5th April 2017
6. Liesivuori, J, Kettunen, A. Farmers' exposure to formic acid vapour in silage making. Ann Occup Hyg. 1983;27:327ï 329
7. Sigurdsson J, Bjornsson A, Gudmundsson ST. Formic acid burn- local and systemic effects: report of a case. Burns 1983;9(1):358-61
8. Vincent J, Brookes, Jacobs MB. Poisons properties, chemical identification, symptoms & emergency treatment. 2nd Ed. 1958. Available from: https://archive.org/stream/in.ernet.dli.2015.139592/2015.139592.Poisons-Second-Edition djvu.txt. Accessed on 5th April 2017
9. Locket S. The clinical diagnosis and treatment of poisoning. 1957:531.
10. Bensely EH, Joron GE. Hand book of treatment of acute poisoning. 2nd Ed. 1958
11. Robert H Dreisbach. Handbook of Poisoning: Prevention, Diagnosis and Treatment. 11th Ed.1983; 217-21.
12. Jefferys D B, Wiseman H. M. Formic acid poisoning. Postgrad. Med. J., 1980;56:761-2,
13. Sujathan G, Jayapalan VK. Formic acid poisoning. J Ind Acad Foren Med 1991;13(2):29-31

Case Report

Female Infanticide – Murder of Humanity

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Abstract:

Infanticide refers to the deliberate killing of a child below one year of age. Female infanticide is the intentional killing of baby girls due to preference for a male baby. The killing may be consequent to active infanticide in which the means like fatal injury and poisoning are the direct and immediate cause of death and passive infanticide which involves the indirect cause like sustained nutritional deprivation. This crime is generally committed at the time of or within a few days of delivery. In many cases, the infant has obvious injury over her vital parts that confirms the homicide. Here, we are presenting a case of female infanticide in which the infant was murdered by inflicting fatal head injury with other injuries over the body. We have also reviewed the present status of female infanticide in our country.

Key Words: Infanticide, Social evils, Homicide, Rigorous imprisonment, Muconium, Subdural haemorrhage, Contusion

Background:

India has experienced a long history of social evils and traditions since antiquity. The social evils which were rampant in our society during the British rule in India were mainly Sati system, female infanticide, purdah system, caste system, child marriage, devadasi and untouchability, etc, to name a few. Of these evils, there is scant literature about female infanticide but its practice was credulously prevalent in Indian families.

Infanticide is defined as the killing of an infant, where an infant is defined as a child under the age of 1 year.[1] Outright infanticide can be classified into active infanticide & passive infanticide; the difference being that in the former the cause of death such as fatal beatings, poisonings etc. are direct and immediate, while in the later, the means such as sustained nutrient deprivation, are indirect and delayed.[2] Female infanticide is the intentional killing of baby girls due to the preference for male babies and from the low value associated with the birth of females.[3]

Legally, infanticide amounts to homicide and all legal provisions applicable to the offence of homicide are applicable to infanticide. The crime of infanticide is generally committed at the time of or within a few minutes or hours after the birth of the child.[4] In case where infanticide is not proved, the mother is usually charged under S. 318 of the Indian Penal Code, with a lesser offence of concealment of birth.

Section 318 IPC clearly states (in context to the female infant) that whoever secretly buries or otherwise disposes the dead body of a newly born female child, whether such child dies before or after or during its birth, intentionally conceals the birth of such child, shall be punished with rigorous imprisonment for a term which may extend to five years and shall also be liable to fine which may extend fifty thousand rupees.[5]

Most of the time, the infant has many injuries and other external findings that rule out accident and confirm infanticide. The secret disposal of the infant body in an open place like jungle, fields, railway tracks etc, in adverse environmental condition invites the suspicion

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of homicide beyond the reasonable doubt. However, the finding of any trauma externally as well as internally are usually revealed from a careful autopsy. A female infant was found with a number of fatal homicidal contusions all over the body. The same is described here in details.

Case History:

Dead body of a female infant was brought to the department of Forensic Medicine, Pt. B. D. Sharma PGIMS, Rohtak for postmortem examination. It was purportedly recovered from the outer area of a railway station from the shrubs, a bit away from the railway line, two days before the autopsy.

The female infant was unidentified and was brought with daily diary number for treatment by police to the local Government General Hospital. Due to its critical condition, it was referred to the department of Pediatrics of our institute. Despite of best efforts the infant could not be saved and was subsequently brought to our department for Postmortem examination. The apparent cause of death was unknown to the investigating officer of the case.

Autopsy findings:

The dead body was received in a white sheet of cloth with a hospital identity tag present over the body. Rigor mortis was present all over. Postmortem staining was present over back except pressure areas and was fixed. The stump of cut umbilical cord was tied with a black thread. Length of infant was 45 cm, weight was 2.6 Kg. Scalp hairs were 3-4 cm long, black and thick. Both eyebrows and eyelashes were well developed. Nails were present beyond the tip of fingers and were thick. Cartilages were present in both ears. All the internal solid viscera were found congested. Stomach contained whitish mucoid material. Muconium was present up to the end of large intestine. Gallbladder contained bile. On careful examination of the body, multiple diffuse reddish contusions of various sizes with deep ecchymosis were found at various sites all over the body as described below:

1. Diffuse reddish contusion was present over bilateral frontal, parietal and occipital region of the scalp. On further dissection and opening the cranial cavity and removing the duramater, diffuse subdural haemorrhage was present on both cerebral hemispheres. Hematoma was present at the base of brain.
2. Reddish contusion was present over left side of face below the left eye. On dissection, underlying tissues were ecchymosed.
3. Reddish contusion was present over left clavicular region. On dissection, underlying tissues were ecchymosed.
4. Reddish contusion was present over anterior aspect of left knee. On dissection, underlying tissues were ecchymosed.
5. Reddish contusion was present over the lateral aspect of dorsum of left foot, below the left ankle joint. On dissection, underlying tissues were ecchymosed. (**Photo 1, 2, 3 & 4)**

Figure 1: External appearance of infant

Figure 2: Contusion over scalp

Figure 3: Subdural Hemorrhage of brain

Figure 4: Subdural Hemorrhage of brain

Centers of ossification had appeared for the manubrium and body of sternum, but not for xyphoid process. Center of ossification had appeared for calceneum, talus, lower end of femur and upper end of tibia, but not for upper end of humerus and femur. At the end of autopsy it was opined that the dead body was of full term viable female foetus with the cause of death opined as cranio-cerebral injuries and their complications, consequent to injuries caused by hard and blunt force impact, antemortem in nature and fresh in duration. The postmortem interval was opined to be between 12 to 24 hours.

Discussion:

Infanticide is killing of an entirely dependent child under õone year of ageò who is killed by mother, parents or others in whose care the child is entrusted.[6] Infanticide must be differentiated from sudden infant death syndrome (SIDS) which is the sudden death of any infant or young child which is unexpected by history and in whom a thorough necropsy fails to demonstrate an adequate cause of death.[7] The legal bearing on infanticide is the same as in culpable homicide and is regarded as murder, in law, except that the law presumes that the child was born dead. It is punishable under S 302, IPC by death or imprisonment for life and also fine.[4] India has a social structure that makes it beneficial for a family to favor male offspring to that of female.

The custom of female infanticide came into existence in India over the ages. In terms of emergence of this tradition, the view of some scholars reveals that there were some motives accountable behind its practice in the contemporary Indian society. One such motive was to escape from a great economic burden. The liability relied on parents of the female baby because of the existence of a dowry system whereby the parents of the girls were required to pay a gift to the sonôs family at the time of marriage. The demand of dowry at that time was probably very high, and, it usually consisted of either in the form of lots of money or valuable commodities.The social set up of India was primarily patriarchy, wherein the woman has no right or say in the running of their lives. The family runs through a male only.[8] This common belief was deep-rooted among the Rajputs and other castes of western as well as central India during the 19th century CE.[9]

However, it was such a patriarchy social structure whereby a woman was usually afforded to a subordinate status in society, to such as extent that even, the birth of a female infant in a family was considered to be a curse. It is also widely believed that the sons are the breadwinners, inheriting the affluence of their parents. For that reason, the male child is invariably most welcome and desired rather than a female child in Indian social and cultural milieu. Another reason behind its practice was the prudence of honour and pride of caste.[10] However, It remains a critical concern in a number of "Third World" countries today, notably the two most populous countries on earth, China and India.[11]

There are several institutions (Government and non-government) that are attempting to bring in changes in the practices related with the discrimination against the Girl

Child in India. Discrimination against the Girl Child is a very serious social problem prevailing in India. Census of India, (Provisional Data: 2011)[12] has revealed the worst child sex ratio (0-6 years) since independence. Sex ratio is defined as the ratio of males to females in a population, and is generally expressed per 100 females.[13] In India, sex ratio is expressed as number of females per 1000 male. Biologically, normal child sex ratio ranges from 102 to 106 males per 100 females, converting the same in Indian terms it is 943-980 females per 1000 males (World Health Organisation, 2011).[14] The current sex-ratio as per the census figures as shown in **Table 1**. (Provisional Population Totals, 2011).[12] Clearly, the gap is quite large between the desired biological child sex ratio and the prevalent sex ratio. **Table 2** depicts relative study of child sex ration wise top five and bottom five states/union territories.[15]

Table: 1 : Sex ratio and child sex ratio

Year	Sex ratio	Child sex ratio
1991	927	945
2001	933	927
2011	940	914

Source: Census of India (2011)

Table: 2 - Top 5 States/UT

Sr. no.	State	Child Sex Ratio
1	Mizoram	971
2	Meghalaya	970
3	Andaman &Nicibar Islands	966
4	Puducherry	965
5	Chhattisgarh	964
Bottom 5 States/UT		
1	Haryana	830
2	Punjab	846
3	Jammu & Kashmir	859
4	NCT of Delhi	866
5	Chandigarh	867

Source: Census of India 2011

The eight socio economically backward states - Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttaranchal and Uttar Pradesh, referred to as the Empowered Action Group (EAG) states have all shown definite drop in the child sex ratio (**Table - 3**)[16]

Punjab and Haryana, being some of the most problematic states (as per census 2001), have seen an increasing trend in sex-ratio in census; though still remain amongst the lowest. Haryana's Jhajjar and Mahendragarh districts, having child sex ration of 774 and 778 respectively, are the lowest.

Table-3

Sl. No.	EAG State	Child Sex Ratio	
		2001	2011
1	India	927	914
2	Chhattisgarh	975	964
3	Jharkhand	965	943
4	Odisha	953	934
5	Bihar	942	933
6	Madhya Pradesh	932	912
7	Uttar Pradesh	916	899
8	Uttarakhand	908	886
9	Rajasthan	909	883

Source: Census of India 2011

Other states that have seen an increasing trend are Himachal Pradesh, Gujarat, Tamil Nadu, Mizoram and Andaman and Nicobar Islands. Lahul and Spiti district of Himachal Pradesh is having the highest child sex ratio of 1,013. Rest of all the states across the nation have seena drop in child sex-ratio as per the Census report 2001.[13] The figures of Census of India, 2011 are not only alarming but also a matter of grave concern, as mentioned by the Census Commissioner of India Shri C. Chandramauli (Census of India, 2011).[17]

Discrimination against a girl child begins in the mother's womb, when she is deprived of her right to live. Census data suggests that the necessity for a male child, a deeprooted cultural need, has not only lived through the years but has also increased by many points. Clearly, a case of erroneous diffusion of innovations, simple techniques allow easy determination of sex of the foetus. The practice of female foeticide is widespread despite it being an illegal activity. Modernisation, growth and education were expected to create a safe and healthy

environment for the girl child, but the country is witnessing the opposite. Actions have been taken in the form of laws, schemes and awareness campaigns by both the government and the independent bodies. However one needs to look into the effectiveness of all such initiatives and parameters that could be used to measure the same.

Conclusion:

In India, most often, female infants are killed as soon as they are born, either by suffocation or poisoning. Occasionally they are abandoned. However, every possible cause should be ruled out and that requires a thorough careful autopsy of the innocent female child that might have been murdered brutally. To conclude with, our emphasis is on a thorough and careful examination as much as possible so that the innocence could be given true justice.

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References:

1. Stedmanôs Medical Dictionary. Lippincott Williams & Wilkins; 27th edition. 2000.pg 129.
2. Harris, Marvin. Cannibals and Kings. The origins of cultures. New York: Random House; 1977.
3. ñCase Report on Infanticideò. Available from: http://www.gendercide.org/case_infanticide.html. Accessed on August 20 2012
4. Mathiharan K, Patnaik AK. Modiôs medical jurisprudence and toxicology. 23rd Ed. New Delhi: LexisNexis Butterworth; 2006: p. 981.
5. Reddy KSN. The essentials of forensic medicine and toxicology. 33rd ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd 2014: p. 53.
6. Kolloor TM. Female infanticide: a psychological analysis. Grass Roots Action, special issue on Girl Child, 3 April 1990.
7. Bergman AB, Sudden infant death syndrome. Res Medica. J of Royal Medical society. 1972:Vol. 7(1), 1-7.
8. Mahajan V.D. India since 1526. New Delhi: S. Chand & Company Ltd; 1986: 301, 522-3.
9. Koradia K. Female foeticide and Infanticide: An educational programme for adolescents of Jaipur City. IJSSIR, 2013: Vol.2 (5), 55-68.
10. Basumatary A, Study of institution of female infanticide in colonial India. JIARM. 2015: Vol.3(7), 404-11.
11. Available from: http://www.gendercide.org/case_infanticide.html. Accessed on August 20 2012.
12. Provisional Population Totals: India: 2011. (2011). In Census of India. Retrieved September 21, 2012, from http://censusindia.gov.in/2011-prov-results/indiaatglance.html.
13. Available from: www.encyclopedia.com/social-sciences/encyclopedias-almanacs-transcripts.../sex-ratio. Accessed on: August 20 2012.
14. World Health Organisation. (2011). Preventing gender-biased sex selection: an interagency statement ohchr, unfpa, unicef, un women and who (nlm classification: qs 638). geneva, switzerland. in united nations population fund. Available from: http://www.unfpa.org/webdav/site/global/shared/documents/publications/2011/Preventing_genderbiased_sex_selection.pdf. Retrieved September 14, 2012
15. Census of India 2011: Child sex ratio drops to lowest since independence. (2011, March 31). The Economic Times. Available from: http://articles.economictimes.indiatimes.com/2011-03-31/ news/29365989_1_ratio-males-girl-child. Retrieved August 20, 2012,
16. Sadh A, Kapoor PS. Save the girl child initiatives in india - a social marketing perspective. Ind Med J 2012:4(3):18-34.
17. Census of India 2011: Child sex ratio drops to lowest since independence. (2011, March 31). The Economic Times. Available from: http://articles.economictimes.indiatimes.com/2011-03-31/ news/29365989_1_ratio-males-girl-child. Accessed on August 20 2012.

Case Report

Homicide Disguised by Road Traffic Accident: An Autopsy Based Rare Case Report

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Abstract:

We received a dead body of an unknown male, aged about 40 years, in the mortuary of MGM Medical College, Indore for postmortem examination. Preliminary investigation of the police showed case to be of road traffic accident (RTA). The body was completely crushed and mutilated due to run over by multiple heavy vehicles. After meticulous postmortem examination of the body, we came to the conclusion that death was due to asphyxia as a result of manual strangulation and that the body was thrown on a road with heavy traffic to disguise this as case of RTA. After the post-mortem report was received by the police, they registered this case as a murder (IPC 302) instead of the earlier RTA.

Key Words: Road Traffic Accident, Post-mortem Examination, Asphyxia, Strangulation, Murder

Background:

Finding out the cause of death in a severely crushed and mutilated body becomes very difficult. Manual strangulation is a type of asphyxial death. Asphyxia is broadly defined as the interference with the intake or utilization of oxygen, combined with the failure to eliminate carbon dioxide.[1] Best medical evidence of manual strangulation is derived from postmortem examination of the body, but even in living survivors of manual strangulation assaults, it may be possible to recognize a pattern of injury distinctive for manual strangulation. At autopsy, we can examine all the tissues of the neck, both superficial and deep, but In living people, we are left with only superficial examination of the skin, and two-dimensional shadows by radiography.[2,3]

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Patterned abrasions and contusions of the skin of the anterior neck are typical of manual strangulations cases. The injuries that may occur include patterned contusions and abrasions caused by fingernails, finger touch pads, ligatures, or clothing.

Fingernail marks are superficial curvilinear abrasions, occurring singly or in sets. In rare cases, all four finger marks may be evident on the skin in a single pattern. Fingernail marks are rarely associated with the assailantõs hands, but commonly associated with the victimõs own fingers, as victim struggles to pry the assailantõs grasp off his own neck. Finger touch pad contusions are caused by the assailantõs grasp. The thumb generates more pressure than the other fingers, so singular thumb impression contusions may be found more often than contusions, showing the complete hand grasp. Injuries of manual strangulation are easily evident in neck tissue at time of autopsy in the form of contusions, fractures and small haemorrhages in laryngeal mucosa.

Ultimately, a medical opinion of strangulation as the mechanism of neck injury will be based on a complete examination of the neck, either at autopsy or by radiography, to detect superficial and deep injuries fitting a pattern that supports the diagnosis.

Case history:

As per history given by the police, an unknown male of age about 40 yrs was found dead on a road in severely crushed and mutilated form due to multiple time heavy vehicles run over the body. They brought the case for autopsy examination as a case of RTA.

Autopsy findings:

Dead body was received in a yellow colour plastic bori (gunny sack). On opening the bori, another greenish yellow colour plastic bori was found and inside it was the crushed and mutilated body. Beside the body was one white colour plastic bori and one envelope found written as ñ**R.K. Rope Center**ò in Hindi.

Clothing:

One black coloured jacket, one white coloured jacket, one shirt, one pant and one religious book inside the clothes.

External Examination:

The body was flattened, with head severely crushed, no frank spurting of blood seen **(Picture no. 1 & 2),** scalp was lacerated at places and skull fractured to multiple pieces. The face was distorted and crushed, facial bones were fractured in multiple pieces and face was not identifiable. Both upper limbs were present in situ, with the left upper limb bone fractured at places and skin lacerated at places; left forearm bone was completely exposed. The right upper limb was fractured at places and palmar aspect of both hands was intact but the dorsal aspect was lacerated at places. The anterior wall of chest skin was found intact, but the ribs were fractured at multiple places; abdominal wall was lacerated at places and both the abdominal and chest organs were crushed and torn in to multiple pieces. The pelvic area and both lower limbs except the left femur bone were crushed in to multiple small pieces, mixed with muscle and tissues. The scrotum and penis were identifiable. Cyanosis was found over nail beds of fingers.

Picture 1: Body crushed on road site view showing no frank spurting of blood.

Picture 02: External findings after removing cloths showing multiple crushed injuries

Neck Structures:

Neck structures were fixed in formalin and then examined. Following were noted:

1. Abrasion of size 10 x 3 cm, present over the right antero-lateral part of neck. (**Picture no.3**)
2. Multiple abrasions in an area of 20 x 12 cm, present bilaterally over lower part of neck and upper part of chest region, of varying size. (**Picture no.3**)
3. Crescentic reddish abrasion of size 1.5 x 1.2 cm, present over left side of neck, situated 7 cm below the chin and 6.5 cm left lateral to midline, with concavity directed downwards and medially.
4. On opening the neck, a contusion of size 2 x1cm was found present vertically over anterior aspect of thyroid cartilage and beneath it, the underling thyroid cartilage showed a fracture of 3cm.
5. Both sides of greater cornu of thyroid cartilage were found fractured. The left side of greater cornu was found fractured and separated at outer 1/3rd level and right side of greater cornu was found fractured at junction of body of thyroid cartilage. Both the fractured fragments were directed inwards. (**Picture no.4**)

6. Another fracture of length 1.5 cm present over right lateral part of body of thyroid cartilage obliquely placed, medial end of fracture going downward medially and situated 2.5 cm right lateral to midline of the body (**Picture No.4).**
7. Both sides of hyoid bone were found fractured and separated from the body, with the distal fragment directed inwards
8. Both sides of the inner mucosa of larynx showed multiple small petechial haemorrhages **(Picture no.5).**

Surrounding muscles and tissues at all the above mentioned fracture sites were found ecchymosed. Injury no. 1 and 2 were opined as post-mortem in nature and the rest, ante-mortem. The crushed viscera were pale and ante-mortem nature of the crush injury could not be appreciated by the postmortem examination. Opinion regarding the cause of death was given as asphyxia as a result of manual strangulation. Death was homicidal in nature, and time since death was within 24 hours.

Picture 3: External anterior part of neck showing multiple post mortem abrasion

Picture 4: Ecchymosed and fracture seen on right lateral side of thyroid cartilage

Picture 5: Multiple petechiael haemorrhage seen on the sub glotic mucosa of larynx.

Discussion:

Finding out the cause of death in a severely crushed and mutilated body becomes very difficult. Meticulous postmortem examination should be done to rule out any covert cause of death, concealed by vehicular accidents. Concealment of a crime may include burning the corpse, run over by a train or motor vehicle, dropping from height or crushing by a load.[4] RTAs form the bulk of deaths investigated at most autopsy centres[5,6] and may be certified incorrectly due to apathy by the forensic pathologist. In a histological study done by Pollanen in 2000 on 8 cases of manual strangulation, it was found that in all the cases, intra-cartilaginous laryngeal haemorrhages were associated with sub-epithelial laryngeal haemorrhages and intra-laryngeal muscular haemorrhages, forming a ñtriad of haemorrhagesò[7] Forces sufficient to cause thyroid and crcoid cartilage fractures are usually sufficient to cause acute asphyxia and death.[8] In a study by Dimaio VJ on homicidal asphyxia, he found that petechiae were present in 89% of cases and in cases of manual strangulation, fracture of hyoid, thyroid or cricoid cartilage were found in all the male victims and slightly more than half of the female victims.[9] Sometimes, petechial hemorrhages may not seen by necked eye, in such cases, we can make use of the Microfocus Computed Tomography (mf C T) for examination of the hyoid bone and thyroid cartilage in cases of suspected strangulation, where advanced decomposition precludes

detection of petechial hemorrhages and hemorrhages adjacent to fractures.[10] Dunsby observed in his study on lagyngeal cartilage and hyoid bone that the thyroid cartilage alone was fractured in 38/78 cases, hyoid bone alone was fractured in 19/78 cases, and the larynx and hyoid bone both were fractured in 21/78 cases.[11]

Conclusion:

Meticulous examination of dead body is very important to find out the cause of death when whole body is severely crushed. In this case, after thorough examination of neck structures, we were able to arrive at the final opinion.

Conflict of Interest: None.

Financial Assistance: None.

References:

1. Spitz WU. Fisher RS. Medicolegal investigation of death: guideline for the application of pathology to crime investigation.3rd ed. Illinois Charles C Thomas 1993;p783.
2. Scaglione M, Romano L, Grassi R, Pinto F, Calderazzi A, Pieri L: Diagnostic approach to acute laryngeal trauma: role of computerized tomography. [Italian] Radiologia Medica 1997;93 (1-2):67-70. Available from: http://www.markwynn.com/wp-content/uploads/death-by-strangulation.pdf. Retrieved on 5th Jan 2017.
3. Poquet E. Dibiane A. Jourdain C. el-Amine M. Jacob A. Escure MN. Blunt injury of the larynx by hanging. X-ray computed tomographic aspect. [French] Journal de Radiologie 1995;76(2-3):107-9. Available from: https://www.ncbi.nlm.nih.gov/pubmed/7714860. Retrieved on 5th Jan 2017.
4. Mant A. Postmortem injuries. In: Tedeschi CG, Eckert WG, Tedeschi LG. Eds. Fornesic medicine: a study in trauma and environmental hazards.1st Ed. philadelphia: WB Saunders Company. 1977; p1063.
5. Mohan kumar TS, Kanchan T, Yoganarasimha K, Pradeep Kumar G. Profile of unnatural deaths in manipal, southern India, 1994-2004. J Clin Forensic Med 2006:13:117-20.
6. Singh D, Diwan I, Pandey AN, Tiagy S. Spectrum of unnatural fatalities in the chandigarh zone of north west India - a 25 year autopsy study from a tertiary care hospital. J Clin Forensic Med 2003;10:145-52.
7. Pollanen MS. A triad of laryngeal haemorrhage in strangulation : a case report of eight cases. J Fornsic Sci 2000;45(3):614-8.
8. Stanley RB Jr, Hanson DG. Manual strangulation injuries of the larynx. Arch Otolaryngol. 1983;109(5):344-7. Available from:: https://www.ncbi.nlm.nih.gov/pubmed/6847488. Retrieved on 5th Jan 2017
9. Dimaio VJ. Homicidal asphyxia. Am J Forensic Med Pathol 2000;21(1):1-4.
10. Kettner M, Potente S, Schulz B ,Knauff P,Schmidt PH, Ramsthaler F. Analysis of laryngeal fracture in decomposed bodies using microfocus computed tomography. Forensic Sci Med Pathol 2014;10(4):607-12.
11. Dunsby AM, Davison AM. Causes of laryngeal cartilage and hyoid bone fractures found at postmortem. Med Sci Law 2011;51(2):109-13.

Case Report

Heroin 'Body Packer' – A Case Report

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Abstract:

Body packing refers to the internal concealment of drugs within the gastrointestinal tract or other orifices. People who do this are called **B**ody **Packers.** The **Body Packer Syndrome** is accidental and unintentional poisoning with illicit drugs in persons, who attempt to transport drugs illegally across national borders by packing them in plastic packets, ingesting them or inserting them in body orifices, and then subsequently retrieving them in a foreign country, thus safely bypassing custom authorities.

In the present case, a 19 years old male from Afganistan suddenly lost consciousness during flight from Kabul to Delhi. CT Scan done in hospital showed multiple foreign bodies in the gastrointestinal tract. He expired in the hospital after 11 days. Autopsy was conducted in the Safdarjung hospital, New Delhi. A total of 80 heroin capsules were recovered from his body - 19 capsules during the course of treatment in the hospital and 61 capsules during autopsy. Some of these capsules were ruptured and some were intact.

Key Words: Body Packing, Body Packer, Body Packer Syndrome, Heroin

Background:

Body packing refers to the internal concealment of drugs within the gastrointestinal tract or other orifices. People who do this are called **body packers.** Drugs may be concealed within condoms, foil, latex or cellophane.[1] Body packer syndrome is the accidental and unintentional poisoning with illicit drugs in persons, who attempt to transport drugs illegally across national borders by packing them in plastic packets, ingesting them or inserting them in body orifices, and then subsequently retrieving them in a foreign country, thus safely bypassing custom authorities.[2] Although this is more commonly associated with smuggling of cocaine, it has also been reported in the case of other drugs, especially heroin[3]

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Drugs such as loperamide or diphenoxylate hydrochloride with atropine may be taken to reduce gut motility and prevent the passage of the packages on a long distance flight, before the end of journey. On arrival at his destination, the courier takes a laxative, retrieves the packets and pass them to the õpusherò who then distributes the drug. The packets may cause bowel obstruction secondary to torsion, intussuception or impaction. Sometimes, packets unseal or burst in the small intestine, allowing massive absorption of drug in systemic circulation resulting in death of courier. Even if the packets do not rupture, drugs may passively diffuse from the stomach into surrounding organs and appear in the circulation and urine.[4]

Body packing was first described by Dr. Deitel and Dr. Syed in 1973. They found a patient with small bowel obstruction 13 days after swallowing a condom containing hashish. The small bowel was emptied preoperatively by a long-tube, and the impacted bolus was removed by enterotomy.[5] Diagnosis of body packer syndrome is usually done by clinical features, X-ray and CT scan. The sign seen on the X-ray is known as 'double-condom sign'. This sign is due to the air trapped in the individual layers of packing material.[6] This sign

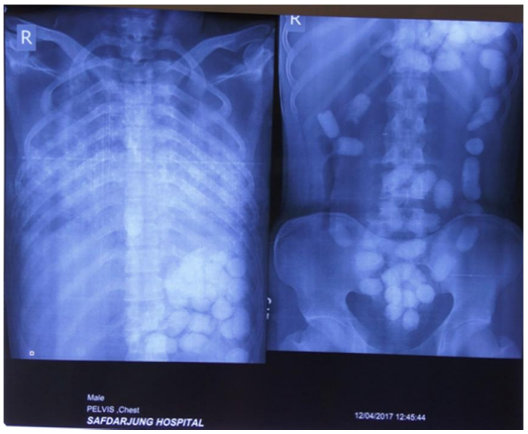
is said to be a diagnostic criterion of body packer syndrome. Computed tomography (CT) has an advantage over plain radiographs, especially in those regions where the drug-filled packets maybe confused with formed feces.[7]

First death of a body packer was reported by Suarez, et al in 1977.[8] The most frequent cause of death among body packers is due to overdoses secondary to rupture of packets within the stomach and/or gastrointestinal tract.[9]

Case report:

A 19 years old male from Afganistan suddenly lost consciousness during flight from Kabul to Delhi on 25/3/17. After landing at IGI Airport he was shifted to Indian Spinal Injuries Centre where history of unknown substance poisoning was elicited and CT Scan showed multiple foreign bodies in the gastrointestinal tract. His BP was unstable and pupils were pin point. He was referred to and admitted at Safdarjung Hospital on 26/3/17 in an unconscious state. He was put on ventilator. Inotropes and IV fluids were given. Total 7 Heroin capsules were removed during digital rectal examination on 26/3/17 and 12 capsules were recovered on 5/4/17 at Safdarjung Hospital. He expired in while undergoing treatment on 5/4/17 at 3:15 AM. Autopsy was conducted on 12/4/17. Post mortem X-ray of the body was taken prior to autopsy which showed multiple foreign bodies in the gastrointestinal tract. (**Fig. 1**)

Fig. 1- X-Ray showing multiple foreign bodies in the gastrointestinal tract



On post mortem examination, the external findings were unremarkable. Bluish discolouration of nailbeds and left eye subconjuctival hemorrhage was present. On Internal examination, pleural cavity contained about 200 ml of blood tinged fluid. Both lungs were found to be congested and edematous. Multiple petechial haemorrhages were seen over lungs and heart. Stomach and Intestines contained sixty one multiple yellowish white colored capsules, of size 3 cm X 2.5 cm, along with brown colored fluid with indistinguishable smell. (**Fig. 2**) Some capsules were intact and some were ruptured and partially or completely empty. (**Fig. 3**) Mucosa was haemorrhagic. The recovered capsules were weighed and then opened to measure the weight of the powder and test the chemical nature of powder. The weight of the powder was about 600 gm. Spot test using standard NDPS Act guidelines was done and the powder tested positive for Heroin (purple colour). (**Fig. 3,4,5,6**)

Fig. 2- Multiple yellowish white colored capsules along with brown colored fluid in stomach.

Fig. 3- Capsules recovered from body showing some capsules with loose packing.

Fig. 4- Photograph showing single intact heroin capsule.

Fig. 5- Powder seen after opening the capsule

.

Fig. 6- Photograph showing spot test for Heroin- identified by purple colour

Discussion:

Drug smuggling by internal concealment is a well-recognized mode of transporting illegal drugs. Body packing has increased since September 11, 2001, possibly due to increased border security which has made conventional trafficking more difficult.[10] The Golden Crescent of South-West Asia and the Golden Triangle of South-East Asia are the worldôs principal opium poppy-growing areas. They account for the lion share of worldôs illicit production of opium and heroin.[11] Owing to the geographical position between them, India continues to be affected by the constantly increasing illegal transit/traffic of heroin. The illegal drug trafficking is the source of funding for terrorists. As per National Crime Records Bureau (NCRB) Report 2014, registered cases under the Narcotic Drugs and Psychotropic Substance Act, 1985 (NDPS Act), has seen a steady increase across India.[12] In 2014, 46923 cases were registered in India, marking an increase of 70% over 2004. Punjabôs share of the above was 14483, thus recording the second highest number of reported incidences under NDPS Act, after Maharashtra, which recorded 14622 cases.[13]

According to Robertôs, et al, the general characteristics of a body packer include:

- Returning from a trip abroad in a location with a history of illicit drug exporting;
- History of frequent trips;
- High profit drugs such as cocaine or heroin involved; and
- The packaging material is made of high-grade latex, aluminium foil, or condoms.[14]

Koehler et al highlighted the risk of a package rupture being increased with prolonged time in the air.[9] A study of profile of body packers in Tehran suggests that they are mostly males with a mean age of 43 years.[15] In another case, 88 Heroin pellets were retrieved at autopsy from the body of a body packer.[16]

In our case, the body packer was a 19 year old male. The investigation proved that the deceased had made 2 more trips to India in recent past. The patient collapsed mid-air during the flight to India. The flight from Kabul to India is only 2.5 hours in duration. However the rupture could have been because of ingestion of high number of capsules (80). The

cause of death was opined as Heroin poisoning and its sequelae.

Conclusion:

Body packing is a method by which illicit drugs may be carried within the human body. Hospital physicians may neglect this type of gastrointestinal foreign body if they are not aware of the body packer syndrome. Emergency departments face an increasing number of drug-related health problems, with difficult medico-legal and social consequences. Body packing should be suspected in anyone with signs of drug-induced toxic effects after a recent arrival on city terminals. An awareness of drug packing should therefore be promoted among medical and radiology staff and autopsy should be done carefully in the cases of death due to body packer syndrome.

In many countries there are no screening measures at the airport to detect the body packers. So screening of all individuals passing through the airport, by X- ray machine should be mandatory at airports to prevent illegal drug trafficking.

Conflict of Interest: None.

Financial Assistance: None.

References:

1. Bickle I, Knipe H. Body packing. Radiopaedia.org. Available from: https://radiopaedia.org/articles/body-packing-1. Accessed on 2017 July 4.
2. Aggrawal A. Textbook of forensic medicine and toxicology. 1st ed. Avichal Publishing Company; 2014. p 747.
3. Pillay VV. Modern medical toxicology. 4th Ed. Jaypee Brothers Medical Publishers (P) Ltd; 2013. p 179.
4. Reddy KSN, Murty OP. The essentials of forensic medicine and toxicology. 32nd Ed. 2013. p 575.
5. Deitel M, Syed AK. Intestinal obstruction by an unusual foreign body. Can Med Assoc J. 1973;109(3):211ï 2. Available from: https://www.ncbi.nlm.nih.gov/pubmed/4728949. Accessed on 2017 July 4
6. De Backer AI, De Keulenaer B, Mortelé KJ, Ros PR. The body packer syndrome. J Belge de Radiologie - Belgisch Tijdschrift voor Radiologi 2002;85:312.
7. Sureka B, Kumar MM, Mittal A, Mukul S. Body packer syndrome. J Post Grad Med 2013;59(2):166.
8. Suarez CA, Arango A, Lester JL. Cocaine-condom ingestion-surgical treatment, JAMA. 1977 Sep 26;238(13):1391ï 2. Available from: https://jamanetwork.com/journals/jama/article-abstract/355640. Accessed on 2017 July 4
9. Koehler SA, Ladham S, Rozin L, Shakir A, Omalu B, Dominick J, Wecht CH.. The risk of body packing: a case of a fatal cocaine overdose. Forensic Sci Int. 2005 Jun 30;151(1):81ï 4.
10. Claffey M. Stampede of drug mules at Kennedy: after 9/11 lull, heroin & ecstasy busts soar. New York Daily News. 2002;5. Available from: http://www.nydailynews.com/archives/news/stampede-drug-mules-kennedy-9-11-lull-heroin-ecstasy-busts-soar-article-1.484075. Accessed on 2017 July 4
11. Golden Crescent. Wikipedia, the free encyclopedia. Available from: https://en.wikipedia.org/wiki/Golden_Crescent. Accessed on 2017 July 4.
12. Crime in India- 2014 Compendium. National Crime Records Bureau. Available from: http://www.ncrb.gov.in/Stat Publications/CII/CII2014/Compendium%202014.pdf . Accessed on 2017 July 4.
13. Debu C. Drug mafia in Punjab and smuggling route/My India. 2016 Mar 23 Available from: https://mapsofindia.com/my-india/india/drug-mafia-in-punjab-and-smuggling-route. Accessed on 2017 July 4.
14. Roberts JR, Price D, Goldfrank L, Hartnett L. The bodystuffer syndrome: a Clandestine form of drug overdose, Am J. Emerg. Med. 1986 Jan;4(1): 24-7.
15. Hassanian-Moghaddam H, Abolmasoumi Z. Consequence of body packing of illicit drugs. Arch Iran Med. 2007;10(1):20-3.
16. Olumbe AK, Kalebi AY. Death from body packer syndrome: case report. East Afr Med J. 2004;81(4):218-20.

Case Report

A Piece of Wooden Stick as a Crime Scene Evidence to Solve The Murder Mystery

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Abstract:

Forensic botany is defined as the use of plant evidence in court. Forensic botany encompasses many sub-disciplines, including plant anatomy, plant ecology, plant systematic, plant molecular biology, palynology, and limnology. Although the field of forensic botany has been recognized, the use of trace plant material as physical evidence in criminal casework is still novel. Plant anatomy uses tree growth ring patterns, to aid in species identification and in performing physical matches of evidence. The physical clues left at the crime scene can assist in determining what transpired at the scene and who was (and was not) involved. The forensic clues challenge experts to analyze evidence from crime scenes.

Herein, we report a piece of wooden stick that was retrieved from the crime scene; and another wooden stick that was used as a weapon and seized from the accused, both belonged to the same plant material. First we performed the physical comparison of the crime scene exhibit and the exhibit collected from accused. The macerated plant material from both the wood samples was used for the morphological and microscopic examination.

A single wooden piece (bark) provided the link between the criminal, the victim and the scene of occurrence.

Key Words: Forensic Botany, Plant Anatomy, Physical Fit, Maceration

Background:

Forensic botany is a broad discipline which involves examination of botanical material (often trace amounts) to identify illicit plants or to ascertain possible links between a suspect, victim and a crime scene.[1-4]

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If the victim is found dead at the scene, we have to consider what type of weapon might have been used. Then, search the area for an item such as a knife, rope, wire, axe, sword, stick, stone or brick that the assailant might have used as a weapon and discarded as he fled the scene. Most of the assailants, generally in rural area, have used easily available wooden articles as weapons - like wooden log, wooden stripe, wooden danda/ lathi , bamboo stick, etc, for the purpose of assault or even murder.

Edmond Locard,[5] a lawyer and a physician, proposed that every criminal carries some elements with him/ her from the scene of crime by which he/ she can be linked with the crime**.** Locard's Exchange Principle states that with contact between two items, there will always be an exchange. This is the basis of trace evidence collection at a crime scene. Locard's Theory simply says that every contact leaves a trace. In his own words: "Physical evidence cannot be wrong, it cannot perjure itself and it cannot be wholly absent. Only

human failure to find it, study and understand it can diminish its value".[6] Every incident, be it a crime, accident, natural disaster, or any other, leaves traces at the scene. The goal of the subsequent investigation is to correctly collect evidence, interpret the facts, reconstruct the events and understand what happened.

According to Indian Evidence Act-1872,[7] Physical evidence can be anything from massive objects to microscopic items, generated as part of a crime and recovered at the scene or at related locations.[Sections 1-55 of IE Act] Physical evidence that resulted from the transfer of small quantities of materials like hair, textile fibers, paint chips, glass fragments, plant fragments, gunshot residue particles is very important at the crime scene. The physical clues left at the crime scene can assist in determining what transpired at the scene and who was (and was not) involved. The forensic clues challenge experts to analyze evidence from crime scenes. Physical evidence, when it is recognized and properly handled, offers the best prospect for providing objective and reliable information about the incident under investigation.

Although the field of forensic botany has been recognized, the use of trace plant material as physical evidence in criminal casework is a challenging task for the forensic expert. Plant anatomy is the study of the structure of a plant and any of its parts. It uses tree growth ring patterns, to aid in species identification and in performing physical matches of evidence.[8] Wood has been of service to mankind through the ages. Wood and bark in stems, branches and roots of trees, shrubs and herbs contain information about their genetic origin, the formation time and environmental conditions.

The most unique feature of wood, unlike other natural materials, is its high degree of structural variability. Even, two pieces of wood belonging to the same timber species, may not be exactly alike. Even though the basic wood structure of the species is more or less similar; every fragment of it may show some difference. This attracts a unique fascination and attraction for this material. At the same time, it makes timber identification a tricky business. Keys based on the anatomical features serve a pivotal role in the identification of an unknown sample of wood.[9] Since the anatomical features are relatively constant for each species they can be successfully employed in identification keys. The commonly used keys for wood identification are the dichotomous key, perforated card key and the computer aided identification key.[10]

Materials and Methodology:

The present study was carried out at the Regional Forensic Science Laboratory, Nashik. Most of the evidence material in cases of assault/ murder cases received in the laboratory consisted of wooden articles used as weapons - wooden log, wooden stripe, wooden danda/ lathi, bamboo stick or wooden stick, etc. Sometimes, they ask interesting questions like do the piece of wooden stick at the crime scene and the wooden stick seized from accused match with each other? Do they belong to the same plant or not? Such questions are challenging for the forensic expert.

In this case, the investigating agency sent fragments of wood left at the scene of crime and the wooden article that was seized from accused person, for the chemical analysis. We performed the physical comparison and then studied the morphological and microscopic features of both the pieces. (**Fig: 1 to 4)** Hall, et al.[11] used nitric acid and formaldehyde for maceration of fibers. Han, et al.[12] proposed the fibre length measurement techniques.

Both the samples were cut into1mm strips and submerged in 37% formaldehyde solution. Prior to start of the maceration process, samples were removed from the formaldehyde solution to avoid more evaporation of fumes. Then, 50% nitric acid was used. The wood samples were taken in test tubes, dipped completely in nitric acid solution and kept in a water bath at 70^{o}C. The maceration process was completed in 8-9 hrs with separation of white colored fibers.

Test tubes containing macerated fibers were removed from the water bath and allowed to cool at room temperature. After cooling, nitric acid was drained and macerated fibers were washed thrice with distilled water

and filtered using Whatman Grade 1 filter paper for separation of fibers. For slide preparation, some amount of fiber suspension was placed on a standard glass slide and allowed to air dry. Glycerol was used to enhance the visibility of the fibers.

Maceration of fibers and vessels for recording the cellular dimensions was done using Schultzes method.[13] Anatomical features covered include the arrangement, distribution, frequency and size of the various cell elements viz., vessel, axial parenchyma, ray parenchyma and fibres in the wood. These characters included both macroscopic and microscopic characters.

Chemicals and Reagents:

All the chemicals (Formaldehyde, Nitric Acid and Glycerol) used for this study purpose were AR (Analytical Reagent) grade and sourced from reputed companies.

Results and Discussion:

Anatomical studies of plant stems, bark or other parts, rarely convey an accurate picture of the real nature of the cells of which they are composed. One method which reveals cells in their cellular structure is the dissociation method.[14,15] The wood samples were treated with chemicals which dissolve the middle lamella and allow the cells/ fibers to become separated from one another. The maceration process is actually a small-scale pulping and sometimes referred to as ñtest-tube pulpingò[16] In present study, we utilized 50% nitric acid used for maceration.

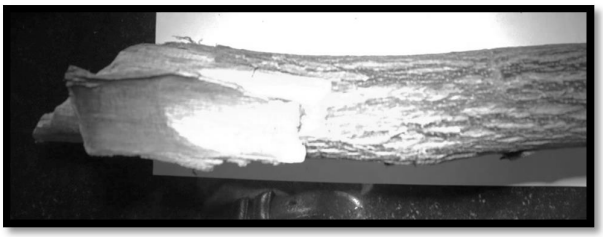
Fig. 1 Physical Fit:

A

Fig. 2 Wooden stick seized from accused person

Fig.3 A piece of wooden stick (bark) left at the crime scene

Fig.4 Physical fit of wooden stick and bark of wooden stick



Microscopic Identification of Wood:

The microscopic identification of wood species is an established method that is routinely used to identify wood type, such as solid woods, veneers, plywood etc. It consists of macroscopic and microscopic examination and comparison and in many cases, the species of wood samples can be determined exactly based on their anatomical structure.

However, observations recorded under Motic digital binocular microscope, [Make: Motic Instruments, Model: BA210 (10X magnification with Motic Image plus 2.0 ML software)] revealed splitting of fibers in 60% nitric acid, whereas 50% nitric acid exhibited separation of fibers without their splitting.

Nitric acid acts as an easy and fast resolving agent to break down the middle lamella for separating the cells. Boiled nitric acid separates organs/cells much faster. Results reveal that 50% nitric acid is not only

convenient for maceration in hot condition but dissolves other extractives also. The morphological & microscopic result reveals that the anatomical arrangement, distribution, frequency and size of the various cell elements are same for both samples (**Fig. 5A & Fig 5B**)

Fig 5A: Macerated plant material of A piece of wooden stick left at the crime scenario.

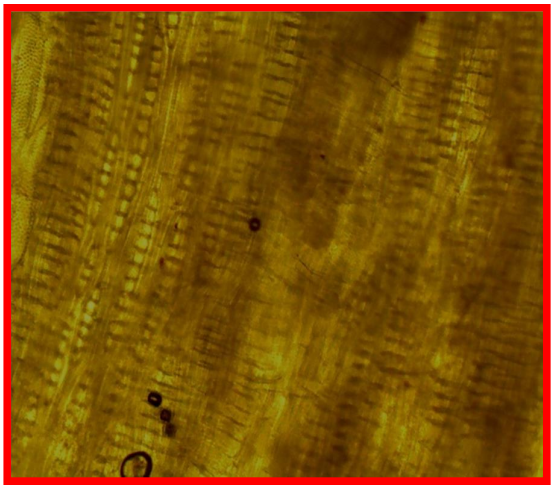
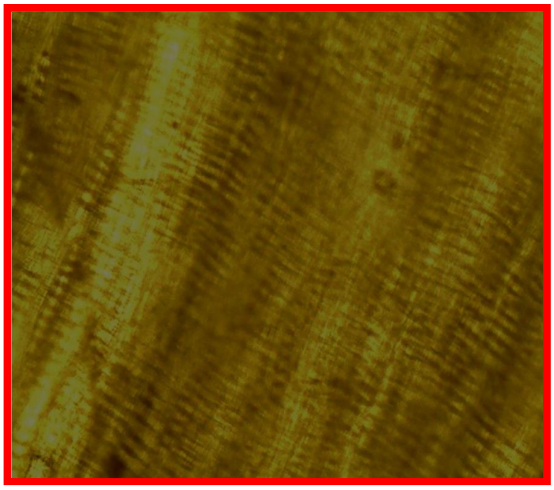


Fig 5B: Macerated plant material of wooden stick seized from accused person.



Conclusion:

Our study revealed that the maceration of wood fibers in 50% nitric acid consumes less time and is also economical than other methods. Boiled nitric acid separates organs/cells much faster. The procedure is not only rapid and economical but also yields complete maceration, which is a prime requirement for wood fiber analysis. This protocol helps to reduce the time and chemical's cost. Nitric acid, in combination with other chemicals, has been used for maceration of fibers in different species.

A single wooden piece (bark) provided the link between the criminal, the victim and the scene of occurrence.

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References:

1. Amato I. The secret life of plant crystals. Chemical & Engineering News 2006;84(6):26-7.
2. Boyd, A.E, Plants & perpetrators: forensic investigation in the botany classroom. American Biology Teacher 2006; 68:145-7.
3. Coyle H.M., Forensic botany: principles and applications to criminal casework. boca raton, FL: CRC Press, 1st Ed. 2004.
4. Dickison WC. Integrative plant anatomy, San Diego, CA, Harcourt Academic Press., 1st Ed. 2000: 399-419.
5. Oudhia P., Pandey N. and Tripathi R.S. Possibilities of utilization of medicinal weeds to increase the income of the farmers..Abstract. National Seminar on Medicinal Plant Resources Development, Gandhi Labour Institute, Ahmadabad (India),1998;4-5.
6. Ministry of Home Affairs. National Crime Records Bureau, Crime in India, 2011; 79.
7. The Indian Evidence Act. Available from: http//ncw.nic.in/Acts/THEINDIANEVIDENCEACT1872.pdf. Accessed on: 3rd March 2017
8. Dilcher DL. Forensic botany: case studies in the use of plant anatomy. Phytomorphology, Golden Jubilee Issue. 2001;181-4.
9. Entwistle T. Silent witness. Nature Australia 2003;27:76-7.
10. Graham S. Crime solving plants. Plant Science Bulletin 2006;52:78ï 84.
11. Hall R, Patton BD, Haas PA. Reaction of formaldehyde and nitric acid in a remotely operated thermo siphon evaporator. Proceedings of Waste Management '86, 1986,

Tucson, Arizona, USA. Available from: http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/17/030/17030967.pdf. Accessed on: 3rd March 2017

12. James HS, Theodore M, Lin Yi-yu. Validity of plant fiber length measurement: a review of fiber length measurement based on kenaf as a model. Mississippi State, Mississippi State University, Ag & Bio Engineering, 1999; 149-167.
13. Sherry B. The forensic evaluation of fracture marks: a validation and experimental study, 2007. Available from: https://digital.library.unt.edu/ark:/67531/metadc146528/m2/1/high_res_d/2007-21_Bethune.pdf. Accessed on: 3rd March 2017
14. Mahesh S, Pramod K, Ansari SA. A rapid and economical method for the maceration of wood fibers in Boswellia serrata Roxb. Tropical Plant Research, 2015; 2(2):108-111
15. Franklin GL. Preparation of thin sections of synthetic resins and wood-resin composites and a new macerating method for wood, Nature 1945;155:51-59. Quoted by: Wheeler EA, Baas P. ñWood identification: A review,ò IAWA. Bull. 1998;19: 241-264

Letter to Editor

Dear Sir,

Through this letter, I would like to highlight the fact that patient safety is still nightmare.

Death of Sridevi Ayyapan - Patient Safety Still a Nightmare.

Sridevi Kapoor died on 13th August 2018 in Dubai while attending a family marriage function. Initial reports stated that the actress died of Cardiac arrest, but later the PM report stated that the death was due to ôAccidental Drowningô The PM reporting of Sridevi Kapoor was widely deliberated and raised many questions of malpractice & medical errors in medical profession. Sadly, it was not for first time that the late Indian actress and her family was in news for medical errors, two decades back her family was in news in US media because of a ôbotchedô up surgery done on her late mother, Rajeswari Ayyapan, that turned her vegetative.[1]

Rajeswari Ayyapan was diagnosed with a malignant brain tumor, and a doctor in India told her that the best place for treatment would be the 'Memorial Sloan Kettering Cancer Center' in New York. The chief neurosurgeon agreed to perform a delicate and fairly common surgery for $35000, which the late actress could easily afford. But on May 26, 1995, in a tragedy built upon a string of human and institutional mistakes, the neurosurgeon, without examining her, or her X-Ray reports or other relevant clinical records showing tumor on the left side of her brain, operated on the right side of her brain and kept cutting at vital tissues where he could not find the tumor.

The confusion resulted because the Chief neurosurgeon received X-Ray reports of another Indian patient with similar condition and the famous surgeon realized his mistake when he went back to his office and saw Rajeswari Ayyapanôs files. There were a trail of errors, which stained Memorialôs reputation for extraordinary care and also cost the neurosurgeon his job. Later on Rajeswari Ayyapan was taken to New York Hospital-Cornell Medical Centre, where another surgeon removed the tumor. But, during the first operation, the portions of brain that control recent memory and some part of vision may have got damaged and she returned to India in a vegetative state and died a year later in 1996.

This was extensively covered by US media around then, which at that point, prompted a successful court fight and impelled then President Bill Clinton's proposal of a program for health care facilities to reveal their medical errors and mistakes.[1-3] The US Dept of Health and Human Services devised a system of voluntary reporting to enhance the data available to assess and resolve patient safety and health care quality issues under The Patient Safety and Quality Improvement Act of 2005,[4] was however, independent of this incidence. Even after the enactment of the Act, studies have shown that medical errors are the third leading cause of death in United States, right now,[5,6] and researches at the John Hopkins had written to the Centre of Disease Control to list deaths due to medical errors at third position, accordingly.[7]

Patient safety is a global public health concern and is a fundamental principle of health care. As far as our health care system is concerned, very little evidence exists about the perceptions of Indian health care providers regarding interventions to improve the patient safety.[8] Even after two decades of the narrated incident and recent wide coverage of the famous actressesô death, prevention of medical error/s is not an area of interest for health care policy makers.

The main aim of this letter is to raise awareness about patient safety issues and develop interventions to better reflect the reality. The most effective interventions in our system will be multi pronged, addressing the resource constraints, system issues, consensus protocols, medical culture and lack of education. However, more research is needed to address the problem. Therefore it is high time that medical profession should move from cottage structured industry to formal factory based organizational structure by developing interventions on the structural and process components unique to a particular health system to improve patient care in our Country.

Thank you.

References

1. A patientôs nightmare unkindest cuts of all: indian film starôs mom ôvegetableô - NY Daily News [Internet]. [cited 2018 Mar 13]. Available from: http://www.nydailynews.com/archives/news/pati

ent-nightmare-unkindest-cuts-indian-film-star-mom-vegetable-article-1.703075

2. Times TNY. Son of cancer patient says family sought the best care [Internet]. [cited 2018 Mar 13]. Available from: https://www.nytimes.com/1995/11/16/nyregion/son-of-cancer-patient-says-family-sought-the-best-care.html
3. Surgery is done on wrong side of a brain - The New York Times [Internet]. [cited 2018 Mar 13]. Available from: https://www.nytimes.com/1995/06/25/nyregion/surgery-is-done-on-wrong-side-of-a-brain.html
4. Rights (OCR) O for C. Patient Safety and Quality Improvement Act of 2005 Statute & Rule [Internet]. HHS.gov. 2008 [cited 2018 Mar 13]. Available from: https://www.hhs.gov/hipaa/for-professionals/patient-safety/statute-and-rule/index.html
5. Study suggests medical errors now third leading cause of death in the u.s. - 05/03/2016 [Internet]. [cited 2018 Mar 13]. Available from: https://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_errors_now_third_leading_cause_of_death_in_the_us
6. Makary MA, Daniel M. Medical errorð the third leading cause of death in the US. BMJ 2016;3:i2139.
7. Allen (ProPublica) M. Hopkins-CDC-letter [Internet]. [cited 2018 Mar 13]. Available from: https://www.documentcloud.org /documents/2822345-Hopkins-CDC-letter.html
8. Landefeld J, Sivaraman R, Arora NK. Barriers to Improving Patient Safety in India: Focus Groups with Providers in the Southern State of Kerala. Indian J Community Med Off Publ Indian Assoc Prev Soc Med. 2015;40(2):116ï 20.

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Sir,

Through this eminent journal I wish to highlight:

Medicolegal Aspects of Video Shooting of Postmortem Examination

Postmortem examination in medicolegal cases is carried out all over India. During the postmortem examination, external and internal injuries/ pathology are noted and postmortem report is issued. In some cases of medicolegal importance, photographs of injuries are taken and prepared for academic and/or medicolegal purposes. But video-shooting of postmortem examination is not done, except in cases where death has occurred in police lock up and in prison in suspicious circumstances with injuries over the body and/or when there is allegation of foul play in death.

Initially, in all cases of (natural/ unnatural) custodial deaths, video-shooting was made mandatory[1] by the N H R C [National human Rights Commission], but afterwards, only in following circumstances where death has occurred in prison:

1. Where the preliminary inquest by the Magistrate has raised suspicion of some foul play
2. Where any complaint alleging foul play has been made to the concerned authorities or there is any suspicion of some foul play[2]

The N H R C is concerned about death during the course of police action and issued guidelines for video filming of postmortem examination in these cases.3 However, in all cases of death in police lockup, video-shooting of postmortem examination is mandatory.[2]

In some non-custody death cases, e.g. alleged medical negligence cases, alleged homicide cases, alleged death following sexual assault, relatives and/ or police demand video-shooting of postmortem examination. In some cases, when a complicated (non custody death) dead body is brought for postmortem examination at places other than medical college, postmortem examination center (e.g. primary health centre, rural hospital, district hospital) the dead body is referred to medical college for postmortem examination to avoid complicated medicolegal work, reason being given as ñfacility for video-shooting of postmortem examination not available at our centerò or ñwe donôt know how to conduct postmortem examination under video-shooting.ò

Sometimes medicolegal postmortem examination is carried out, as usual in confidential manner. Print media reports this confidential postmortem examination as ñin-cameraò postmortem examination like they use terminology ñin-cameraò regarding of statement of survivor of sexual assault cases in court4. Here, no video recording of statement of survivor of sexual assault is done, but it is done in a confidential manner without the presence of public and police and in closed doors, and hence ñin-cameraò word is used. Lay persons think that ñin cameraò as video shooting. And they demand video shooting of postmortem examination as they think its routine procedure.

Advantages of video-shooting of postmortem examination:-

1. Audio-visual proof of external/ internal injuries/ pathology is present and can be submitted to courts of law along with postmortem report
2. Inexperienced/ junior medical officer/ forensic medicine expert can take opinion/ advice from his seniors regarding postmortem findings. This is particularly important because in cases of indoor patients in hospitals, when patient is available for 24 hours for clinical examination, resident doctors take advice about physical/ clinical signs of patients from senior doctors during ward rounds. But in the case of the dead, the relatives are in a hurry for cremation of the dead body and senior doctors can not rush to postmortem room to advice junior doctors about postmortem findings.
3. MBBS and MD (FMT) students get opportunity to watch live postmortems and postmortem procedures (like dissection of organs etc.) in postmortem room, but BHMS, BAMS, BUMS students donôt get such opportunity. They graduate without seeing any dead body/ dissection of dead body of medicolegal cases
4. Similarly these video CDs can be shown to police officers, lawyers and judges as a part of their training to understand various topics of medicolegal importance like inquest, injuries, asphyxial deaths, natural/ unnatural sexual offences, poisoning etc.

Disadvantages of video shooting:-

1. As it is a medicolegal case and is submitted to court along with video CD, like postmortem report, the video CD is also subjected to legal scrutiny and during cross examination, many questions would be asked about postmortem procedures/ techniques.
2. Medical officers having MBBS qualification, who are not well conversant with postmortem techniques, will tend to refer the dead body to tertiary care center for video shooting.
3. The mourners have to travel with dead body to tertiary care center from about 20 to 200 km away from their village/ taluka/ district, for postmortem examination and bring back to their own village for final rites.
4. The already overburdened forensic medicine experts will have to carry out this additional work.
5. Time required for postmortem examination will increase as every minute details of medicolegal postmortem examination will have to be recorded.
6. Video CDs have to be made in duplicate and that too should be preserved in Department office for 10 years or till the disposal of a case by courts5.
7. Who will pay for the cost of video shooting? In NHRC cases, where deaths have occurred in prisons, Jail Superintendent reimburses the cost of video shooting to Dean/ Principal of the medical college. Sometimes, relatives of a dead are ready to pay the cost of video shooting of postmortem examination, provided that they get a copy of video CD. But in no circumstances, copy of video of postmortem examination can be handed over to relatives by doctors, in medicolegal cases.
8. In this digital era of technology, digitally recorded video CD can be altered or morphed, what about these artefacts?
9. If video CD is leaked and circulated on social media, who will be responsible?
10. What about ñrights of privacy of a dead personò? Nobody wants to be filmed naked. Is consent of the person when he is alive, necessary for video shooting of his postmortem examination, after his death in medicolegal cases, like it is taken in as per Human Organ Transplantation Act?
11. Colour changes seen in video shooting may not be exactly similar to those seen to the naked eye.

Thus, in our opinion, except in custody death cases, where there is an indication of video shooting of postmortem examination, video shooting should not be done. If it is to be done, following legal formalities have to be followed:

1. Written order from Magistrate or written request from police officer who has been given quasi judicial powers (e.g. Deputy

Commissioner of police or assistant commissioner of police) should be there.
2. Police department to bear cost of video shooting.
3. Medical officers attached to various primary health centers, rural hospitals, district hospitals should be trained in detail regarding postmortem techniques so that they would not refer the dead body to medical college merely because video shooting of postmortem examination is required.
4. Central/state government should issue guidelines regarding ñprocedureò of video shooting regarding mega pixels of camera, quality of lens, sound recording, preservation (storage) and dispatch. There are no such standard guidelines in the form of G.R. are available either from central/state government. (Only NHRC guidelines are available in this regard, that too regarding video shooting of postmortem examination in custodial deaths.).

References:

1. Available from: http://nhrc.nic.in/documents/sec-1.pdf . Accessed on 18 Sep. 2017.
2. Available from: http://nhrc.nic.in/documents/lettertocm.pdf. Accessed on 18 Sep. 2017.
3. Available from: http://nhrc.nic.in/Documents/Guidelines_for_video_photography_of_PME_death_in_police_action.pdf. Accessed on 18 Sep. 2017.
4. Available from: https://indianexpress.com/article/what-is/what-are-in-camera-proceedings-4949186/ Accessed on 12 Jul. 2017.
5. Singh H, Vij K, Garg A, Dhattarwal SK, Sandhu SS, Aggarwal D. Maintenance of records. How vital? J. Punjab Acad Forensic Med Toxicol. 2012;12(2):107-10.

Thank You,

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CORRIGENDUM

Letter to editor- Prank : Practical Joke, Profession or Path to Prison?

Sunil K Doshi. Jour Ind Acad Forensic Med 2018;40(1):129-130.

Correct Bibliography

The inconvenience caused is deeply regretted - Editor.

References :

4. Woodley C, Silvestri M. The internet is forever: Youthful indiscretions & ill-conceived pranks reveal the need for effective social media policies in academia. In ICICTE Conference. Crete, Greece 2013. Available from:
5. http://www.icicte.org/Proceedings2013/Papers%202013/06-2-Woodley.pdf. Accessed 19 March 2018
6. Toby Meyjes. Best man dies after being ñthrown into water during stag do prankò Available from:
7. http://metro.co.uk/2016/12/14/best-man-dies-after-being-thrown-into-water-during-stag-do-prank-6323764/. Accessed 20 March 2018
8. Kristine Phillips. An 11-year-old boy killed himself after his girlfriend faked her death. Sheôs now facing charges. Available from: https://www.washingtonpost.com/news/education/wp/2017/04/09/an-11-year-old-boy-killed-himself-after-his-girlfriend-faked-her-death-shes-now-facing-charges/?utm_term=.4a9ad612663f. Accessed 20 March 2018
9. Ss. 44, 268, 290, 319, 321, 323, 504, 506 & 509, The Indian Penal Code, 1860.
10. Carroll R. Pranks, Frauds, and Hoaxes from Around the World. Skeptical Inquirer. 2004;28(4):41-6
11. McIntyre Iain. How to Make Trouble and Influence People: Pranks, Protests, Graffiti & Political Mischief-Making from Across Australia. : PM Press; 2013. Available from: https://books.google.co.in/books/about/How_to_Make_Trouble_and_Influence_People.html?id=yaVuAAAAQBAJ&redir_esc=y. Accessed 19 March 2018

CORRIGENDUM

Correlation of Sexual Dimorphism and Posterior Curve Length with the Help of Discriminant Function Analysis - An Autopsy Study in the Population of Delhi

[1]Rajendra Baraw, [2]Monisha Pradhan, [3]S. K. Khanna, [4]Anuradha Singh. **Jour Ind Acad Forensic Med 2018;40(1):85-90.**

Correct Bibliography

The inconvenience caused is deeply regretted - Editor.

References :

1. Reddy KSN. Identification. In - The Essentials of Forensic Medicine and Toxicology. 23rd ed. Hederabad: Medical Book Company; 2004. p. 47.
2. Dikshit PC. Identification. In - Textbook of Forensic Medicine and Toxicology. Delhi: Peepee Publishers & distributers; 2010. p. 47.
3. Singh J, Pathak RK, Singh D. Morphometric sex determination from various sternal widths of Northwest Indian sternums collected from autopsy cadavers: A comparison of sexing methods. Egyptian J Forensic Sciences 2012;2:18-28
4. Knight B, Sakko P. The establishment of identity of human remains. In Knightôs forensic Pathology. A member of the Hodder Headlines groups, London. 3rd Ed. 2004; p. 118.
5. Mukhopadhyay PP. Determination of sex from adult sternum by discriminant function analysis on autopsy sample of Indian Bengali Population: A new approach. J Indian Acad Forensic Med 2010;32(4):321-4
6. Peter William, Lawrence H. Bamister. Sternum. Greys Anatomy: Churchill Livingstone.1995; 30th Ed: P.537
7. Jitinder I, Jhingan V, Kulkarni M. Sexing the human sternum. Am J Phys Anthrpol 1980;53(2):217-24.
8. Gautam RS, Shah GV, Jadar HR, Gohn BJ. The human sternum as an index of age and sex. J Anatomy. 2003;52(1):20-3.
9. Hunnargi SA, Menezes RG, Kanchan T, Lobo SW, Uysal S, Herekar NG, et al. Sternal index: Is it a reliable indicator of sex in the Maharashtrian population of India. J Forensic Leg Med. 2009;16(2):56-8.
10. Macaluso PJ. The efficacy of sternal measurements for sex estimation in South African blacks. Forensic Sci Int. 2010;202(1-3):111.
11. Osunwoke EA, Gwunireama IU, Orish CN, Ordu KS, Ebowe I. A study of sexual dimorphism of the human sternum in the southern Nigerian population. J Appl Bio sci. 2010;26:1636-9
12. Ramadan M, Turkmen N, Dolgan NA, Gokharman D, Menezes, Kacar M, et al. Sex determination from measurements of the sternum and fourth rib using multislice computed tomography of the chest. Forensic Sci Int. 2010;197:120.
13. Puttabanthi S, Velichety SD, Padi T, Boddetie RK, Priyanka JR. Sexing of unknown adult human sterna by metrical analysis. Int J Bio Med Res 2012;3(2):1516-9
14. Selthofer R, Nikolic V, Marcela T, Radic R, Leksan I, Rudez I, et al. Morphometric analysis of the sternum, Coll. Antropol. 2006;30(1):437
15. Asghar Ghasemi1, Saleh Zahediasl. Normality Tests for Statistical Analysis: A Guide for Non-Statisticians. Int J Endocrinol Metab. 2012; 10(2): 486ï 9.

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